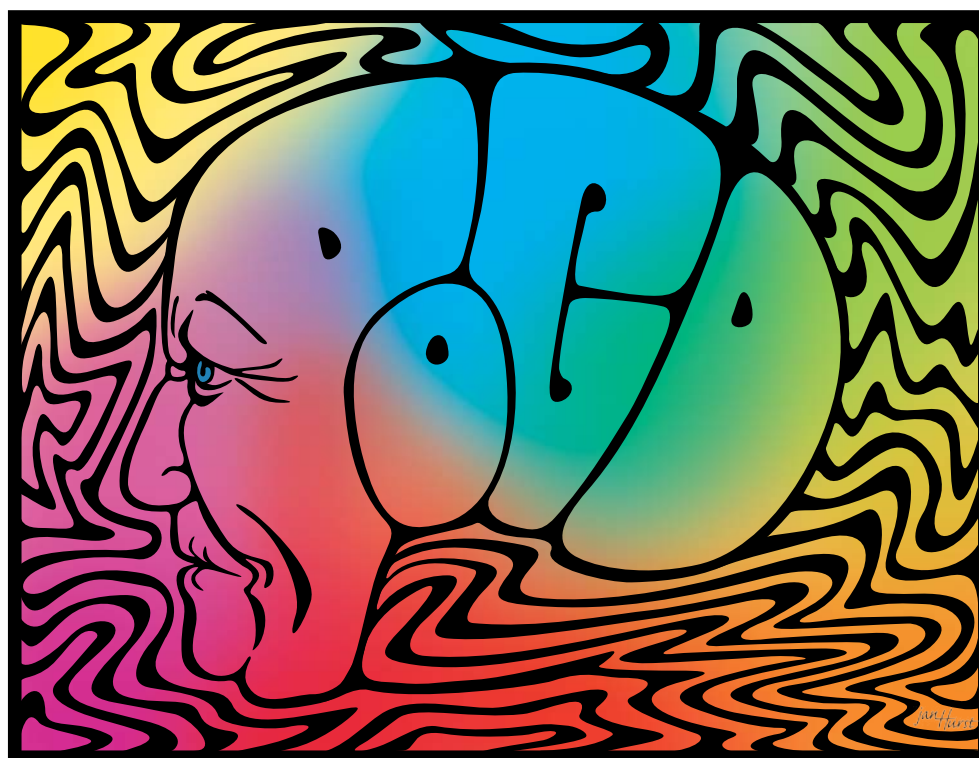


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ANESTHESIA & ANALGESIA®

Abstracts of Posters presented at the
2011 Annual Meeting of the
International Anesthesia Research Society
Vancouver, British Columbia, Canada
May 21-24, 2011

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Abstracts of Posters Presented at the International Anesthesia Research Society IARS 2011 Annual Meeting Vancouver, Canada May 21-24, 2011

Abstracts (by category):

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| Ambulatory Anesthesia | S-01 – S-17 |
| Bleeding / Blood Product Conservation | S-18 – S-25 |
| Cardiothoracic & Vascular – Basic Science | S-26 – S-36 |
| Cardiothoracic & Vascular – Clinical | S-37 – S-65 |
| Critical Care & Trauma | S-68 – S-101 |
| Economics | S-102 – S-114 |
| Education & Patient Safety | S-115 – S-188 |
| Equipment Monitoring | S-189 – S-240 |
| Geriatric Anesthesia | S-241 – S-242 |
| Liver/Transplantation | S-243 – S-255 |
| Neuroanesthesia | S-256 – S-277 |
| Obstetric Anesthesia | S-282 – S-292 |
| Pain – Basic Science | S-293 – S-303 |
| Pain – Clinical - Acute | S-304 – S-315 |
| Pain – Clinical - Chronic | S-316 – S-322 |
| Pediatric Anesthesia: General Topics | S-323 – S-345 |
| Pediatric Anesthesia: Neonatal Safety & Anesthetics | S-346 – S-354 |
| Pharmacology – Basic Science | S-355 – S-375 |
| Pharmacology – Clinical | S-379 – S-396 |
| Regional Anesthesia | S-403 – S-418 |
| Author Index | S-419 – S-428 |

Authors submitting abstracts have certified that if human research is reported, approval by an institutional human research committee has been obtained, or if animal research is reported, the usual standards and guidelines for animal care have been followed. Material published in this supplement has not undergone review by the Editorial Board of Anesthesia and Analgesia. Any of the abstracts in this supplement may have been transmitted by the author to IARS in various forms of electronic medium. IARS has used its best efforts to receive and format electronic submissions for publication in this supplement but has not reviewed each abstract for the purpose of textual error correction and is not liable in any way for any formatting, textual or grammatical error or inaccuracy.

IARS 2011 Annual Meeting

Abstract Presentation Schedule

Ambulatory Anesthesia

- (S-01) Wang, J., Saturday, 8:00
- (S-02) Ehrenfeld, J., Saturday, 8:00
- (S-03) Rosero, E., Saturday, 8:00
- (S-04) Kumar, V., Saturday, 8:00
- (S-05) Murashima, K., Saturday, 8:00
- (S-06) Hirsch, J., Saturday, 8:00
- (S-07) Negron-Gonzalez, M., Saturday, 1:00
- (S-08) Abdelmalak, B., Saturday, 1:00
- (S-09) Van den Berg, A., Saturday, 1:00
- (S-11) Sabouri, A., Saturday, 1:00
- (S-12) van den Berg, A., Sunday, 10:00
- (S-14) Simmons, D., Sunday, 10:00
- (S-15) Wax, D., Sunday, 10:00
- (S-16) Apfel, C., Saturday, 1:00
- (S-17) Patel, P., Sunday, 10:00

Bleeding / Blood Product Conservation

- (S-18) Puente, E., Monday, 2:45
- (S-19) Ono, K., Monday, 2:45
- (S-20) Hofer, J., Monday, 2:45
- (S-21) Malayaman, S., Monday, 2:45
- (S-23) Van Haelst, I., Monday, 2:45
- (S-24) Puente, E., Monday, 2:45
- (S-25) Henneman, J., Monday, 2:45

Cardiothoracic & Vascular-Basic Science

- (S-26) Eckle, T., Sunday, 4:15
- (S-27) Wang, T., Sunday, 4:15
- (S-28) Koeppen, M., Sunday, 4:15
- (S-29) Wang, B., Sunday, 4:15
- (S-31) Xia, Z., Monday, 8:00
- (S-32) Eckle, T., Monday, 8:00
- (S-33) Treskatsch, S., Monday, 8:00
- (S-34) Simoni, J., Monday, 8:00
- (S-35) Tsui, A., Monday, 8:00
- (S-36) Liu, H., Monday, 8:00

Cardiothoracic & Vascular-Clinical

- (S-37) Withdrawn
- (S-38) Wittwer, E., Sunday, 10:00
- (S-39) Burtin, P., Sunday, 10:00
- (S-40) Murphy, G., Sunday, 10:00
- (S-41) Murphy, G., Sunday, 10:00
- (S-42) McGill, N., Monday, 1:00
- (S-43) Gulati, H., Monday, 1:00
- (S-44) Flores, A., Monday, 1:00
- (S-45) Weiner, M., Monday, 1:00
- (S-46) Schier, R., Monday, 1:00
- (S-48) Yamaguchi, K., Monday, 10:00
- (S-49) Tran, D., Monday, 10:00
- (S-50) Demir, A., Monday, 10:00
- (S-51) Gatling, J., Monday, 10:00
- (S-52) Ozgok, A., Monday, 10:00
- (S-53) Yazicioglu, H., Sunday, 2:45

- (S-54) Billings, F., Sunday, 2:45
- (S-55) Thiele, R., Sunday, 2:45
- (S-56) Bae, H., Sunday, 2:45
- (S-57) Fernandez, A., Sunday, 2:45
- (S-58) Fujii, Y., Saturday, 8:00
- (S-59) Song, J., Saturday, 8:00
- (S-60) Kodaka, M., Saturday, 8:00
- (S-61) Withdrawn
- (S-62) Koch, E., Saturday, 8:00
- (S-63) Hayward, G., Saturday, 8:00
- (S-64) Taniguchi, Y., Sunday, 2:45
- (S-65) Kumar, A., Monday, 10:00

Critical Care & Trauma

- (S-68) Matsusaki, T., Sunday, 2:45
- (S-69) Tani, M., Saturday, 10:00
- (S-70) Prasad, V., Saturday, 10:00
- (S-71) Mantha, S., Saturday, 10:00
- (S-72) Olmos, A., Saturday, 10:00
- (S-73) Sharma, V., Saturday, 10:00
- (S-74) Singh, H., Saturday, 10:00
- (S-75) Singh, H., Saturday, 10:00
- (S-76) Hong, C., Saturday, 2:45
- (S-77) Hudcova, J., Saturday, 2:45
- (S-78) Tritsch, L., Saturday, 2:45
- (S-79) Nishie, H., Saturday, 2:45
- (S-80) Henzler, D., Saturday, 2:45
- (S-81) Stentz, M., Saturday, 2:45
- (S-82) Eckle, T., Saturday, 2:45
- (S-83) Gehr, L., Sunday, 2:45
- (S-84) Krishnamoorthy, V., Sunday, 2:45
- (S-85) Lenart, J., Sunday, 2:45
- (S-86) Griffie, M., Sunday, 2:45
- (S-87) Lehmann, C., Sunday, 2:45
- (S-88) Wei, J., Sunday, 2:45
- (S-89) Kuhn, K., Monday, 10:00
- (S-90) Messenger, B., Monday, 10:00
- (S-91) Lee, J., Monday, 10:00
- (S-92) Sasso, U., Monday, 10:00
- (S-93) Gonzalez, H., Monday, 10:00
- (S-94) Withdrawn
- (S-95) Wilson, G., Monday, 1:00
- (S-96) Estebe, J., Monday, 1:00
- (S-97) Hino, H., Monday, 1:00
- (S-98) Liu, K., Monday, 1:00
- (S-100) Pena, C., Monday, 1:00
- (S-101) Beebe, D., Monday, 1:00

IARS 2011 Annual Meeting

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Economics

- (S-102) Kadry, B., Saturday, 10:00
- (S-103) Kadry, B., Saturday, 10:00
- (S-104) Walia, A., Saturday, 10:00
- (S-105) Tighe, P., Saturday, 10:00
- (S-106) Marian, A., Saturday, 10:00
- (S-107) Woo, J., Saturday, 10:00
- (S-108) Woo, J., Saturday, 10:00
- (S-109) Tavare, A., Sunday, 4:15
- (S-110) Bennett, H., Sunday, 4:15
- (S-111) Fujii, S., Sunday, 4:15
- (S-112) Dauber, B., Sunday, 4:15
- (S-113) Dauber, B., Sunday, 4:15
- (S-114) Lew, M., Saturday, 10:00

Education and Patient Safety

- (S-115) Mitchell, J., Saturday, 8:00
- (S-116) Xie, Y., Saturday, 8:00
- (S-117) Vigoda, M., Saturday, 8:00
- (S-118) Sakai, T., Saturday, 8:00
- (S-119) Van Klei, W., Saturday, 8:00
- (S-120) Hamrick, J., Saturday, 8:00
- (S-121) Nunnally, M., Saturday, 1:00
- (S-122) Vigoda, M., Saturday, 1:00
- (S-123) Nunnally, M., Saturday, 1:00
- (S-124) Fortier, C., Saturday, 1:00
- (S-125) Petrovic, M., Saturday, 1:00
- (S-126) Marian, A., Saturday, 1:00
- (S-127) Mark, L., Saturday, 2:45
- (S-128) Johnson, S., Saturday, 2:45
- (S-129) Busso, V., Saturday, 2:45
- (S-130) Hofer, I., Saturday, 2:45
- (S-131) Goldstein, S., Saturday, 2:45
- (S-132) Tomita, M., Saturday, 2:45
- (S-133) Withdrawn.
- (S-134) Tom, W., Sunday, 8:00
- (S-135) West, A., Sunday, 8:00
- (S-136) Nunnally, M., Sunday, 8:00
- (S-137) Johnson, S., Sunday, 8:00
- (S-138) Kochhar, A., Sunday, 8:00
- (S-139) Tanaka, P., Sunday, 8:00
- (S-140) Curley, E., Sunday, 8:00
- (S-142) Vigoda, M., Sunday, 4:15
- (S-143) Bhananker, S., Sunday, 4:15
- (S-144) Steppan, J., Sunday, 4:15
- (S-145) Kraidin, J., Sunday, 4:15
- (S-146) Lin, S., Sunday, 4:15
- (S-147) Canales, C., Sunday, 4:15
- (S-148) Downey, R., Sunday, 2:45
- (S-149) Gorman, K., Sunday, 2:45
- (S-150) Rao, A., Sunday, 2:45
- (S-151) Price, K., Sunday, 2:45
- (S-152) De Oliveira, G., Sunday, 2:45
- (S-153) Rinehart, J., Sunday, 2:45

- (S-154) Bhananker, S., Sunday, 2:45
- (S-155) Dauber, B., Sunday, 2:45
- (S-156) Kong, K., Monday, 8:00
- (S-157) Tse, J., Monday, 8:00
- (S-158) Mon, K., Monday, 8:00
- (S-159) Cavallone, L., Monday, 8:00
- (S-160) Voscopoulos, C., Monday, 8:00
- (S-161) Rollins, M., Monday, 8:00
- (S-162) Duggan, L., Monday, 8:00
- (S-163) Withdrawn
- (S-164) Straker, T., Monday, 10:00
- (S-165) Toshniwal, G., Monday, 10:00
- (S-166) Takeuchi, N., Monday, 10:00
- (S-167) Negron-Gonzalez, M., Monday, 10:00
- (S-168) Mon, K., Monday, 10:00
- (S-169) Mudumbai, S., Monday, 10:00
- (S-170) Daniels, J., Monday, 1:00
- (S-171) Reynolds, J., Monday, 1:00
- (S-172) Yorozu, T., Monday, 1:00
- (S-173) Dote, K., Monday, 1:00
- (S-174) Sim, A., Monday, 1:00
- (S-175) McIlrath, S., Monday, 1:00
- (S-177) Johnson, S., Saturday, 4:15
- (S-178) Whitlock, E., Saturday, 4:15
- (S-180) Truong, A., Saturday, 4:15
- (S-181) Jameson, L., Saturday, 4:15
- (S-182) Sauve, K., Saturday, 4:15
- (S-183) Deepika, K., Monday, 2:45
- (S-184) Ginosar, Y., Monday, 2:45
- (S-185) Calderwood, S., Monday, 2:45
- (S-186) Subramanyam, K., Monday, 2:45
- (S-187) Lace, C., Monday, 2:45
- (S-188) Ittzes, B., Monday, 2:45

Equipment Monitoring

- (S-189) Ishida, Y., Saturday, 8:00
- (S-190) Weigel, W., Saturday, 8:00
- (S-192) Rothfield, K., Saturday, 8:00
- (S-193) Ydemann, M., Saturday, 8:00
- (S-194) Gil, K., Saturday, 8:00
- (S-195) Capan, L., Saturday, 1:00
- (S-196) Asakura, Y., Saturday, 1:00
- (S-197) Batchelder, P., Saturday, 1:00
- (S-198) Withdrawn
- (S-199) Young, E., Saturday, 1:00
- (S-200) Chandler, J., Saturday, 1:00
- (S-201) Rice, M., Sunday, 8:00
- (S-202) Ahlgren, B., Sunday, 8:00
- (S-203) Neice, A., Sunday, 8:00
- (S-204) Ball, T., Sunday, 8:00
- (S-205) van Waes, J., Sunday, 8:00
- (S-206) Wanderer, J., Sunday, 8:00
- (S-207) Görges, M., Sunday, 8:00
- (S-208) Uchida, M., Sunday, 4:15
- (S-209) Pitts, R., Sunday, 4:15

IARS 2011 Annual Meeting Abstract Presentation Schedule

- (S-210) Thiele, R., Sunday, 4:15
- (S-211) van Waes, J., Sunday, 4:15
- (S-212) Rothfield, K., Sunday, 4:15
- (S-213) Sreshta, E., Sunday, 4:15
- (S-214) Whitaker, E., Sunday, 4:15
- (S-215) Maryak, B., Sunday, 2:45
- (S-216) Thiele, R., Sunday, 2:45
- (S-217) Amornyotin, S., Sunday, 2:45
- (S-218) Rothfield, K., Sunday, 2:45
- (S-219) Whitlock, E., Sunday, 2:45
- (S-220) Marks, R., Sunday, 2:45
- (S-221) Rothfield, K., Monday, 8:00
- (S-222) Kaneko, G., Monday, 8:00
- (S-223) Miller, R., Monday, 8:00
- (S-224) Bennett, C., Monday, 8:00
- (S-225) Fernandez, A., Monday, 8:00
- (S-226) Du, E., Monday, 8:00
- (S-227) Ota, J., Monday, 8:00
- (S-229) Meng, L., Monday, 10:00
- (S-230) Ginosar, Y., Monday, 10:00
- (S-231) Rao, A., Monday, 10:00
- (S-232) A. Rao, Sunday, 8:00
- (S-233) Benbassat, M., Monday, 10:00
- (S-234) Andrijauskas, A., Sunday, 8:00
- (S-235) MacLeod, D., Monday, 1:00
- (S-236) Pai, S., Monday, 1:00
- (S-237) Yuka, S., Monday, 1:00
- (S-238) Marian, A., Monday, 1:00
- (S-240) Bairamian, J., Monday, 1:00

Geriatrics

- (S-241) Jaller, Y., Saturday, 8:00
- (S-242) Tang, J., Saturday, 8:00

Liver / Transplantation

- (S-243) Raffel, B., Saturday, 8:00
- (S-244) Vos, J., Saturday, 8:00
- (S-245) Naguit, K., Saturday, 8:00
- (S-246) Saner, F., Saturday, 8:00
- (S-247) Yang, J., Saturday, 8:00
- (S-248) Li, Z., Saturday, 8:00
- (S-249) Lahsaei, P., Saturday, 8:00
- (S-250) Kosaka, J., Saturday, 2:45
- (S-251) Hudcova, J., Saturday, 2:45
- (S-252) Hudcova, J., Saturday, 2:45
- (S-253) Hudcova, J., Saturday, 2:45
- (S-255) Kinsella, S., Saturday, 2:45

Neuroanesthesia

- (S-256) Alexander, B., Saturday, 10:00
- (S-257) Alexander, B., Saturday, 10:00
- (S-258) Alexander, B., Saturday, 10:00
- (S-259) Erminy, N., Saturday, 10:00
- (S-260) Ma, N., Saturday, 10:00
- (S-261) Yoo, K., Monday, 8:00

- (S-262) Sharma, D., Monday, 8:00
- (S-263) Alexander, B., Monday, 8:00
- (S-264) O'Bannon, R., Monday, 8:00
- (S-265) Dauber, M., Monday, 8:00
- (S-266) Zekan, A., Sunday, 2:45
- (S-267) Gharapetian, A., Sunday, 2:45
- (S-268) Withdrawn
- (S-269) To, W., Sunday, 2:45
- (S-270) Bohorquez, J., Sunday, 2:45
- (S-271) Antor, M., Sunday, 2:45
- (S-277) Garcia, E., Sunday, 2:45
- (S-272) Indramoarya, T., Sunday, 10:00
- (S-273) Wang, D., Sunday, 10:00
- (S-275) Cordova, M., Sunday, 10:00
- (S-276) Uribe, A., Sunday, 10:00

Obstetric Anesthesia

- (S-282) Ajmal, M., Sunday, 8:00
- (S-283) Shah, S., Sunday, 8:00
- (S-285) Busso, V., Sunday, 8:00
- (S-286) Chen, K., Sunday, 8:00
- (S-291) Li, H., Sunday, 8:00
- (S-287) Ajmal, M., Monday, 2:45
- (S-288) Song, E., Monday, 2:45
- (S-289) Wang, M., Monday, 2:45
- (S-290) Terkawi, A., Monday, 2:45
- (S-292) Ginosar, Y., Monday, 2:45

Pain - Basic Science

- (S-293) Nishiyama, T., Saturday, 10:00
- (S-294) Zhang, Y., Saturday, 10:00
- (S-296) Liu, Y., Saturday, 10:00
- (S-297) Ruschulte, H., Saturday, 10:00
- (S-298) Mousa, S., Saturday, 10:00
- (S-299) Yang, Z., Sunday, 10:00
- (S-300) Zhang, Y., Sunday, 10:00
- (S-301) She, S., Sunday, 10:00
- (S-302) Buvanendran, A., Sunday, 10:00
- (S-303) Shaqura, M., Sunday, 10:00

Pain - Clinical - Acute

- (S-304) Manjunath, P., Monday, 2:45
- (S-305) Viscusi, E., Monday, 2:45
- (S-306) Blum, S., Monday, 2:45
- (S-307) Azim, S., Monday, 2:45
- (S-308) Kramer, D., Monday, 2:45
- (S-309) Puente, E., Monday, 2:45
- (S-310) Lim, S., Sunday, 8:00
- (S-311) Bergese, S., Sunday, 8:00
- (S-312) Buvanendran, A., Sunday, 8:00
- (S-313) Fowler, M., Sunday, 8:00
- (S-314) O'Donnell, B., Sunday, 8:00
- (S-315) Joshi, G., Sunday, 8:00

IARS 2011 Annual Meeting

Abstract Presentation Schedule

Pain - Clinical – Chronic

- (S-316) Sakai, T., Saturday, 4:15
- (S-317) Ranganathan, G., Saturday, 4:15
- (S-318) Lee, C., Saturday, 4:15
- (S-319) Buvanendran, A., Saturday, 4:15
- (S-320) Inagaki, Y., Saturday, 4:15
- (S-321) Fievez, L., Saturday, 4:15
- (S-322) Mishra, R., Saturday, 4:15

Pediatric Anesthesia: General Topics

- (S-323) Wu, L., Saturday, 10:00
- (S-324) Maeda, K., Saturday, 10:00
- (S-325) Withdrawn
- (S-326) Thampi, S., Saturday, 10:00
- (S-327) Reece-Stremtan, S., Saturday, 10:00
- (S-328) Rodriguez, C., Saturday, 10:00
- (S-329) Bolash, R., Saturday, 2:45
- (S-330) Carollo, D., Saturday, 2:45
- (S-331) McVay, T., Saturday, 2:45
- (S-332) Whyte, S., Saturday, 2:45
- (S-333) Whyte, S., Saturday, 2:45
- (S-334) Whyte, S., Saturday, 2:45
- (S-335) Withdrawn
- (S-336) Ing, C., Sunday, 8:00
- (S-337) Ring, L., Sunday, 8:00
- (S-338) Chung, C., Sunday, 8:00
- (S-339) Stinson, J., Sunday, 8:00
- (S-340) Beebe, D., Sunday, 8:00
- (S-341) Rafique, M., Monday, 8:00
- (S-342) Yoshizawa, S., Monday, 8:00
- (S-343) Shin, S., Monday, 8:00
- (S-344) Wu, A., Monday, 8:00
- (S-345) Mukkamala, S., Monday, 8:00

Pediatric Anesthesia: Neonatal Safety and Anesthetics

- (S-346) Moran, C., Saturday, 1:00
- (S-347) Wood, C., Saturday, 1:00
- (S-348) Wise-Faberowski, L., Saturday, 1:00
- (S-349) Withdrawn
- (S-350) Kopp, V., Monday, 10:00
- (S-351) Jacob, Z., Monday, 10:00
- (S-352) Costine, B., Monday, 10:00
- (S-353) Peluso, B., Monday, 10:00
- (S-354) Martynyuk, A., Monday, 10:00

Pharmacology - Basic Science

- (S-355) Pearce, R., Saturday, 4:15
- (S-356) Yuan, C., Saturday, 4:15
- (S-357) Yao, S., Saturday, 4:15
- (S-358) Zurek, A., Saturday, 4:15
- (S-359) Erasso, D., Saturday, 4:15
- (S-360) Lin, D., Saturday, 2:45
- (S-361) Ma, Q., Saturday, 2:45
- (S-362) Maynes, J., Saturday, 2:45
- (S-363) Singleton, P., Saturday, 2:45

- (S-364) Whittington, R., Saturday, 2:45
- (S-365) Houseman, B., Saturday, 2:45
- (S-366) Carino, C., Sunday, 8:00
- (S-367) Whittington, R., Sunday, 8:00
- (S-368) Chen, C., Sunday, 8:00
- (S-369) Danyadi, B., Sunday, 8:00
- (S-370) Sakamotot, H., Sunday, 8:00
- (S-371) Wang, Y., Sunday, 4:15
- (S-372) Mizogami, M., Sunday, 4:15
- (S-373) Obara, S., Sunday, 4:15
- (S-374) Savarese, J., Sunday, 4:15
- (S-375) Nagashima, M., Sunday, 4:15

Pharmacology - Clinical

- (S-379) Egas, J., Sunday, 10:00
- (S-380) Singla, N., Sunday, 10:00
- (S-381) Lee, P., Sunday, 10:00
- (S-382) Viola-Blitz, J., Sunday, 10:00
- (S-383) Khafagy, H., Sunday, 10:00
- (S-384) Terasako, K., Sunday, 10:00
- (S-385) Lee, J., Sunday, 10:00
- (S-386) Van De Water, M., Monday, 8:00
- (S-387) So, M., Monday, 8:00
- (S-388) Kang, W., Monday, 8:00
- (S-389) Monk, T., Monday, 8:00
- (S-390) Swaniker, J., Monday, 8:00
- (S-391) Osman, E., Monday, 10:00
- (S-392) Dalecki, P., Monday, 10:00
- (S-393) Withdrawn
- (S-394) Malhotra, J., Monday, 10:00
- (S-395) O'Neill, D., Monday, 10:00
- (S-396) Chen, X., Monday, 10:00

Regional Anesthesia – 1

- (S-403) Guay, J., Monday, 8:00
- (S-404) Withdrawn
- (S-405) Ahmad, N., Monday, 8:00
- (S-406) Johnson, R., Monday, 8:00
- (S-407) Rao, A., Monday, 8:00
- (S-408) Lee, P., Saturday, 4:15
- (S-409) Takagi, H., Saturday, 4:15
- (S-410) Mantham, V., Saturday, 4:15
- (S-411) Clendenen, S., Saturday, 4:15
- (S-412) Rhee, A., Saturday, 4:15
- (S-413) Hoshi, T., Monday, 2:45
- (S-414) Finnerty, O., Monday, 2:45
- (S-415) Gasanova, I., Monday, 2:45
- (S-416) Mehio, A., Monday, 2:45
- (S-417) Withdrawn
- (S-418) Withdrawn

Ambulatory Anesthesia

S-01.**PERIOPERATIVE CONTINUATION VERSUS INTERRUPTION OF ORAL HYPOGLYCEMIC AGENTS IN TYPE 2 DIABETIC PATIENTS UNDERGOING AMBULATORY SURGERY****AUTHORS:** R. Subramanyam, J. Wang, A. Adesanya, A. Kamali, M. MacDonald, G. P. Joshi**AFFILIATION:** University of Texas Southwestern Med Center., Dallas, TX

INTRODUCTION: Type 2 diabetes mellitus (T2DM) patients on oral hypoglycemic agents (OHA) are usually instructed to discontinue the medication(s) on the day of surgery due to concern for perioperative hypoglycemia. This practice can also lead to perioperative hyperglycemia and disruption of long-term blood glucose control. We hypothesized that uninterrupted perioperative treatment with OHA in T2DM will not result in hypoglycemia but improved blood glucose (BG) control.

METHODS: 40 patients with T2DM on treatment with OHA scheduled for ambulatory surgery were randomized to either withhold medication (WM) or continue medication (CM) on the morning of elective surgery. Pre-anesthesia BG was measured on arrival for surgery, intraoperative BG was checked hourly and postoperative BG was checked in the post anesthesia care unit (PACU). Mean Intraoperative and postoperative BG was compared between WM and CM patients. The incidence of hypoglycemia and hyperglycemia were compared during both intraoperative and postoperative periods in the WM and CM groups.

RESULTS: Mean patient age was 53.4 ± 13.23 y. 42.5% of subjects were male and 57.5% were female. Mean body weight was 84.95 ± 21.6 kg. 25 % of subjects withheld medication (WM) on the morning of surgery while 75 % continued medications (CM). The mean preoperative BG was not significantly different among WM subjects (142 ± 33 mg/dl) compared to CM subjects (142 ± 43 mg/dl), ($p = 0.99$), however the intraoperative BG was significantly different between WM subjects (194 ± 57 mg/dl) and CM subjects (138 ± 43 mg/dl) ($p = 0.05$). Postoperative BG was also significantly different among WM subjects (188 ± 47 mg/dl) compared to CM subjects (149 ± 43 mg/dl) ($p = 0.03$). Intraoperative hypoglycemia (BG < 70 mg/dl) occurred in 1 subject in the CM group and no subjects in the WM group. There was no postoperative hypoglycemia in both WM and CM groups. Conversely, intraoperative hyperglycemia (BG > 180 mg/dl) occurred in 50% of patients in the WM group compared to 17% of patients in the CM group ($p = 0.043$) while postoperative hyperglycemia occurred in 33% of patients in the WM group compared to 24% of patients in the CM group ($p = 0.58$).

DISCUSSION: This study suggests that T2DM patients undergoing ambulatory surgery can safely continue OHA in the perioperative period with minimal risk of hypoglycemia. Intraoperative and postoperative hyperglycemia occurs more commonly in patients interrupting oral hypoglycemic agents than in patients continuing medications through the perioperative period.

REFERENCES: (1) Joshi GP et al. SAMBA consensus statement on perioperative blood glucose management in diabetic patients undergoing ambulatory surgery. Anesth Analg 2010;111:1378-87.

Table 1

| | WM (n=10) | CM (n=30) | |
|--|--------------------|--------------------|---------------|
| Capillary Blood Glucose Levels (mg/dl) | | | |
| Preoperative | 142 ± 33 mg/dl | 142 ± 43 mg/dl | p=0.99 |
| Intraoperative | 194 ± 57 mg/dl | 138 ± 43 mg/dl | p=0.05 |
| Postoperative | 188 ± 47 mg/dl | 149 ± 43 mg/dl | p=0.03 |
| Hypoglycemia Incidence | | | |
| Intraoperative | 0 | 1 | |
| Postoperative | 0 | 0 | |
| Hyperglycemia Incidence | | | |
| Intraoperative | 50% | 17% | P=0.043 |
| Postoperative | 33% | 24% | P=0.58 |

WM – Withholding medication group;

CM - continuing medication group

S-02.**PILOT IMPLEMENTATION & ASSESSMENT OF A COMPUTERIZED PREANESTHETIC ASSESSMENT TOOL**

AUTHORS: J. M. Ehrenfeld, M. S. Higgins, S. Hersey, S. Eagle, W. S. Sandberg

AFFILIATION: Vanderbilt University, Nashville, TN

INTRODUCTION: Hospitals take one of three approaches to preoperative evaluation: (1) patients visit a clinic ahead of their procedure; (2) patients are interviewed by telephone; or (3) patients are seen on the day of surgery. Each of these approaches has shortcomings, and all share a major problem: they apply a universal process to a heterogeneous population and fail to meet patients' individual needs.

Given the limitations of existing methods of preop evaluation, there is interest in patient-driven computerized systems which are comprehensive, pt specific, and "smart" (i.e., provide "checks and balances" to help eliminate errors from miscomprehension or forgetfulness).

We therefore undertook a pilot implementation of a computerized preanesthetic assessment tool Breeze™ (MedSleuth, Inc.). This software creates a patient driven preop survey (created 'on the fly' based on answers to previous questions) to provide timely and accurate preop assessments. Specifically, the software elicits a med list from the patient and, based upon the med list and additional focused questions, constructs a medical problem list.

METHODS: After IRB approval, patients were enrolled during their pre-surgical visit & instructed to complete the web-based questionnaire from home. The software creates a customized questionnaire based on a patients medication profile and successive responses to the questions using machine learning. Subsequently, all patients were seen in our preop clinic and their online history was compared to their in-person history by a blinded reviewer. Our goal was to investigate the effect of Breeze™ with regards to: (1) ease of use; (2) survey accuracy; (3) patient & provider satisfaction; and (4) potential cost savings.

RESULTS: Twenty-five patients were enrolled and completed both the questionnaire and an in person preop evaluation. The avg age of the survey participant was 55 yrs. Median time to complete the survey was 22 min. Patients found the questionnaire easy to use (90% rated "very easy" or "easy"). Concordance between the Breeze and in-person med lists was 91%. A summary of the allergy, social history and ASA assignment concordance are shown in Tables 1 & 2. The Breeze application obtained a much more consistent & complete social history than the in-person interviews.

DISCUSSION: An on-line questionnaire used to obtain a preop history is accurate & well accepted by patients. This type of a tool is likely to increase satisfaction with the preop process and reduce overall costs associated with traditional in-person evaluations.

REFERENCES

This study was supported by a grant from the NIH (1 R44 RR030694-01)

Table 1: Comparison of Allergies and Social History

| | Breeze | Clinician Interview |
|---------------------------------|----------|---------------------|
| Allergies | | |
| Total # Patients with Allergies | 12 (48%) | 12 (48%) |
| Total # of Allergies (all pts) | 24 | 26 |
| Alcohol | 19 (76%) | 3 (12%) |
| Current Tobacco Use | 1 (4%) | 0 (0%) |
| Former Tobacco Use | 5 (20%) | 7 (28%) |
| Illicit Substance Use | 0 (0%) | 0 (0%) |

Table 2: ASA Score Assignment

| | Actual Preop | Blinded Review | |
|------------|--------------|----------------|----------------|
| | | MedSleuth | In-Person Eval |
| ASA 1 | 1 (4%) | 0 (0%) | 0 (0%) |
| 2 | 14 (56%) | 12 (48%) | 4 (16%) |
| 3 | 9 (36%) | 11 (44%) | 19 (76%) |
| 4 | 0 (0%) | 2 (8%) | 2 (8%) |
| unassigned | 1 (4%) | | |

S-03.**PERIOPERATIVE OUTCOMES OF AMBULATORY SURGERY IN HOSPITAL SETTINGS AND FREE-STANDING SURGERY CENTERS IN THE UNITED STATES**

AUTHORS: E. B. Rosero¹, A. Adesanya², C. H. Timaran¹, G. P. Joshi²

AFFILIATION: ¹Surgery, University of Texas Southwestern Medical Center, Dallas, TX; ²Anesthesiology, University of Texas Southwestern Medical Center, Dallas, TX

INTRODUCTION: The number surgeries performed in free-standing ambulatory surgery centers (ASCs) has increased in the United States (US)¹. However, outcomes after ambulatory surgery in ASCs compared with that in hospital-based outpatient department (HOPDs) setting are not known. The purpose of this study was to evaluate the current use and outcomes of ambulatory surgery in ASCs as compared with HOPDs in the US.

METHODS: Data from the National Survey of Ambulatory Surgery², was analyzed to characterize surgical visits performed in ASCs and HOPDs in the US during the year 2006. Differences in patient comorbidities (assessed with the Charlson comorbidity index), demographics, class of procedure, type of anesthesia, as well as surgical time, time to discharge, and postoperative complications were evaluated in ASCs in relation to HOPDs. Logistic regression models were used to assess the association between type of facility and postoperative adverse outcomes.

RESULTS: A total of 33,681,064 ambulatory surgical visits were identified. Of those, 43.5% were performed in ASCs and 56.5% in HOPDs. The proportion of women was similar in ASCs and HOPDs (58% vs. 57%, respectively; P=0.22). Although patients in ASCs were older than those in HOPDs (mean [SE] age, 53 [0.2] vs. 51 [0.2] yrs, P<0.0001), patients in ASCs had lower comorbidity scores (0.05 [0.01] vs. 0.27 [0.01], P<0.0001). General anesthesia (GA) was used more often in HOPDs than in ASCs (41.8% vs. 28.5%), and monitored anesthesia care more frequently used in ASCs (57.2% vs. 45.0%), P<0.0001. Mean [SE] surgical time and time in the postanesthesia care unit were significantly shorter in ASCs (25 [0.3] vs. 34 [0.4] min and 53 [0.6] vs. 79 [0.9] min, respectively; P<0.0001 for both). The incidence of postoperative apnea (0.1 vs. 0.02 %), hypoxia (0.15 vs. 0.03%), and hypotension (0.28 vs. 0.07%) was higher in ASCs, while the incidence of bleeding complications was higher in HOPDs (0.07 vs. 0.27%); (P<0.001 for all). After adjusting for demographic characteristics, comorbidity index, surgical time, class of procedure, and use of GA, HOPD was an independent predictor of unanticipated hospital admissions (OR 7.64, 95% CI 3.2- 18.3, P<0.0001) and of delayed discharge (>180 min) (OR 3.8, 95% CI 3.0- 4.7, P<0.0001).

DISCUSSION: Although patients in ASCs are healthier, they sustain more complications than patients treated in HOPDs. Nevertheless, the incidence of delayed discharge and unanticipated hospital admission is lower in the ASCs. This may suggest a lower threshold of hospital admission and/or an indicator of efficiency in HOPDs, and requires further investigation.

REFERENCES:

1. Inquiry. 2007; 44(2):200-10
2. Vital Health Stat 1 1997: I-IV, 1-124

S-04.**LOW DOSE PROPOFOL AND KETAMINE ANESTHESIA FOR CARDIOVERSION ALLOWS OBESE PATIENTS TO INDEPENDENTLY MAINTAIN A PATENT AIRWAY****AUTHORS:** V. Kumar, J. Spivey, M. E. Arthur, J. Rawlings, M. R. Castresana**AFFILIATION:** Medical College of Georgia, Augusta, GA.

INTRODUCTION: Obesity is a risk factor for obstructive sleep apnea and airway obstruction under sedation. As a result, careful attention to airway management during direct current cardioversion (DCC) in obese patients must be given in whom ventilatory monitoring, airway maintenance, and resuscitation may be difficult. Ketamine provides analgesia and amnesia without depressing respiration. Propofol rapidly produces unconsciousness followed by rapid awakening but large doses can cause significant respiratory depression. A combination of low dose ketamine and propofol appears to be safe and effective providing adequate analgesia, and anesthesia without significant hemodynamic or respiratory compromise.

METHODS: We retrospectively analyzed the data of 31 obese patients (BMI >32) with atrial fibrillation presenting for elective DCC. All patients were anesthetized with low doses of propofol supplemented with ketamine. Supplemental oxygen was provided (6 liters by face mask) and the patients were monitored to assess level of consciousness and identify hemodynamic instability, apnea, airway obstruction and/or oxygen desaturation. Airway obstruction was considered if any airway support was needed during or after the procedure.

RESULTS: The patients mean age was 58.9±12.1 years with a mean BMI of 39.8±8.7; 35% were morbidly obese (BMI ≥ 40). 74% were male and 58% had documented OSA. Propofol (dose range, 0.2-0.8 mg/kg) was supplemented with ketamine (dose range, 0.3-0.5 mg/kg). No acute desaturation or respiratory depression was observed. No patients experienced airway obstruction requiring any intervention. On a scale of 1 (very unsatisfied) to 5 (very satisfied), 90% rated their experience as 5. The wake-up time, measured from the beginning of anesthesia to the point the patient was fully awake was 5.6±2.3 minutes. No recall was reported.

DISCUSSION: Anesthesia for DCC can be provided by a variety of anesthetics, all of which can potentially trigger adverse respiratory and hemodynamic events in obese patients. These patients may also have some degree of OSA. Low dose propofol supplemented with ketamine appears to have a very low incidence of respiratory and hemodynamic complications that may be present with other anesthetics especially if narcotics or larger doses of propofol are utilized. We believe this is the first report of the potential advantages of combined low dose propofol and ketamine in obese patients presenting for DCC. Clinical trials comparing propofol/ketamine to other techniques are needed.

REFERENCES:

1. Schwartz AR, Patil SP, Laffan AM, Polotsky V, Schneider H, Smith PL. Proc Am Thorac Soc. 2008 Feb 15;5(2):185-92.

S-05.**NEW SUPRAGLOTTIC AIRWAY DEVICE TULIP IS EASY TO INSERT: A MANIKIN STUDY****AUTHORS:** K. Murashima¹, M. Ozaki²**AFFILIATION:** ¹Shin-Nippon Steel Hirohata Hospital, Himeji, Japan; ²St.Marianna University of Medicine Hospital, Kawasaki, Japan

INTRODUCTION: The Tulip™ (Marshall, Bath, UK) is single-use new supraglottic airway device(SGA) which features easy insertion and no need of size selection for all adults. This study is aimed to assess ease of insertion of the Tulip and other two SGAs using a manikin.

METHODS: Two board-certificated anesthesiologists who had clinical experience of LMA over 200 times were enrolled as participants in this study. The participants used three different supraglottic airways, Tulip™ (Tulip), LMA-Unique™ (Unique), Ambu-Auraonce LMATM (Auraonce) in random order. Adult size of Tulip, size 4 of Unique and Auraonce were used. Each participant inserted one of the three devices into the manikin (AirSim airway trainer™ Trucorp, Belfast, Ireland), inflated its cuff, connected a bag-valve and attempted to ventilate the lungs of the manikin according to the recommended techniques of each device. The end point of the attempt was clear inflation of the lungs of manikin. If the lungs were not inflated, the device was withdrawn and next attempt was tried. The assessment of three devices was repeated five times. At least 15 insertions were performed per participant. Number of attempts for successful ventilation, insertion time, subjective difficulty of insertion were recorded. Insertion time was defined as follows, the start-point is the time of the device touching the manikin and the end-point was the time of the participant leaving the device. The subjective difficulty of insertion was measured visual analogue scale (1-10).

RESULTS: In all first attempts, the lungs were clearly ventilated. The insertion time of Tulip, Unique and Auraonce were 2.07±0.13, 4.97±0.38, 4.55±0.17 seconds respectively. Insertion time was significantly shorter with the Tulip than the other devices (P<0.05).

The visual analogue scale (VAS) of Tulip, Unique and Auraonce were 1.5±0.5, 4±1.1, 3.4±0.2 respectively. The VAS score of insertion difficulty was significantly lower with the Tulip than the other devices (P<0.05).

DISCUSSION: We have demonstrated fast and easy insertion of the Tulip which consists of airway tube and inflatable cuff (Fig). The airway tube has insertion depth scale which lead to optimal placement relative to the size of the patient. If placed optimally, the cuff was placed into oropharynx. On the other hand, the cuff of LMA is placed into hypopharynx1). We consider these features of the Tulip lead short and easy insertion.

The insertion of Tulip is easier than other supraglottic airway device in manikin. However, further study about seal pressure and patients are needed.

REFERENCES:

1. Br J Anaesth. 80(5):677-9 1998



S-06.**AN INTERNET BASED PROTOCOL FOR THE
PREOPERATIVE MANAGEMENT OF PATIENTS WITH
DIABETES**

AUTHORS: J. Hirsch^{1,3}, K. Rouine-Rapp¹, H. Windham⁴, A. Gruber-Kalamas¹, D. L. Robinowitz¹, R. J. Rushakoff²

AFFILIATION: ¹Department of Anesthesia and Perioperative Care, UCSF, San Francisco, CA; ²Division of Endocrinology and Metabolism, UCSF, San Francisco, CA; ³Anesthesiology Section, San Francisco VAMC, San Francisco, CA; ⁴Department of Pharmacy, UCSF, San Francisco, CA

INTRODUCTION: The perioperative management of diabetic patients presents special challenges to the providers in the Pre-op clinic and on the day of surgery.¹⁻³ While hypoglycemia needs to be avoided, uncontrolled hyperglycemia bears risks of electrolyte imbalances, perioperative infection and delays in wound healing. Other potential problems include delays in surgery and increased need for additional hospital admissions. Preoperative diabetes management has become more complex with current outpatient diabetes management strategies using any number of combinations of oral diabetes medications, long acting, rapid acting and premixed insulins, and new oral and injected incretin medications. Continuous infusion subcutaneous insulin pumps are now frequently utilized and need to be discontinued during longer procedures or in the presence of radiation. Complexity is further increased by perioperative NPO requirements during bowel preparation. These complex interactions, aggravated by communication and compliance problems frequently lead to complications ranging from suboptimal management to life-threatening events.

METHODS: Our group developed and is in the process of testing an easy to use, procedure and patient specific reference system for providers to use during preoperative evaluation up to the day of surgery. By entering the basic information on any combination of diabetes medications, insulin regimens or insulin pumps and surgery parameters into a universally accessible, internet based expert system, providers can easily obtain patient specific recommendations for the preoperative management. To facilitate communication, the system provides a handout with detailed recommendations for the individual patient. The solution is available online under <http://ucsf.logicnets.com>.

RESULTS: Preliminary results of usability testing by 11 experienced providers on 16 preoperative outpatients resulted in an evaluation time of 8.53 min. A direct improvement in the quality of care was recorded in 56% of patients, time savings in 60%. The software was considered helpful in 81% and easy to use in 87%. Recommendations were deemed acceptable in 88%, and the recommendation was given to the patient in 81%.

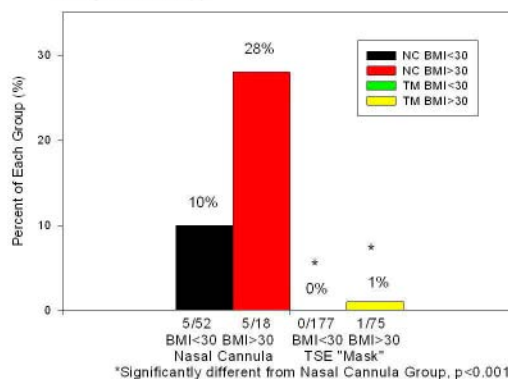
DISCUSSION: Based on this data, the expert system continues to be modified and a formal randomized intervention trial is currently being established.

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S-07.**PRE-OXYGENATION WITH NO-COST TSE “MASK” REDUCES SEVERE DESATURATION IN OBESE PATIENTS UNDER DEEP PROPOFOL SEDATION DURING COLONOSCOPY****AUTHORS:** M. Negron-Gonzalez, S. Cohen, T. Mehta, S. Barsoum, C. W. Hunter, J. Tse**AFFILIATION:** Dept of Anesthesia, UMDNJ-Robert Wood Johnson Medical School, New Brunswick, NJ**INTRODUCTION:** Patients routinely receive nasal cannula (NC) O₂ and iv sedation during colonoscopy. Over-sedation or airway obstruction may cause desaturation, especially in obese patients who have low O₂ reserve and high O₂ demand. A plastic sheet was shown to improve oxygenation in deeply-sedated patients by converting a NC to a face tent (TSE “Mask”) during upper GI endoscopy.¹ We examined its effectiveness in improving oxygenation in obese patients during colonoscopy.**METHODS:** Review of patients who underwent colonoscopy identified 2 groups. Group 1 (NC, n=70) received only NC O₂. Group 2 (TM, n=252) received NC O₂ and a clean plastic specimen bag covering patient’s eyes, nose and mouth(1-3). Patients received NC O₂ (3-5 l/min) prior to sedation with only iv propofol. Monitors included ECG, BP cuff, pulse oximetry, capnography and oximetry. Data collected included age, weight, height, O₂ Sat, bag-mask ventilation, amount of propofol, duration, O₂ and CO₂ levels. Student t-test and Chi Square test were used for analysis. A p value <0.05 was considered as significant. (Mean±S.D.)**RESULTS:** There were no differences in age, ASA status, room air (RA) O₂ Sat, duration and propofol dose between NC and TM groups(Table).Among non-obese patients (BMI<30), the highest NC O₂ flow, the number of patients with severe Desat (O₂ Sat<85%)(Fig) and bag-mask ventilation were higher in NC than TM group whereas O₂ Sat after 5 min O₂ and the lowest O₂ Sat were lower in NC than TM.Among obese patients (BMI>30), the highest NC O₂ flow and the number of patients with severe Desat (O₂ Sat<85%) were higher in NC than TM group whereas the lowest O₂ Sat was lower in NC than TM.FiO₂ was higher in TM (0.74±0.16, n=171) than NC group (0.34±0.17, n=15). There is a small difference in FiO₂ betweenNon-Obese TM (0.72±0.15) and Obese TM patients (0.78±0.16). There were small differences in EtCO₂ (NC: 29±8; TM: 34±7 mm Hg) and inhaled CO₂ (NC: 3±3; TM: 8±5 mm Hg). There was no difference in EtCO₂ or inhaled CO₂ between Non-Obese and Obese TM patients.Fifteen patients in NC group experienced severe desaturation with sedation (Lowest O₂ Sat:86±7%) and NCs were converted to TMs. Their FiO₂ was increased from 35±23% (NC) to 77±13% with TM and O₂ Sat was improved to 98±3%, 99±2% and 99±1% at 5-min intervals.**DISCUSSION:** The data show that pre-oxygenation with a No-Cost TSE “Mask” improves oxygenation and prevents severe desaturation especially in obese patients under deep propofol-sedation during colonoscopy. Even though it may be used as a rescue device when patient’s oxygenation deteriorates, it should be routinely used prior to sedation during colonoscopy.**REFERENCES:**

1. Anesth 107:A922, 2007.
2. Anesth 102:484, 2005.
3. www.TSEMask.com

Fig. 1 Effect of TSE “Mask” on Severe Desaturation (O₂ Saturation <85%) during Colonoscopy**Effects of TSE “Mask” on Patients under Deep Propofol Sedation during Colonoscopy**

| | Age (yrs) | BMI | ASA Status | Duration (min) | Propofol Dosage ug/kg/min | Highest O ₂ Flow (l/min) | Room Air O ₂ Sat | O ₂ Sat 5-min O ₂ | Lowest O ₂ Sat | Severe Desat (O ₂ Sat <85%) | Assisted Ventilation |
|----------------------------|-----------|-----------|------------|----------------|---------------------------|-------------------------------------|-----------------------------|---|---------------------------|--|----------------------|
| Non-Obese NC group (n=52) | 57±17 | 25±3 | 1.9±0.6 | 25±13 | 214±64 | 5.2±1.7 | 99±1% | 99±3% | 94±7% | 5/52 | 2/52 |
| Non-Obese TM group (n=177) | 56±15 | 25±3 | 2.2±0.7 | 26±11 | 224±79 | 4.3±1.0 * | 98±2% | 100±1% * | 98±2% * | 0/177 * | 0/177 * |
| | n.s. | n.s. | n.s. | n.s. | n.s. | *p<0.0001 | n.s. | *p<0.0001 | *p<0.0001 | *p<0.001 | *p<0.02 |
| Obese NC group (n=18) | 57±12 | 34±4 # | 2.3±0.6 | 24±9 | 202±56 | 6.1±1.8 | 98±2% | 99±2% | 90±7% # | 5/18 | 1/18 |
| Obese TM group (n=75) | 56±12 | 36±5 # | 2.2±0.6 | 30±15 | 190±78 | 4.8±1.4 * | 98±2% | 100±1% | 96±5% * | 1/75 * | 1/75 |
| | n.s. | n.s. | n.s. | n.s. | n.s. | *p<0.003 | n.s. | n.s. | *p<0.0001 | *p<0.001 | n.s. |
| | | #p<0.0001 | | | | | | | #p<0.0001 | | |

Data are presented as Mean±S.D. n.s. Not significantly different from respective NC group. *Significantly different from respective NC group. #Significantly different from Non-Obese group.

S-08.**PREOPERATIVE GLUCOSE AND POSTOPERATIVE OUTCOMES IN AMBULATORY SURGERY PATIENTS**

AUTHORS: B. B. Abdelmalak, J. Dalton, J. B. Abdelmalak, E. Christiansen, J. Foss

AFFILIATION: Cleveland Clinic, Cleveland, OH

INTRODUCTION: Pre-operative hyperglycemia is harmful in certain non-cardiac surgery populations. Evidence is lacking on how hyperglycemia may impact outcomes in presumably healthier ambulatory surgery center (ASC) patients. Thus we tested the hypothesis that pre-operative hyperglycemia is associated with increased post-operative morbidity and mortality in an ASC cohort.

METHODS: With IRB approval, we identified all patients presenting for ASC between Jan. 05 and Nov. 09 in the Anesthesia Clinical Database. We excluded patients with missing baseline glucose. Composite outcome included in-hospital cardiovascular, neurological, renal, pulmonary, infectious, major bleeding, wound disruption complications, and in-hospital mortality. Additive logistic regression models (ALRMs) were used to estimate the relationship between baseline glucose and the probability of the outcome before and after adjusting for patient demographics, type of surgery and preoperative co-variables.

RESULTS: A total of 3,598 were analyzed. The incidence [95% CI] of in-hospital outcomes was 1.81% [1.36%, 2.39%]. Unadjusted and adjusted estimates of the relationship between glucose and in-hospital morbidity and mortality are shown in Figure 1. Baseline glucose exhibited a significant univariable relationship with the probability of the outcome ($P=0.027$, Wald test); however this relationship was not significant after adjusting for baseline variables ($P=0.055$).

DISCUSSION: Preoperative blood glucose levels greater than 200 mg/dL were associated with 2.1-fold increased risk in mortality in non-cardiac, non-vascular surgery patients, and with a 4-fold increase in pulmonary embolism in patients undergoing total joint replacement. Thus our results were unexpected. This might be due to decreased precision attributable to the relatively low incidence and corresponding number of events observed in our sample; further study is needed to detect a clinically meaningful association. A large percentage of our patients had an undetermined blood glucose concentration, as it is not a customary practice to check preop blood glucose levels in non-diabetic patients. Since we have previously identified that 13.2% of non-diabetic ASC patients have an impaired fasting glucose (≥ 110 mg/dL), perhaps clinicians should monitor perioperative glucose concentrations in nondiabetic patients. When such an approach is implemented, we might learn more about its implications. In conclusion, baseline glucose was not independently related with the probability of major in-hospital morbidity and mortality in ASC patients.

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S-09.**PREOPERATIVE PATIENT HISTORY AND PREFERENCES RATIONALIZES ANESTHESIA PLANNING**

AUTHOR: A. A. van den Berg

AFFILIATION: Port Hedland Regional Hospital, Port Hedland, WA, Australia

INTRODUCTION: Modern anesthesia is influenced by popularization of ambulatory or same-day admission surgery, nerve stimulator-ultra-sound guided local analgesia (LA), avoidance of anxiolytic premedication, total intravenous anesthesia (TIVA) to reduce emesis (PONV) in susceptible patients, sevoflurane induction and maintenance of general anesthesia (SIMA-GA), augmentation of perioperative analgesia using appropriate LA techniques (inserted "asleep" or "awake, as per patient preference), and, in same-day admission patients, of patient controlled intravenous analgesia (PCIA) or epidural-perineural infusion therapy (inserted "asleep" or "awake") for postoperative analgesia. The author hypothesised that a survey of patient history (PONV, motion sickness, smoking) and preferences (for anxiolytic premedication, LA v. GA, inhaled v. IV induction of GA, for augmentation of GA with a LA technique [inserted asleep or awake] or, in same-day admission patients, choice of PCIA or epidural-perineural infusion therapy [inserted asleep or awake] for perioperative pain relief) would provide epidemiological data guiding an "anesthesia plan" for each patient.

METHODS: With institutional approval and patient consent, consecutive adult patients presenting to the author were interviewed in the day stay-same day admission unit preoperatively. Patient history (PONV, motion sickness, smoking) and preferences (as described above) were canvassed using a questionnaire. Patient demographics and nature of surgery were also recorded. Analysis used Chi-squared tests ($p<0.05$ significance).

RESULTS: 1500 ASA 1-3 patients (age range 17-93 years) were interviewed, of whom 83(6%), 490(34%) and 470(31%) gave histories of PONV, motion sickness and smoking: 191(13%) and 1309(87%) patients requested and declined premedication ($p<0.0005$): 233(15%) and 1141(76%) preferred LA to GA ($p<0.0005$), with 126(8%) undecided: 450(30%) and 685(45%) chose inhaled and IV induction of GA ($p<0.0005$), with 365(24%) undecided: 72(5%) patients requested augmentation of GA with LA, of whom 3(4%) and 69(96%) requested "awake" and "asleep" placement of the LA block: 123(8%) and 120(8%) same-day admission patients requested complimentary epidural-perineural or PCIA for postoperative analgesia, respectively.

DISCUSSION: These data rationalize documentation of a 'patient-centred anesthesia plan' for each patient preoperatively. The plan guides premedication, choice of LA or GA, route of induction of GA, use of TIVA or SIMA-GA, "asleep" or "awake" insertion of LA to augment GA, and use of PCIA or peri-neural infusion therapy for postoperative analgesia.

REFERENCES: None

S-11.**CORRELATION OF THE DEPTH OF SEDATION ASSESSED BY THE SURGEON AND BIS INDEX IN DENTAL EXTRACTIONS IN PEDIATRIC PATIENTS**

AUTHORS: A. S. Sabouri,^{1,2} C. Heard,^{1,2} A. Shepherd,^{1,2} P. R. Creighton,^{1,2} T. Votta^{1,2}

AFFILIATIONS: ¹WCHOB, Buffalo, NY; ²SUNY at Buffalo, Buffalo, NY

INTRODUCTION: IV deep sedation is frequently used during dental procedures. Depth of sedation is usually monitored by practitioner by using different clinical scales. In addition to these scales, the use of the bispectral (BIS) index can be useful in determining the level of consciousness during deep sedation.^{1,2} Improper sedation for this type of surgery can cause procedure delays or even cancellation.³ The purpose of this research project is to verify the efficacy of using the BIS monitor in determining an appropriate level of sedation by a surgeon during routine 3rd molar extractions.

METHODS: Following IRB approval and obtained informed consent/assent, 50 patients were recruited. All patients received ASA standard monitoring as well as the BIS monitor. A standardized sedation regimen, including 4mg midazolam, 100mcg fentanyl and 10mg of propofol increments titrated for effect, was used. The appropriateness of the sedation was assessed by the surgeon. See the attached table. The BIS data was blinded from the surgeon, anesthesiologist and the observer RN.

RESULTS: Mean age of patient was 17.3(± 1.4) Y/O. 76% of patients were female. Mean BMI was 26.8(±6.5). 98% of patients were ASA classification 1 or 2. Mean duration of surgery was 18 min (±8). Median Surgeon assessment during whole procedure was 5 with Min. of 2 and Max. of 7 (1st and 3rd quartile=5). This median associated with mean BIS of 68.4 (range of 76.0 to 60.2). The highest surgeon assessment of 7 was associated with mean BIS of 62.3(range of 77.5 to 48.8). The lowest surgeon assessment of 2 was associated with mean BIS of 73.8 (range of 85.1 to 60.4). Mean BIS during surgery was 71.4 (±11.3). The BIS quartile was highly correlated to the surgeon's assessment of sedation (R= 0.94). See the attached graph. Correlation between duration of surgery and mean BIS or median surgeon assessment was poor(R=0.1) and(R=-0.03)

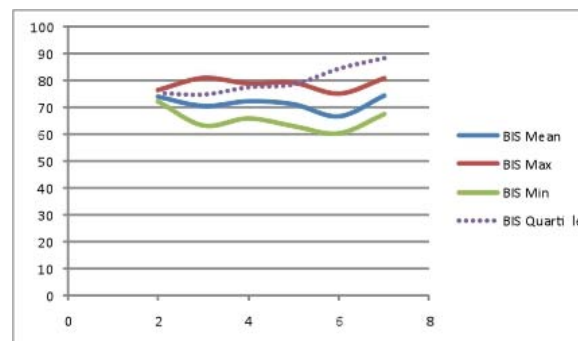
DISCUSSION: The use of deep sedation by non-anesthesia providers is a very common practice in pediatric dentistry. BIS index showed wide range of numbers associate with proper depth of sedation however, higher BIS numbers were correlated with higher chance of interfering with surgery. More studies needed to correlate the duration of surgery and average BIS index.

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Guidelines for Surgeon's Depth of Sedation Assessment

| | |
|----|---|
| 0 | Surgery canceled unable to treat patient due to lack of cooperation |
| 1 | Patient combative / aggressive / potential risk of injury to surgeon or patient |
| 2 | Significant movement or patient vocalizes comprehensible discomfort |
| 3 | Stimulated movement surgical delay - wait for additional meds to work |
| 4 | Unstimulated movement no surgical delay |
| 5 | Appropriate depth of sedation. No movement no delay |
| 6 | Noisy airway no delay or patient intervention |
| 7 | Intervention before airway causes problems or slight delay surgery |
| 8 | Intervention after airway complication or moderate delay surgery |
| 9 | Oral airway / BMV or long delay surgery |
| 10 | Surgery abandoned due to airway |



S-12.**ANESTHESIA FOR GASTRO-INTESTINAL ENDOSCOPY: PATIENT PREFERENCES FOR LOCAL ANALGESIA VERSUS GENERAL (SEDATION) ANESTHESIA****AUTHORS:** A. A. van den Berg**AFFILIATION:** Port Hedland Regional Hospital, Port Hedland, WA, Australia

INTRODUCTION: Upper and lower intestinal endoscopic procedures are variously performed in awake and sedated patients. Gastroscopy may be performed in awake or mildly sedated patients after application of pharyngeal lidocaine. Colonoscopy usually requires intravenous general sedation-anesthesia (GAS) though, very occasionally, is performed under spinal-neuraxial analgesia. It is suggested that guidelines and practices based on patient preferences are most likely to meet criteria for high quality care and patient satisfaction.¹ This audit was undertaken to investigate the preferences of patients undergoing elective gastro-colonoscopy to have their endoscopic procedure performed under an appropriate local analgesic or general 'sedative' anesthetic technique.

METHODS: With institutional approval, 324 successive patients presenting for elective gastroscopy, colonoscopy or combined gastro-colonoscopy were visited in the Day-Stay Unit before 0800 hrs on the morning of the procedure. After routine pre-anesthetic consultation, each patient was offered the choice of an appropriate LA technique (oropharyngeal spray of lidocaine for gastroscopy, neuraxial spinal blockade with lidocaine for colonoscopy) or a GAS technique (hypnosis induced with either propofol or sevoflurane, and maintained by intravenous infusion of propofol). Patient demographics, nature of endoscopy and patient preference for LA or GAS were recorded. Analysis: Chi-squared; $p < 0.05$ significance.

RESULTS: Of 324 patients audited (gastroscopy, N=123; colonoscopy, N=183; gastro-colonoscopy, N=18), 7(2%) and 317(98%) chose LA and GAS ($p < 0.0005$), respectively. Only 5(4%) of 123 and 2(1%) of 183 patients having gastroscopy and colonoscopy, respectively, requested LA, which was satisfactorily provided by topical application or neuraxial injection of lidocaine.

DISCUSSION: This audit of patient preference reveals that the vast majority of patients scheduled for elective gastro-colonoscopy elect to have the procedure under a 'general sedative anesthetic' rather than appropriate local anesthetic technique. The finding that LA is not preferred by most patients suggests that the popularity of gastroscopy under LA, especially, needs re-evaluation, and that a more "patient-centred" approach to this doctor-patient interaction is required in those centres practising gastroscopy under a LA technique.

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S-14.**ABO TYPE AND PONV: IS THERE A CLINICAL CORRELATION?****AUTHORS:** D. Simmons,¹ C. V. Maani²**AFFILIATION:** ¹San Antonio Uniformed Services Health Education Consortium, San Antonio, TX; ²US Army Institute of Surgical Research, Fort Sam Houston, TX

INTRODUCTION: Postoperative nausea and vomiting (PONV) is the most frequent complaint in the post surgical period, occurring in 25-30% of the general population and up to 80% in high-risk patients. Although usually self-limiting and non-fatal, PONV is associated with unplanned hospital admission, increased hospital stay, wound dehiscence, and patient dissatisfaction. Routine administration of anti-emetics is neither substantiated nor cost effective; and in some cases, untoward side effects and expense may result. For the purposes of prevention, preoperative identification of those with risk factors for PONV is worthwhile. Current understanding of risk factors for PONV is ongoing and complicated by the multi-factorial nature of PONV. Several studies have identified key factors that contribute to the occurrence of PONV; relating to patient, surgery and anesthetic plan. To date no study has investigated patient ABO type as a risk factor for the development of PONV. The purpose of this study is to determine if a correlation between ABO type and PONV exists.

METHODS: Adult patients scheduled for elective surgery who gave informed consent were enrolled in this observational questionnaire-based study during their pre-anesthesia visit. The collected data relevant to PONV was analyzed.

Challenging Case Report (only complete if your submission falls into the "Challenging Case Report" category. If you select the "Challenging Case Report" category on the next step, this section must be completed.): N/A

Results: The final sample size comprised of 973 patient completed surveys. The overall incidence of PONV was 30%. Consistent with findings from other studies, female gender, history of motion sickness, and non-smoking status were patient-related factors with statistically significant associations with PONV. A statistically significant correlation between ABO type and PONV was not demonstrated in this study.

DISCUSSION: The recognition of independent PONV risk factors has several implications in the management of PONV. Preoperative identification of those at risk will allow for optimal use of antiemetic prophylaxis and multimodal management strategies. As with previous studies we found that female gender, nonsmoking status, and history of motion sickness were independent risk factors for PONV; however, patient ABO type as a fixed patient-related factor did not appear to have a correlation. Further PONV research examining other patient specific factors such as genetic characteristics could optimize patient care by reducing the incidence and healthcare burden of PONV, allowing clinicians to selectively target safe and effective PONV prophylaxis in at-risk populations while minimizing use when not indicated.

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S-15.**BRIEF NITROUS OXIDE USE AND EARLY RECOVERY AFTER LAPAROSCOPIC SURGERY****AUTHORS:** D. Wax, M. Mazzeffi**AFFILIATION:** Mount Sinai School of Medicine, New York, NY

INTRODUCTION: Anesthesiologists may employ various strategies to decrease recovery time. One such strategy is the use of a volatile agent for maintenance and then substituting nitrous oxide (N₂O) at the end of the case in an effort to decrease time-to-extubation, since N₂O has low solubility but is usually avoided during laparoscopy. N₂O, however, may have adverse effects and may not decrease recovery time.^{1,2} Post-operative nausea/vomiting (PONV) is one of the adverse effects of concern since N₂O has been implicated as a significant risk factor for PONV, reportedly increasing incidence up to 28% overall and 163% in laparoscopic cases.^{3,4,5,6} Other reports have suggested that PONV is only increased with longer N₂O exposure or in patients at high baseline risk.^{7,8,9} We investigated the effect of brief exposure to N₂O on early PONV and time-to-extubation after laparoscopic surgery.

METHODS: With IRB approval, 500 cases of laparoscopic cholecystectomy, herniorrhaphy and oophorectomy from 2004-2009 were identified, factors in Table 1 were tabulated, and cases were grouped into those using no N₂O and those using N₂O briefly. Recovery room records documenting anti-emetic administration were used as an indicator of early PONV. Statistical comparison of the two groups was performed.

RESULTS: A total of 469 records were available for analysis. Table 1 shows that the groups were statistically similar except for the inhalational agents used. Most brief N₂O use was for 5-15 minutes, and the average eN₂O concentration during that time was 47%. There was no statistically significant difference in the incidence of early PONV, occurring in 26% and 30% of the no-N₂O and brief-N₂O groups, respectively. For a subset of 146 non-smoking female patients receiving only a single prophylactic antiemetic medication and representing the group with highest baseline risk, 31% vs. 32% of the no-N₂O and brief-N₂O groups, respectively, had early PONV. The median time from the end of the procedure to extubation was 5 minutes in both groups.

DISCUSSION: Brief use of N₂O following laparoscopic surgery did not appear to increase the incidence of early PONV, even in the highest risk subgroup. However, this strategy did not decrease time-to-extubation. This lack of benefit, combined with its other reported adverse effects, suggest that brief use of N₂O at the end of laparoscopic surgery to decrease time-to-extubation may not be a worthwhile strategy.

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S-16.**PALONOSETRON OR ONDANSETRON FOR RESCUE TREATMENT OF PONV AFTER FAILED PROPHYLAXIS WITH ONDANSETRON****AUTHORS:** C. C. Apfel,¹ K. Candiotti,² T. J. Gan,³ R. Ahmed,⁴ D. Cox⁴**AFFILIATION:** ¹UCSF Medical Center at Mt. Zion, San Francisco, CA; ²University of Miami School of Medicine, Miami, FL; ³Duke University Medical Center, Durham, NC; ⁴Eisai, Inc., Woodcliff Lake, NJ

INTRODUCTION: Postoperative nausea and vomiting (PONV), a frequent postoperative complication, is associated with considerable medical and economic impact as well as patient discomfort and dissatisfaction. 5-HT₃ receptor antagonists prevent PONV; however, few treatment studies for PONV have been performed. Palonosetron HCl is a potent 5-HT₃ receptor antagonist with a longer half-life and distinctly different binding properties compared to older 5-HT₃ receptor antagonists.

METHODS: We conducted a multi-center, open-label, randomized, pilot study comparing palonosetron 0.075mg IV and ondansetron 4mg IV as rescue medication in patients experiencing PONV. The study included patients predicted to be at high risk for PONV and who were scheduled for laparoscopic or gynecological surgery under general anesthesia. All patients received an intraoperative prophylactic dose of ondansetron 4mg IV. Patients who developed PONV in the PACU were randomized to receive either palonosetron or ondansetron. The primary outcome was complete control during the 72-hour post-study administration period, defined as no emetic episode, no rescue medication, and a NRS severity score ≤3.

RESULTS: A total of 239 patients were screened, with 220 (92.1%) randomized and 98 (44.5%) treated for PONV - 48 patients received palonosetron and 50 received ondansetron. In the 0-72 hour post study drug administration period, the incidence of complete control was 25% in the palonosetron and 18% in the ondansetron group. The corresponding incidences for vomiting were 29.8% and 48%, with 62.5% and 56% of patients requiring additional rescue treatment. The most common unexpected adverse events (AEs) for palonosetron and ondansetron were 14.6% vs. 12.0% for headache, 8.3% vs. 10.0% for constipation, and 6.5% vs. 8.0% for dizziness. AEs were generally of mild intensity, with a higher incidence of moderate intensity AEs in ondansetron patients (29.2% vs. 42.0%).

DISCUSSION: While there were numerically higher incidences of complete control and lower incidences for vomiting in the palonosetron versus the ondansetron group, this pilot study was not powered to detect a statistically significant difference. A larger study would be needed to draw a firm conclusion.

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S-17.**A CLOSER LOOK AT THE EFFECT OF DEXTROSE ON POSTOPERATIVE NAUSEA AND VOMITING**

AUTHORS: P. Patel, M. Nguyen, D. L. Anderson, T. Rasmussen, J. Brown, R. L. Applegate

AFFILIATION: Department of Anesthesiology, Loma Linda University School of Medicine, Loma Linda, CA

INTRODUCTION: Postoperative nausea and vomiting (PONV) may occur despite antiemetic prophylaxis and is associated with unanticipated or prolonged hospital stay, financial impact, and patient dissatisfaction. Previous studies have shown that intravenous fluids and dextrose may decrease PONV. We sought to determine if dextrose had an effect on PONV in the absence of antiemetic prophylaxis.

METHODS: IRB approved, double blind randomized placebo-controlled trial (NCT01123837). Consenting adult female, ASA I and II non-diabetic patients undergoing gynecologic, urologic or breast surgery were randomly assigned to infusion of 250 cc of Lactated Ringer's Solution (P; n=76) or Dextrose 5% in Lactated Ringer's Solution (D; n=87) over 2 hours beginning with surgical closing. Blood glucose was checked using a point of care device before transfer to operating room (OR), in OR when surgeon was closing, and in recovery room after infusion. No antiemetics were given in OR. PONV scores were recorded at 0, 30, 60, 120 minutes and 24 hours after arrival in the recovery room. Medication administration was recorded. Statistical analysis with $p < 0.05$ considered significant was performed using JMP 8.0.2. Continuous data were compared using the t-test. Ordinal and nominal data were compared using Chi-Square.

RESULTS: Data from 163 patients with normal baseline blood sugar were analyzed. There were no intergroup differences in age, BMI, ASA, history of PONV, or tobacco use; none of these correlated with PONV. There was no intergroup difference in PONV (P 52%; D 55%; $p=0.73$). 47 subjects required >1 dose or >1 medication to treat PONV. Blood glucose increase after infusion was more in D than P ($p < 0.001$). Subjects with any PONV had (Table 1): longer surgery; higher blood glucose and larger increases after infusion but similar perioperative fentanyl dose.

DISCUSSION: IV dextrose did not prevent or reduce PONV. A larger increase in blood glucose during study fluid infusion correlated to PONV. It is possible that blood glucose increase could reduce gastric emptying and increase the sensation of gastric fullness, potentially contributing to PONV. It is also possible that increase in blood glucose reflects a stress response that could be related to PONV. This study provides insight and suggests a need for further investigation regarding the relationship between changes in blood glucose and PONV.

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Bleeding / Blood Product Conservation

S-18.**SUBSET OF PATIENTS UNDERGOING MAJOR ORTHOPEDIC SURGERY WITH REGIONAL ANESTHESIA FROM THE DESIRUDIN REGISTRY: SAFETY REPORT**

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AFFILIATION: ¹The Ohio State University, Department of Anesthesiology, Columbus, OH; ²Canyon Pharmaceuticals, Parsippany, NJ

INTRODUCTION: Patients undergoing Major Orthopedic Surgery (MOS) are at increased risk of Deep Venous Thrombosis (DVT). It has been recommended by The American College of Chest Physicians that perioperative DVT prophylaxis is provided for all patients undergoing major surgical or invasive procedures. The opportune administration of anticoagulant (AC) therapy in the perioperative setting is crucial to balance the risk of thromboembolic and bleeding episodes. Desirudin is approved by the FDA for DVT prophylaxis in total hip replacement (THR) surgeries and is the first member of the thrombin inhibitor family that can be administered by subcutaneous (SC) injection. The regional anesthetic (RA) approach is challenging, especially when using long half-life anticoagulant agents that may increase the risk of bleeding and hematomas. The use of a short-term anticoagulant (2-3 hr half-life) may provide an option for better monitoring and less risk of bleeding in patients receiving regional anesthesia, requiring DVT prophylaxis. The DESIRE Registry was the first prospective evaluation of desirudin in this patient population. A subgroup of patients who received desirudin and RA was evaluated to determine whether a fixed dose desirudin would be a safe alternative perioperatively.

METHODS: This was a multi-center, prospective, single-arm, observational study in patients undergoing major orthopedic surgery in Europe. All patients received desirudin 15 mg SC BID and were followed and evaluated for DVT, PE, bleeding and death throughout hospitalization.

Challenging Case Report (only complete if your submission falls into the "Challenging Case Report" category. If you select the "Challenging Case Report" category on the next step, this section must be completed.): N/A

RESULTS: After IRB approval and informed consent, from the total of 603 patients enrolled in the registry, 184 of them underwent RA alone. Mean age was 70 yrs (33-97), mean weight 79.9 kg (35-145) and mean duration of therapy of 10.6 days (2-31). The timing of desirudin administration varied and was given > 1 day after anesthesia start in 16%, on the same day in 66% and following induction in 18% of the patients. Five patients (0.83%) in the entire registry required discontinuation of desirudin due to bleeding, 2 (0.33%) of them from the RA subgroup. No patients experienced a spinal hematoma or other bleeding events associated with the RA.

DISCUSSION: Desirudin has been proven to be superior to enoxaparin in orthopedic surgery regardless the type of anesthesia used. Perioperative AC during RA is controversial due to the potential side effects of bleeding and spinal hematoma. Data from this registry suggests that desirudin can be administered safely along with RA in patients undergoing major orthopedic surgery for DVT prophylaxis without an increased risk for bleeding, hematoma or other potential adverse events.

REFERENCES: N/A

S-19.**THE HEMORRHAGIC RISKS OF PERIOPERATIVE ASPIRIN CONTINUATION IN PATIENTS UNDERGOING LAPAROSCOPIC CHOLECYSTECTOMY OR COLORECTAL CANCER RESECTIONS**

AUTHORS: K. Ono,¹ H. Idani,² H. Hidaka,¹ K. Kusudo,¹ Y. Koyama,¹ C. Tanaka¹

INTRODUCTION: Because of the increased thrombotic risks when aspirin is withdrawn in the perioperative period¹, it is our institutional policy to continue aspirin throughout major abdominal surgery. Aspirin continuation, however, may expose patients to the hemorrhagic risks. Especially during laparoscopic-assisted surgery, bleeding-induced poor visualization may increase conversion rate to open surgery and associated morbidity. This study was undertaken to investigate the hemorrhagic risks of patients on aspirin therapy undergoing either laparoscopic cholecystectomy or colorectal cancer resections, which are among the most popular laparoscopic abdominal procedures.

METHODS: Consecutive adult patients scheduled to undergo laparoscopic cholecystectomy or colorectal resections were enrolled prospectively into the study from January 1, 2009 to December 31, 2010. All the patients were divided into two groups according to preoperative aspirin prescription. Patients on aspirin therapy were instructed to continue the drug until the day of the surgery. Duration of surgical procedures, amount of intraoperative blood loss, length of postoperative hospital stay and incidence of conversion to open surgery or reoperation were compared between the two groups. Data were analyzed with Student's t-test, Chi-square test and Fisher exact test.

RESULTS: Among 181 and 157 patients who underwent elective laparoscopic cholecystectomy and colorectal resections, respectively, 26 and 17 patients continued aspirin therapy during the two years period. As shown in Table, there was no statistically significant difference on above outcomes between patients with aspirin and those without undergoing either procedure.

DISCUSSION: The findings of this study indicate that the risk of bleeding and associated morbidity did not increase in patients with aspirin who underwent laparoscopic cholecystectomy or colorectal cancer surgery. Considering of the relatively low risk of bleeding when continued and the high thrombotic risks after withdrawal, aspirin should not be interrupted throughout surgery in these patients.

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| Laparoscopic procedure | Cholecystectomy | | Colorectal resections | |
|--------------------------------------|-----------------------|------------------------|-----------------------|------------------------|
| | Aspirin (+) (n=26) | Aspirin (-) (n=155) | Aspirin (+) (n=17) | Aspirin (-) (n=140) |
| With or without aspirin | | | | |
| Duration of surgical procedure (min) | 100 ± 47* | 78 ± 34* | 152 ± 52* | 153 ± 45* |
| Intraoperative blood loss (ml) | 30 ± 98* | 23 ± 81* | 48 ± 63* | 51 ± 124* |
| Length of postoperative stay (days) | 5 ± 2* | 5 ± 4* | 11 ± 9* | 12 ± 10* |
| Rate of conversion or reoperation | 7% (2/26) | 6% (10/155) | 17% (3/17) | 16% (24/140) |

*: Mean ± SD

S-20.**ADMINISTRATION OF CELL SAVER BLOOD INCREASES ACTIVATED CLOTTING TIME IN CARDIAC SURGERY PATIENTS****AUTHORS:** J. E. Hofer,¹ A. Tung,² M. Nunnally,³ M. O'Connor⁴**AFFILIATION:** ¹University of Chicago, Chicago, IL; ²University of Chicago, Chicago, IL; ³University of Chicago, Chicago, IL; ⁴University of Chicago, Chicago, IL

INTRODUCTION: Although cell saver technology is commonly used, the hemostatic effect of cell saver infusion remains poorly characterized. While some studies report no change in coagulation parameters with use of cell saver blood, decreased hemostasis is often observed clinically. This change in hemostasis has been named Salvaged Cell Syndrome (SCS). We hypothesized that the Activated Clotting Time (ACT) might characterize the coagulopathy associated with the infusion of cell saver blood in cardiac surgery patients.

METHODS: After obtaining IRB approval and written informed consent, patients undergoing cardiac surgery with cardiopulmonary bypass were enrolled in this study. ACT measurements were taken post-induction/pre-sternotomy, post reversal of systemic heparinization with protamine, and approximately 30 minutes after administration of cell saver blood. Patients were excluded from analysis if their post-protamine ACT suggested residual heparin effect (post-protamine ACT > 20% higher than baseline). These ACT measurements were compared to pre-operative lab results, post-operative lab values, and transfusion requirements for the first 24 hours in the ICU. Data analysis was performed using a paired t-test in Microsoft Excel, with statistical significance taken at $p < 0.05$.

RESULTS: We enrolled 30 patients including CABG (9), valve (10), CABG-valve (3) and device placement (8). Baseline ACT measurements ranged from 102 to 160 seconds. The ACT rose a mean of 9 seconds (range = -13 to 36 seconds) following the infusion of cell saver blood ($p < 0.0001$). The volume of cell saver transfused ranged from 100-1000cc.

DISCUSSION: Administration of cell saver blood was associated with an increase in ACT levels compared to baseline and post-protamine ACT measurements. This suggests that the decreased hemostasis on the surgical field following cell saver infusion may correlate with this inexpensive test. Possible causes for increased ACT values include dilutional thrombocytopenia, fibrinogen and clotting factor dilution, residual heparin, and anti-coagulant elements of the inflammatory cascade. Further investigation is needed to elicit the specific causes of coagulopathy associated with cell saver.

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S-21.**CARBON MONOXIDE RELEASING MOLECULE-2 IMPROVES COAGULATION IN PATIENT PLASMA IN VITRO FOLLOWING CARDIOPULMONARY BYPASS****AUTHORS:** S. N. Malayaman, J. M. Persaud, J. B. Cohen, V. G. Nielsen**AFFILIATION:** Department of Anesthesiology, Drexel University College of Medicine, Philadelphia, PA

INTRODUCTION: Coagulopathy following cardiopulmonary bypass (CPB) is an acquired, multifactorial¹⁻⁴ condition that remains an important source of morbidity and mortality. Carbon monoxide releasing molecule (tricarbonyldichlororuthenium (II) dimer; CORM-2) has been shown to improve coagulation and attenuate fibrinolysis.^{5,6} The purpose of this study was to determine if CORM-2 exposure would improve coagulation following CPB.

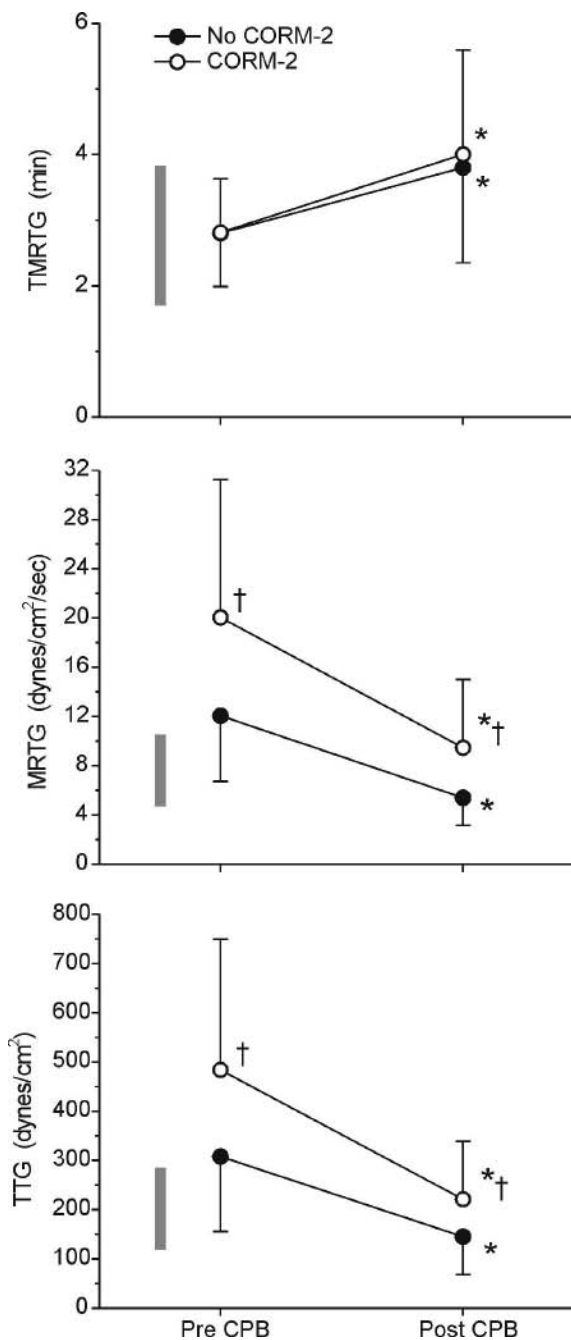
Methods: After IRB approval, written informed consent was obtained from patients scheduled for elective cardiac surgery requiring CPB. Data from 22 patients were used to assess effects of CORM-2 on coagulation, whereas data from 21 of these patients were used to assess effects of CORM-2 on fibrinolysis. Whole blood was collected and anticoagulated with sodium citrate after induction of anesthesia and after CPB and heparin neutralization with protamine. Blood samples were centrifuged for 15 min, with plasma collected and stored at -80°C prior to analysis. Samples were subsequently exposed to 0 or 100 μ M CORM-2, and coagulation activated with tissue factor. Data were collected with thrombelastography until clot strength stabilized.

RESULTS: Patients underwent CPB for 133 ± 61 min (mean \pm SD). As seen in the figure, CPB resulted in a significant increase in time to maximum rate of thrombus generation (TMRTG) which is the time interval (sec) observed prior to maximum speed of clot growth (top panel), a significant decrease (52%) in maximum rate of thrombus generation (MRTG), which is the maximum velocity of clot growth observed (dynes/cm²/sec) (middle panel) and a significant decrease (53%) in total thrombus generation (TTG) which is the amount of clot strength generated during clot growth (bottom panel). While CORM-2 exposure did not significantly affect TMRTG, it significantly increased MRTG (75%) and TTG (52%) before and after CPB compared to matched unexposed samples. The statistical power for these analyses was 0.99-1.0.

DISCUSSION: We present the first clinical investigation of the in vitro efficacy of CORM-2 in attenuating the complex coagulopathy associated with CPB. In sum, CORM-2 enhances coagulation and decreases fibrinolytic vulnerability in vitro in samples obtained from patients undergoing CPB. If preclinical investigations continue to demonstrate hemostatic efficacy and safety, it is anticipated that clinical trials designed to determine the role of CORM-2 in attenuation of complex coagulopathies will be pursued.

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Effects of CPB and CORM-2 on thrombus growth. Gray bars in each panel represent the 95% confidence interval for data obtained from 20 normal subjects. * $P < 0.05$ vs. preCPB, † $P < 0.05$ vs. no CORM-2 exposure.

S-23.**THE EFFECT OF A PREOPERATIVE ERYTHROPOIETIN PROTOCOL ON ALLOGENEIC BLOOD TRANSFUSIONS IN DAILY CLINICAL PRACTICE**

AUTHOR: I. van Haelst,¹ T. Egberts,^{2,3} J. Doodeman,¹ M. Bennis,⁴ C. J. Kalkman,⁵ W. A. Van Kleij⁵

AFFILIATION: ¹Clinical Pharmacy, Medical Center Alkmaar, Alkmaar, Netherlands; ²Clinical Pharmacy, University Medical Center Utrecht, Utrecht, Netherlands; ³Pharmacoepidemiology and Pharmacotherapy, Utrecht University, Utrecht, Netherlands; ⁴Anesthesiology, Medical Center Alkmaar, Alkmaar, Netherlands; ⁵Perioperative Care and Emergency Medicine, University Medical Center Utrecht, Utrecht, Netherlands

INTRODUCTION: Various perioperative blood management strategies have been applied to reduce allogeneic blood transfusions (ABTs) in patients undergoing Total Hip Arthroplasty (THA). In clinical trials, preoperative treatment with recombinant human erythropoietin (rHuEPO) has been shown to reduce the transfusion rate up to 50%.¹ The efficacy of an erythropoietin protocol in daily clinical practice has been insufficiently studied. Therefore, this study evaluated the effect of such protocol on ABT in THA patients. The protocol was part of an integral blood management strategy.

METHODS: This observational study was designed as an interrupted time series (1999 to 2010).² The intervention was the implementation of a preoperative rHuEPO protocol in THA patients in hospital A in 2003. Patients were classified according to baseline Hb value: 10-13 g/dL (eligible patients for rHuEPO) and > 13 g/dL. In hospital B patients never received rHuEPO. We therefore additionally compared the outcomes to those in hospital B. Since 2004, local transfusion protocols were based on a national transfusion guideline.³ The outcome was the percentage of patients receiving an ABT both during surgery and/or postoperative admission. Segmented regression analysis was used to estimate changes in outcomes that occurred after the intervention.²

RESULTS: A total of 4,568 and 1,001 elective primary THA patients were included in hospital A and B, respectively. In hospital A approximately 65% of the THA patients with a baseline Hb between 10-13 g/dL received rHuEPO. Figure 1 and 2 show the transfusion rates in both hospitals. The immediate absolute reductions in transfusion rate after the intervention in hospital A were 16% (95% CI: 21-10) for the total study population and 26% (95% CI: 35- 6) and 6% (95% CI: 13-1) for the Hb strata 10-13 g/dL and > 13 g/dL, respectively. In 1999 the transfusion rate was significantly higher in hospital A compared to B. In 2009, transfusion rates in hospital A and B were comparable.

DISCUSSION: The introduction of a preoperative rHuEPO protocol in the intervention hospital resulted in a significant reduction in transfusion rate in the THA patients with a baseline Hb value between 10-13 g/dL. In the introduction period a reduction was also seen in the group of patients not eligible for the protocol (baseline Hb > 13 g/dL). The implementation of a rHuEPO protocol seemed to have led to a stricter perioperative transfusion policy in all THA patients in hospital A. At the end of the study period, hospital B had comparable transfusion rates, however without a rHuEPO protocol.

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S-24.**SAFETY REPORT FROM THE DESIRUDIN POST-MARKETING REGISTRY-EUROPE IN PATIENTS UNDERGOING MAJOR ORTHOPEDIC SURGERY (DESIRE)**

AUTHOR: E. G. Puente,¹ M. Kurz,² M. A. Antor,¹ A. A. Uribe,¹ N. Erminy,¹ S. D. Bergese¹

AFFILIATION: ¹The Ohio State University, Department of Anesthesiology, Columbus, OH; ²Canyon Pharmaceuticals, Inc., Parsippany, NJ

INTRODUCTION: Introduction: Deep venous thrombosis (DVT) is an important complication in patients undergoing major orthopedic surgery (MOS). The American College of Chest Physicians recommends perioperative DVT prophylaxis for all patients undergoing major surgical or invasive procedures. Perioperative anticoagulant (AC) administration should be optimally managed to balance the risk of thromboembolic and bleeding episodes. There are scant alternatives to heparin-based anticoagulation for surgical patients. Desirudin is the first thrombin inhibitor administered subcutaneously and approved by the FDA for DVT prophylaxis in total hip replacement (THR) surgeries in the US. Desirudin is an AC with a short-term and reversible effect (2-3 hr. half-life) and may provide an option for better management, monitoring and less risk of bleeding in patients requiring anticoagulation for treatment or prophylaxis after MOS.

METHODS: This was a multi-center, prospective, single-arm, registry in patients undergoing MOS in Europe. All patients received desirudin 15 mg subcutaneous (SC) BID and were followed and evaluated for DVT, PE, bleeding and death throughout hospitalization.

Challenging Case Report (only complete if your submission falls into the "Challenging Case Report" category. If you select the "Challenging Case Report" category on the next step, this section must be completed.): N/A

RESULTS: After IRB approval and informed consent, 603 patients were enrolled in the registry, 581 patients were included in the data analysis, 303 (52.15%) underwent THR, 196 (33.73%) total knee replacement, 39 (6.72%) hip fracture repair, 43 (7.4%) other (e.g. spinal and trauma). Mean age was 67.9 ± 5 yr. (range 11-100 yr.). Two-thirds of patients had 3 or more risk factors for DVT not including orthopedic surgery. Thirty-five percent had a prior DVT episode, 13% post-thrombotic syndrome, 9.8% prior PE, 10% history of cancer, 30% obese (BMI > 30), 17% smokers, 17% DM and 33% CHF. Patients received desirudin for a mean of 11 ± 6.6 days and 28.3% of patients received desirudin for greater than 12 days (max 57 days). The timing of desirudin administration varied and was given prior to surgery in 50.3% and after surgery in 48.8% of patients. There were 11 (1.8%) confirmed venous thrombotic events, 8 (1.38%) DVT's and 3 (0.52%) PE's including one fatal case after an emergent spinal surgery due to trauma. Desirudin was discontinued in 5 (0.86%) patients due to bleeding.

DISCUSSION: Patients undergoing MOS are at high risk for major VTE and require a reliable and effective AC therapy with fewer risks. Prophylaxis with desirudin in this patient registry resulted in few VTE events and fewer patients requiring discontinuation of therapy due to bleeding. The results from this registry suggest that desirudin has low risk for bleeding, PE and VTE and can be administered safely for prophylaxis in this patient population.

REFERENCES: N/A

S-25.**A PREDICTIVE MODEL FOR INTRAOPERATIVE BLOOD PRODUCT REQUIREMENTS****AUTHORS:** J. P. Henneman,¹ J. M. Ehrenfeld^{2,1}**AFFILIATION:** ¹Massachusetts General Hospital, Boston, MA;
²Vanderbilt, Nashville, TN

INTRODUCTION: Blood products are an extremely valuable commodity given their high cost, difficulty in acquisition, and necessity to patients in critical times. Anesthesiologists transfuse more blood than many other specialists, and they order much more blood than they administer which leads to excess cost and waste. In 2009, at the Massachusetts General Hospital, only 63% of the 6,696 units of PRBCs that were ordered for surgical patients during the perioperative period were presumed transfused. We therefore set out to create a predictive model for blood product transfusion during surgery to help guide perioperative blood product ordering for surgical patients.

METHODS: We began by obtaining both preoperative characteristics (laboratory studies and demographics) and intraoperative blood utilization data on a large sample of surgical patients. Preoperative factors considered included: age, gender, race, height, weight, surgeon, procedure, ASA physical status classification, emergency status, surgical duration and all standard hematological labs. Forward selection modeling techniques were used to identify significant parameters. Our final logistic model provided beta coefficients for each of the parameters considered to be statistically significant, and enabled the calculation of a probability score (0-100%). The sensitivity and specificity was then calculated for all modeled patients, using a threshold of 7%. Finally, we used a subsequent group of patients from January 2010 to September 2010 (not included in the original sample) to validate our model.

RESULTS: Data from 48,959 adult surgical patients in the period March 2006 to January 2010 was used to build our final model. The following factors were found to be predictive of an intraoperative blood transfusion: age, preoperative hemoglobin, prothrombin time-international normalized ratio, ASA physical status classification, emergency status, surgical duration and surgical procedure. The sensitivity and specificity of the model on the modeled population was 0.923 & 0.876 respectively, and 0.853 & 0.910 for the separate non-modeled population of 10,614 patients.

DISCUSSION: We have developed a model to predict intraoperative blood transfusion that may be used to help guide clinical decision making. As it relies on commonly available preoperative information, we expect the model will be particularly useful to anesthesiologists when deciding whether to order blood products before the start of a surgical case. Ultimately, we expect this model may help reduce excessive blood product ordering, wastage of blood products, and perioperative cost.

REFERENCES: N/A

Cardiothoracic & Vascular Basic Science

S-26.**LIGHT THERAPY IN MYOCARDIAL ISCHEMIA
(ANIMALS INVOLVED)**

AUTHORS: T. Eckle,¹ K. Hartmann,¹ L. Walker,³ D. Kominsky,¹ M. Mittelbronn,² H. Eltzschig¹

AFFILIATION: ¹Department of Anesthesiology, University of Colorado Denver, Denver, CO; ²Institute of Neurology (Edinger Institute), University of Frankfurt, Frankfurt, Germany; ³Division of Cardiology, Department of Medicine, University of Colorado Denver, Denver, CO

INTRODUCTION: Studies of metabolic adaptation during environmental stress have broad applications to human disease. As such, adenosine signaling has been implicated in cardiac adjustment to limited oxygen availability.^{1,2} A search for adenosine-dependent pathways activated during myocardial ischemia pointed us towards the circadian rhythm gene period2 (Per2).

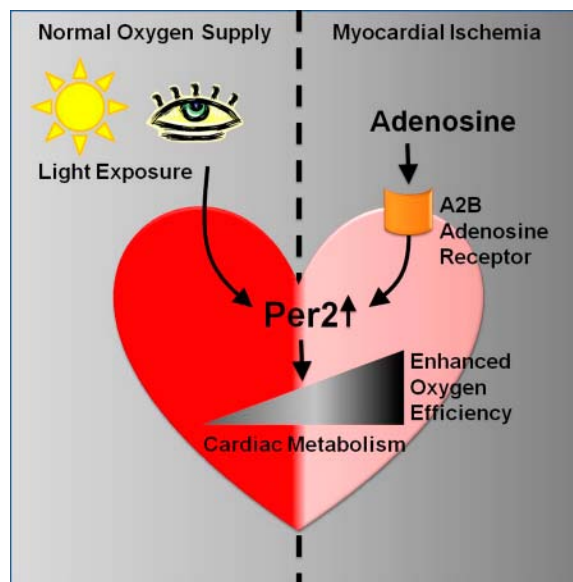
METHODS: All animal and human studies had IACUC and IRB approval and were in accordance with the APS/NIH guidelines. Studies on induction or stabilization of Per2 were assessed by real-time RT-PCR, western blotting, and immunohistochemistry using in vitro and in vivo models for myocardial hypoxia and ischemia (3), respectively. In order to elucidate the role of cardiac Per2 we exposed wildtype and Per2^{-/-} mice to myocardial ischemia and determined infarct sizes, metabolic and structural changes.

RESULTS: Pharmacological or genetic studies confirmed adenosine-dependent stabilization of Per2 with ischemia via inhibition of the SCF E3 ubiquitin ligase. Cardiac biopsies of patients suffering from ischemic heart disease observed elevated PER2 transcript and protein (6.6 ± 1.5 and 1.8 ± 0.25 over control, respectively). Serendipitously, Per2^{-/-} mice experienced larger infarcts and were not protected by ischemic preconditioning. Metabolic studies revealed that Per2^{-/-} mice failed to convert from lipid metabolism to aerobic and anaerobic glycolysis during myocardial ischemia. Moreover, cardiac stabilization of Per2 via light exposure provided profound cardioprotection from ischemia (7.6 ± 0.5 fold reduction of infarct size).

DISCUSSION: These studies reveal a role of a master regulator for Per2 in mediating ischemia tolerance by reprogramming cardiac metabolism and give a clue for light-dependent metabolic adaptation of the heart.

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S-27.**THE SYNERGY OF ANTIOXIDANTS
N-ACETYLCYSTEINE AND ALLOPURINOL
ENHANCES CARDIAC ADIPONECTIN ACTIVATION
AND REDUCES POSTISCHEMIC MYOCARDIAL
REPERFUSION INJURY IN STREPTOZOTOCIN
-INDUCED DIABETIC RATS****AUTHORS:** T. Wang, S. Qiao, Y. Liu, K. F. Ng, M. G. Irwin, Z. Xia**AFFILIATION:** University of Hong Kong, Hong Kong, China

INTRODUCTION: Hyperglycemia-induced oxidative stress plays a central role in the development of diabetic myocardial complications. Adiponectin, an adipokine with anti-diabetic and anti-ischemic effects,¹ is decreased in diabetes. It is unknown whether or not antioxidant treatment with N-acetylcysteine (NAC) and/or allopurinol (ALP) may attenuate adiponectin deficiency and myocardial ischemia injury in the early stage of diabetes.

METHODS: Control or streptozotocin (STZ)-induced diabetic rats were either untreated (C, D) or treated with NAC (1.5g/kg/day) or ALP (100 mg/kg/day) or their combination for four weeks starting at one week after streptozotocin injection. Plasma and cardiac biochemical parameters were measured after the completion of treatment, and the rat hearts were subjected to myocardial ischemia/reperfusion by occluding the left coronary artery for 30 minutes followed by 2 hours reperfusion.

RESULTS: Plasma and cardiac adiponectin levels were decreased in diabetic rats accompanied by decreased cardiac adiponectin receptor 2 (AdipoR2), reduced phosphorylation of Akt, STAT3 and eNOS but increased plasma interleukin-6 and tumor necrosis factor- α (all $P < 0.05$ vs. C). NAC but not ALP increased cardiac adiponectin concentrations and AdipoR2 expression in diabetic rats. ALP enhanced the effects of NAC in restoring cardiac AdipoR2 and phosphorylations of Akt, STAT3 and eNOS in diabetic rats. Further, NAC and ALP, respectively, decreased postischemic myocardial infarct size and creatinine kinase-MB secretion in diabetic rats, while their combination conferred synergistic protective effects.

DISCUSSION: NAC and ALP synergistically restore myocardial adiponectin and AdipoR2 mediated eNOS activation. This may represent the mechanism through which NAC and ALP combination greatly reduces myocardial ischemic injury in early diabetic rats.

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S-28.**A2BAR AGONIST TREATMENT AS THERAPEUTIC
OPTION IN MYOCARDIAL ISCHEMIA REPERFUSION
INJURY (ANIMALS INVOLVED)****AUTHORS:** M. Koeppen,¹ M. Mittelbronn,² T. Eckle¹**AFFILIATION:** ¹Department of Anesthesiology, University of Colorado Denver, Denver, CO; ²Institute of Neurology (Edinger Institute), University of Frankfurt, Frankfurt, Germany

INTRODUCTION: Recent studies on adenosine signaling in mice identified the A2B adenosine receptor as the important mediator of cardiac ischemic preconditioning.¹ However, the role of A2BAR signaling on tissue injury during reperfusion of the post ischemic myocardium has still to be elucidated.

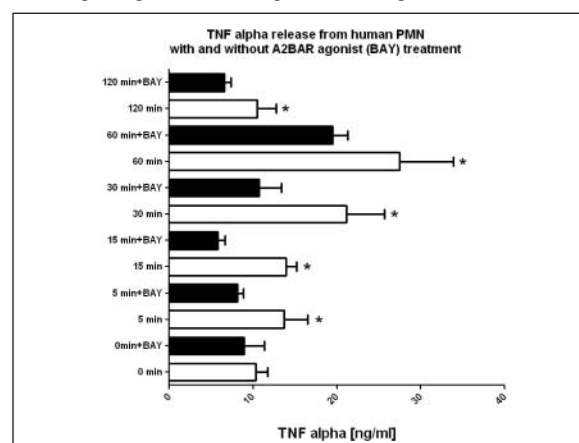
METHODS: All animal and human studies had IACUC and IRB approval and were in accordance with the APS/NIH guidelines. To understand inflammatory processes after myocardial ischemia, we analyzed post ischemic myocardium using Multiplex ELISA, MPO ELISA and histology. Activated human PMNs were analyzed for TNF α release with and without specific A2BAR (BAY 60-6853) agonist treatment. In order to elucidate the role of A2BAR signaling in ischemia reperfusion injury we generated chimeric mice for the A2BAR² and exposed them to myocardial ischemia.³

RESULTS: A multiplex ELISA study on inflammatory markers identified IL8 and TNF α as significantly increased in the reperfused myocardium of A2BAR^{-/-} mice when compared to wildtype, whereas other markers were unchanged. Histological studies showed that increased IL8 levels correlated with the infiltration of mainly neutrophils into the post ischemic myocardium. Subsequent studies using a highly specific A2BAR agonist on activated human neutrophils revealed an A2BAR dependent attenuation of TNF α release. Following studies using A2BAR chimeric mice revealed A2BAR signaling on bone marrow derived cells as an endogenous cardioprotective mechanism.

DISCUSSION: Taken together, these studies suggest A2BAR agonist treatment in myocardial ischemia to dampen neutrophil mediated reperfusion injury.

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S-29.**PTEN-AKT SIGNALING IN DIABETIC HUMAN MYOCARDIUM - POTENTIAL ROLE OF PREOPERATIVE GLUCOMETRICS**

AUTHORS: B. Wang,¹ K. Raedschelders,¹ J. Shrivah,¹ Y. Hui,³ G. Fradet,² D. M. Ansley¹

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INTRODUCTION: The molecular defects associated with Type 2 diabetes (DM2) and hyperglycemia contributing to poor postoperative outcomes have not been well defined.¹ Impaired prosurvival phosphatase and tensin homologue on chromosome 10 (PTEN)-Akt signaling could be an important feature of the diabetic heart, rendering it resistant to preconditioning or at risk of injury.² The purpose of this study was to determine the relationship between baseline differences in preoperative glucometrics and their association with PTEN and myocardial Akt signalling in patients with or without DM2 undergoing primary CABG.

METHODS: Following institutional approval and informed patient consent, 36 patients (18 DM2; 18 non DM2) enrolled in PRO-TECT II were studied.³ Standardized anesthetic care preceded coronary sinus (CS) catheterization, right atrial tissue biopsy, and blinded PRO-TECT II intervention. Preoperative glycosylated Hgm (HgmA1c) and fasting blood glucose (FBG) were recorded. CS 15-f2t-isoprostane (a biomarker of oxidative stress) was determined by liquid chromatography-mass spectrometry. PTEN, Akt, phospho-Akt, eNOS, phospho-eNOS, and antiapoptotic Bcl-2 expression were determined by Western blot. $P < 0.05$ was considered statistically significant.

Challenging Case Report (only complete if your submission falls into the "Challenging Case Report" category. If you select the "Challenging Case Report" category on the next step, this section must be completed.): N/A

Results: HgmA1c was $6.9 \pm 1.2\%$ in DM2. FBG (8.1 ± 1.63 vs 6.44 ± 1.42 mmol/L; $P = 0.002$), CS 15-f2t-isoprostane concentrations (100.5 ± 57.3 vs 53.4 ± 35.1 pg/ml; $P = 0.0006$) and PTEN expression (1.01 ± 0.64 vs 0.55 ± 0.5 AU; $P = 0.005$) were higher in patients with DM2. FBG correlated with CS plasma 15-f2t-isoprostane ($P = 0.02$; $r = 0.4$; 95% CI: 1.41 to 16.72). CS 15-f2t-isoprostane correlated with myocardial PTEN expression ($P = 0.008$; $r = 0.44$; 95% CI: 0.002 to 0.011). Myocardial phospho-Akt expression was decreased in patients on oral hypoglycemic agents ($p = 0.014$). Phospho-eNOS and Bcl-2 were significantly lower in diabetic compared to non-diabetic myocardium ($P = 0.0045$; $P = 0.026$). FBG and Bcl-2 were negatively correlated ($P = 0.008$; $r = 0.44$; 95% CI: -0.22 to -0.03).

DISCUSSION: Hyperglycemia and oxidative stress may regulate PTEN interruption of Akt prosurvival signalling in diabetic human myocardium and explain impaired responsiveness to preconditioning stimuli. A decrease in antiapoptotic Bcl-2 could promote mitochondrial directed cell death. Simultaneously targeting perioperative glucometrics and cardiac tissues to inhibit PTEN or activate PI3K/Akt may prove to be an effective treatment alternative for the cardioprotection of surgical patients with DM2. This is being explored in the PRO-TECT II study.

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S-31.**ANTIOXIDANT N-ACETYLCYSTEINE RESTORES REMIFENTANIL PRECONDITIONING CARDIOPROTECTION IN RATS WITH STREPTOZOTOCIN-INDUCED DIABETES**

AUTHORS: Z. Xia^{1,2}, S. Qiao,¹ Y. Liu,¹ H. Liu,^{1,2} G. T. Wong,¹ M. G. Irwin¹

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INTRODUCTION: Preconditioning with the opioid receptor agonist remifentanyl confers cardioprotection against myocardial ischemia reperfusion injury.¹ However, remifentanyl preconditioning (RPC) is less effective in diabetes,² a disease associated with increased oxidative stress. We hypothesized that treatment with the antioxidant N-acetylcysteine (NAC) may restore the sensitivity of diabetic hearts to RPC.

METHODS: Male control (C) or streptozotocin-induced diabetic (D) Sprague-Dawley rats were either untreated or treated with 1.5g/kg/day of NAC (DN) for four weeks starting at one week after streptozotocin injection. Rats in all groups were subjected to ischemia reperfusion injury, which consisted of 30 min of coronary artery occlusion followed by 2 hours of reperfusion. The study groups (n=5-6/group) included control untreated (C), diabetic untreated (D), control plus RPC (C+RPC), diabetic plus RPC (D+RPC), diabetic NAC treated (DN), diabetic NAC treated plus RPC (DN+RPC) groups. RPC was achieved with 3 consecutive 5 min infusions of remifentanyl (6 µg/kg) interspersed with 5 min infusion-free periods immediately prior to ischemia. Myocardial infarct size (IS), as a percentage of the area at risk, was determined by triphenyltetrazolium chloride staining. Plasma samples were obtained at the end of 2 hours reperfusion to measure cardiac specific creatine kinase-MB (CK-MB). Data are expressed as mean \pm S.E.M.

RESULTS: The IS in diabetic untreated group ($49.7 \pm 3.8\%$) was similar to that in the control group ($40.1 \pm 5.2\%$) ($P > 0.05$ D vs. C). RPC significantly reduced IS in C rats ($25.2 \pm 3.8\%$ in C+RPC, $P < 0.05$ vs. C) but not in D rats ($39.5 \pm 6.6\%$ in D+RPC, $P > 0.05$ vs. D). NAC treatment alone reduced IS in D rats ($20.4 \pm 4.4\%$ in DN, $P < 0.05$ vs. D) and marginally potentiated RPC effects in D rats (IS: $18.0 \pm 4.1\%$ in DN+RPC, $P < 0.01$ vs. D or D+RPC; $P > 0.05$ vs. DN). The patterns of CK-MB variations in groups C (42.7 ± 1.8 U/L), D (41.4 ± 1.3 U/L), C+RPC (37.7 ± 0.8 U/L), D+RPC (39.9 ± 0.9 U/L), DN (36.0 ± 1.3 U/L) and DN+RPC (30.0 ± 1.0 U/L) basically mirrored the changes of IS, except that differences in CK-MB between DN and DN+RPC groups reached statistical significance ($P < 0.05$) while IS in DN+RPC was just about 10% lower than that in DN group ($P > 0.05$).

DISCUSSION: Antioxidant NAC can restore and potentiate remifentanyl preconditioning cardioprotective effects in diabetic rats reflected as further reduction in post-ischemic myocardial cellular damage.

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S-32.**ENT2 IN MYOCARDIAL ISCHEMIA
(ANIMALS INVOLVED)****AUTHORS:** T. Eckle, H. Eltzschig**AFFILIATION:** Department of Anesthesiology, University of Colorado Denver, Denver, CO

INTRODUCTION: Adenosine mediated cardiac ischemic preconditioning (IP) has been suggested as the strongest form of in vivo protection during acute myocardial infarction. However, the underlying molecular mechanisms remain poorly understood. As extracellular adenosine is rapidly taken up into the intracellular space followed by metabolism to inosine or AMP, adenosine transport mechanisms (ENTs) represent an important target for modulating cardiac adenosine responses during IP.

METHODS: All animal studies had IACUC/IRB approval and were in accordance with the APS/NIH guidelines. Studies on ENT regulation were assessed by real-time RT-PCR and western blotting using in vitro and in vivo models for myocardial hypoxia and ischemia, respectively. In order to elucidate the role of cardiac ENT we exposed wildtype, ENT1 and ENT2 minus mice to myocardial ischemia with and without IP and determined metabolic changes and infarct sizes.^{1,2}

RESULTS: Studies on ENT1-3 transcript levels revealed a dominant downregulation of ENT2 mRNA due to hypoxic preconditioning of neonatal cardiomyocytes in vitro or cardiac ischemic preconditioning in vivo. Analysis of cardiac adenosine levels showed a significant increase at baseline in ENT1^{-/-}, but not in ENT2^{-/-}. IP treatment of the heart in vivo increased significantly cardiac adenosine in wildtype and ENT2^{-/-}, but not ENT1^{-/-} mice when compared to corresponding controls. Following myocardial ischemia studies without IP resulted in reduced infarct sizes in ENT1^{-/-} and ENT2^{-/-} mice. However, IP pretreatment did not further decrease infarct sizes in ENT1^{-/-}, whereas IP treatment in ENT2^{-/-} mice led to even stronger cardioprotection when compared to wildtype mice.

DISCUSSION: Taken together, these data point towards a critical role of cardiac ENT2 in IP mediated cardioprotection.

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S-33.**BETA-ADRENORECEPTOR REGULATION IN AN
EXPERIMENTAL MODEL OF HEART FAILURE
INDUCED BY AN AORTOCAVAL, INFRARENAL SHUNT****AUTHORS:** S. Treskatsch,¹ A. Feldheiser,¹ M. Shakibaei,² S. Mousa,¹ M. Schäfer,¹ C. Spies¹**AFFILIATION:** ¹Dep. of Anesthesiology and Intensive Care Medicine, CCM/CVK, Charite, Berlin, Germany; ²Institute of Anatomy, LMU, München, Germany

INTRODUCTION: In the model of aortocaval, infrarenal shunt a chronic volume overload leads to congestive heart failure. Despite increased plasma catecholamines the inotropic myocardial response is attenuated.¹ The exact regulation of the myocardial expression of beta1-, beta2-, and beta3-adrenergic receptors has not been systematically investigated in this model.^{2,3}

METHODS: Following IRB approval, this project examined in Wistar rats four weeks after shunt induction with the needle (16G)-technique described by Garcia/Diebold the extent of chronic heart failure by an intraventricular pressure-volume-catheter in vivo, the adaptations in myocardial beta-adrenergic receptor expression by RT-PCR, and the changes in the subcellular myocardial structure by electron microscopy.

RESULTS: Preliminary results revealed a significant increased heart- (3,84 ± 0,07 vs. 6,48 ± 0,22 mg/g BW) and lung index (3,75 ± 0,14 vs. 6,75 ± 0,44 mg/g BW) in shunt animals accompanied by an increased central venous and left enddiastolic pressure. Stroke volume (132,6 ± 4,9 vs. 290,5 ± 26,2 µl) was more than doubled, however, left ventricular ejection fraction (71,9 ± 2,2 vs. 39,8 ± 5,0 %) and the maximum rate of pressure development (15444,6 ± 793,7 vs. 10740 ± 869,1 mmHg/s) were significantly reduced. There was a significant correlation between the heart-/lung index increase and LVEF decrease. Furthermore, a restriction of the diastolic function became obvious by means of a reduced maximum rate of pressure decay (-9824,6 ± 683,1 vs. -6699,6 ± 497,0 mmHg/s) and Tau. Expression of beta1- and beta2-receptor mRNA were downregulated, however, expression of beta3-receptor mRNA was up-regulated in both ventricles. Changes of the subcellular myocardial structure pointing towards a dilatation were visible in electron microscopy.

DISCUSSION: In conclusion, the hemodynamic characterization of the aortocaval, infrarenal shunt model revealed overt signs of a decompensated congestive heart failure with a significant reduced systolic and diastolic function. This restriction in function was accompanied by a beta1- and beta2-receptor mRNA-downregulation, a beta3-receptor mRNA-upregulation and concurrent subcellular changes towards a myocardial dilatation.

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S-34.**BRADYKININ-INDUCED ALTERATION IN HUMAN
BRAIN CAPILLARY ENDOTHELIAL CELL FUNCTION**

AUTHORS: J. Simoni,¹ H. F. Gonzalez,^{2,1} G. Simoni,¹ S. J. Campbell,¹ J. Wasnick,² J. A. Griswold¹

AFFILIATION: ¹Department of Surgery, Texas Tech University Health Sciences Center, Lubbock, TX; ²Department of Anesthesiology, Texas Tech University Health Sciences Center, Lubbock, TX

INTRODUCTION: The endogenous vasoactive nanopeptide bradykinin (BK) is an important inflammatory mediator that increases vascular permeability.^{1,2} The cerebral exposure to BK is associated with arteriolar dilation and selective opening of the blood-brain barrier.³ BK has been implicated as a factor in the capillary leak syndrome (CLS) and cerebral edema, often seen in burn patients.⁴ The inflammatory response after burn injury favors the release of BK.⁵ The current study was designed to investigate the vascular effect of BK, using normal and glutathione (GSH) depleted human brain capillary endothelial cells (EC) to mimic the condition of burn patients with ischemic episodes.

METHODS: The confluent normal and GSH depleted EC grown on polycarbonate membranes or coverslips were incubated for 18 hrs in a cell culture medium containing BK in a concentration of 10⁻⁷ or 10⁻⁶ M and tested for: (i) permeability by determining the diffusion rate of 125I-albumin across the monolayer, (ii) microscopic densitometry assessment of cell shrinkage, (iii) inflammatory response by monitoring the surface expression of the intracellular adhesion molecule (ICAM-1), and (iv) early and late apoptosis using Annexin V-FITC and propidium iodide (PI) fluorescence probes, respectively.

RESULTS: Results indicate that although BK in a concentration of 10⁻⁷ M produces no effect on normal EC, doses of 10⁻⁶ M increase EC permeability, induce cell shrinkage and initiate moderate inflammatory response. These effects were aggravated in GSH depleted EC. BK in a concentration of 10⁻⁷ M caused an evident translocation of phosphatidylserine (PS) to the external portion of the membrane, greater cell shrinkage, higher diffusion rate of 125I-albumin and a more visible expression of ICAM-1, as compared to normal EC. In higher concentrations, BK further enhanced these responses, including the initiation of late apoptotic events represented by the binding of PI to DNA, and increased permeability (p<0.01) that was associated with evident cell shrinkage, larger gap formation and more extensive expression of ICAM-1 (p<0.01).

DISCUSSION: These observations suggest that BK in ischemic EC can be considered as a strong pro-apoptotic force, being also responsible for increased cell shrinkage and permeability and the cellular inflammatory responses. BK can be a mediator of the endothelial complications in burns, particularly blood-brain barrier permeabilizing activity in sera of severe-burn patients.

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S-35.**DIFFERENCES IN ORGAN SPECIFIC HIF- α EXPRESSION BEFORE AND AFTER ACUTE ANEMIA IN HIF- α (ODD) LUCIFERASE MICE**

AUTHORS: A. Tsui^{1,2}, P. A. Marsden,^{2,3} M. Henkelman,⁴ K. M. Lee^{1,2}, D. Mazer,^{1,2} G. M. Hare^{1,2}

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INTRODUCTION: Acute anemia leads to increased morbidity and mortality by undefined mechanisms. Tissue hypoxia is a likely mechanism of organ injury which remains incompletely understood. Upregulation of hypoxic proteins has been demonstrated during anemia.¹ To further characterize this hypoxic tissue response, we utilized a transgenic mouse model to study real-time HIF- α expression in vivo [HIF- α (ODD)-luciferase]; thus, allowing us to determine the hypoxic cellular response to anemia in multiple organs.

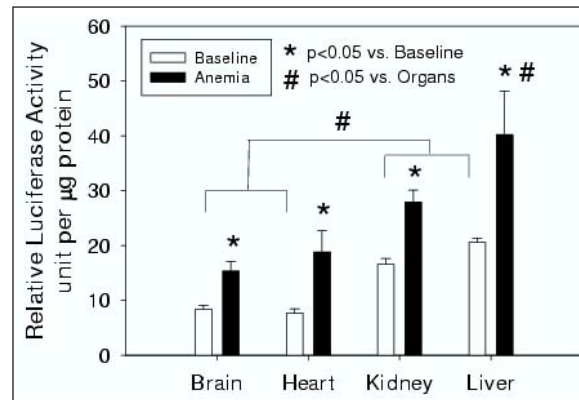
METHODS: After obtaining ACC approval, real-time expression of HIF- α was assessed in anesthetized HIF- α (ODD)-luciferase mice hemodiluted to a target hemoglobin concentrations (Hb) of 50g/L. Whole body HIF- α expression was measured in vivo by bioluminescence imaging after injecting D-luciferin (50mg/kg; i.p). Anesthetized (1.5% isoflurane, 21% oxygen) spontaneously breathing mice were placed in a light-tight chamber and photons were collected (Xenogen 300) at baseline and 1, 6, and 24 hrs following hemodilution. To determine specific tissue luciferase activity in vitro, tissue was harvested from control and anemic HIF- α (ODD)-luciferase mice after 6 hrs. Luciferase activity was measured in triplicate by FLUORstar Optima. Significance was assigned at $p < 0.05$ by ANOVA (Mean \pm SD).

RESULTS: Whole body HIF- α luciferase activity increased maximally after 6 hrs of anemia (2.2 ± 0.4 fold, $p < 0.05$), relative to baseline. Baseline tissue HIF- α luciferase expression was higher in the kidney and liver (16.6 ± 1.1 and 20.6 ± 0.8 RLU/ μ g protein) relative to the brain and heart (8.4 ± 0.7 and 7.7 ± 0.7 RLU/ μ g protein)($p < 0.05$). In acute anemia, HIF- α luciferase activity was increased in all organs ($p < 0.05$). The largest increase occurred in the liver (40.2 ± 7.9 RLU/ μ g protein, $p < 0.05$), relative to the brain, heart and kidney (15.4 ± 1.7 , 18.9 ± 3.8 , 28.0 ± 2.2 RLU/ μ g protein).

DISCUSSION: Utilizing HIF- α (ODD)-luciferase mice, we demonstrated that basal HIF- α expression was lower in brain and heart, relative to the kidney and liver, suggesting that lower basal PO₂ values may have contributed to HIF- α stabilization in the kidney and liver. Anemia increased HIF- α expression in all organs assessed suggesting a generalized reduction in tissue PO₂. Higher HIF- α levels in the anemic liver, relative to other organs, provided evidence of heterogeneity in tissue oxygen delivery during acute anemia. These data have important implications with respect to understanding the cellular mechanisms of anemia-induced morbidity and mortality and may help to determine optimal treatments for acute anemia (SCA, CIHR, HSFC support).

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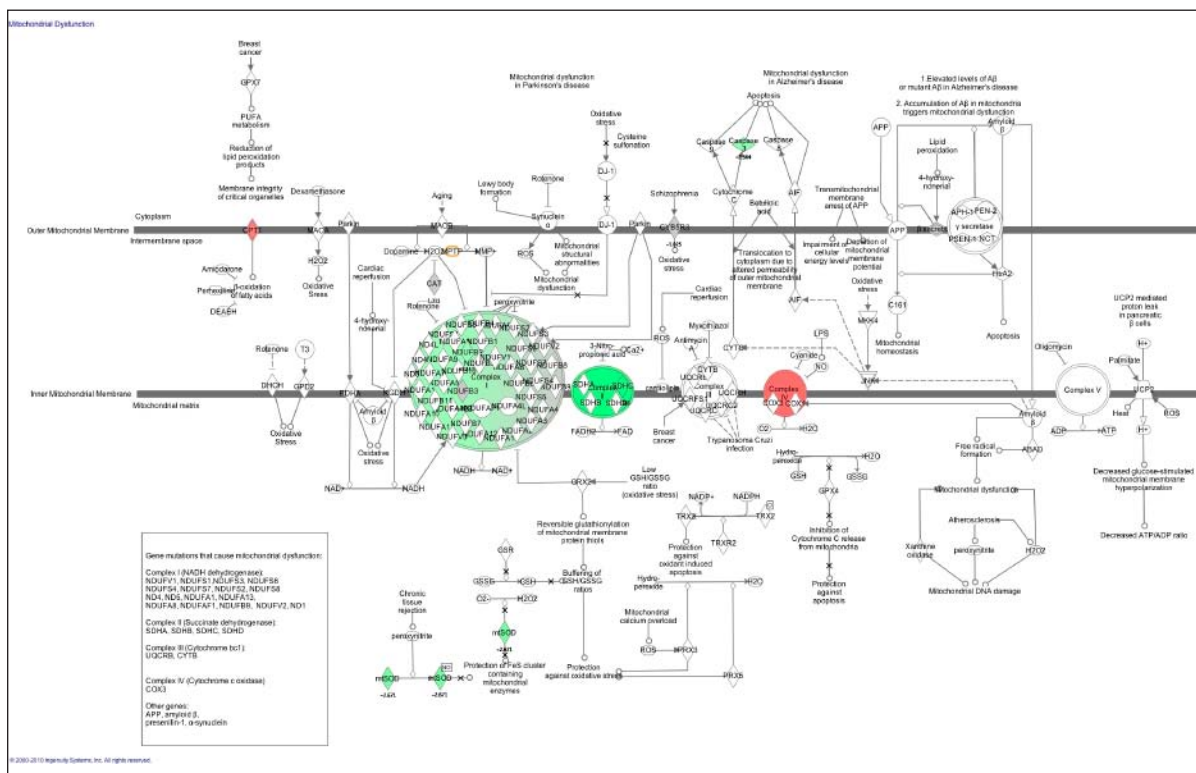
McLaren AT et al. Am J Physiol 2007 292:R403



Organ Specific HIF Luciferase Activity Before and After Anemia

S-36.**EPINEPHRINE EXPOSURE ALTERS
MITOCHONDRIAL GENE EXPRESSION PROFILE IN
CULTURED RAT CARDIOMYOCYTES****AUTHORS:** H. Liu, X. Hu, P. L. Kalarickal, C. J. Fox, P. Primeaux, A. D. Kaye**AFFILIATION:** Tulane University Medical Center, New Orleans, LA**INTRODUCTION:** Low cardiac output syndrome necessitates inotropic support. Epinephrine is one of the most commonly used inotropes. However, studies have shown epinephrine could lead to adverse clinical outcomes.^{1,2} We hypothesize that epinephrine exposure may alter mitochondria gene expression profile and lead to adverse clinical outcomes.**METHODS:** Rat cardiomyocytes (H9C2) were inoculated at the concentration of 0.5M/ml and cultured at 37°C in DME. The cells were allowed to settle down overnight and then exposed to epinephrine (1μM) for 1, 24 and 48 hours. H9C2 cells without epinephrine served as controls. RNA was extracted from cultured cardiomyocytes for whole genome gene expression study. This array contains 41,000+ rat genes. cDNA were synthesized from RNA samples and then used to synthesize fluorescent cRNA. Labeled cRNA samples were hybridized to the Whole Rat Genome Oligo Microarray slides. After hybridization, arrays were washed and scanned. These data were imported into GeneSpring software as 20 one-color arrays and normalized to the median per chip and the median value per gene across all arrays. Parameter data was added so that microarrays could be grouped by time and treatment. Guided workflow returned several gene lists. These were analyzed for significant Gene Ontology and pathway hits based on passed P value.**RESULTS:** Several Epinephrine-induced gene expression changes (with $P < 0.05$) that related to mitochondrial dysfunction were identified. Up-regulated genes included Mitochondrial Complex IV (Cytochrome c oxidase), CPT I (Carnitine palmitoyltransferase I), and down-regulated genes SDHA, B, C, D, NDUFS, Caspase, and others (Figure-1). Mitochondria are critical for cellular bioenergetics and mediate cellular apoptosis.**DISCUSSION:** Our study showed that epinephrine exposure alters mitochondrial gene expression pattern in cardiomyocytes, and implied that clinically observed adverse outcomes in patients being treated with epinephrine may be related to epinephrine-induced mitochondrial dysfunction. Animal studies are needed to illustrate the importance of these gene expressional changes.**REFERENCES:**

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Cardiothoracic & Vascular – Clinical

S-37.

WITHDRAWN.

S-38.**RAPID VENTRICULAR PACING FOR INDUCED HYPOTENSION AND PRECISE DEPLOYMENT OF ENDOVASCULAR AORTIC STENT GRAFTS****AUTHORS:** E. D. Wittwer,¹ G. S. Oderich,² N. E. Torres,¹ W. J. Mauermann,¹ J. N. Pulido¹**AFFILIATION:** ¹Mayo Clinic, Department of Anesthesiology, Rochester, MN; ²Mayo Clinic, Vascular Division, Rochester, MN

INTRODUCTION: Precise deployment of endovascular aortic stent grafts for aortic arch and proximal thoracic aortic aneurysms (TAA) requires strict blood pressure control to avoid malposition due to displacement by pulsatile forces. Adenosine induced asystole or vasodilators are frequently used methods of induced hypotension, but disadvantages include the slow or unpredictable effect and delayed recovery times. Rapid ventricular pacing (RVP) via transfemoral venous approach has been described by cardiologists for use in the catheterization laboratory for this purpose.¹ This technique induces an immediate decrease in mean arterial pressure (MAP) with controlled duration and rapid recovery when terminated. We describe a novel approach with the use of a standard pulmonary artery catheter (PAC) via transjugular approach.

METHODS: Records of 18 patients treated for aortic arch and TAAs utilizing PAC guided RVP were reviewed. The pacing rate, duration, number of episodes, MAP, time to recovery of normal MAP and complications were noted.

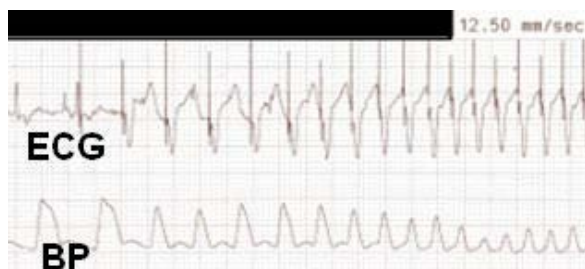
Following induction of anesthesia, an arterial line, right internal jugular introducer and PAC were placed, followed by pacing wire advancement via right ventricular pacing port. Capture of the pacing wire was tested. Rapid ventricular pacing was performed during endograft deployment and/or balloon dilatation of landing zones, with pacing up to 200 bpm to achieve a MAP of 40-55 mmHg. Pacing was then terminated and patients were scrutinized for hemodynamic recovery.

RESULTS: Mean pacing rate, duration, number of episodes and MAP were 177 bpm, 30 sec, 3 episodes and 47 mmHg, respectively. One patient with severe mitral valve insufficiency and cardiomyopathy died during ventricular pacing for multiple graft deployments due to refractory hypotension. No other complications were found. Two patients had temporary post-op arrhythmias and 2 had conduction abnormalities on ECG with no significant post-op troponin elevations. All cause intraoperative and in hospital mortality was 12%.

DISCUSSION: PAC directed RVP is an effective technique for decreasing MAP and pulsatile blood flow rapidly while allowing for fast hemodynamic recovery. Anesthesiologists have the ability and skill to provide RVP with careful patient selection and prudence in the number of pacing episodes performed. Adequate recovery time after each episode and ensuring a quick return to normal MAP and rhythm prior to repeat pacing episodes is important. RVP may be contraindicated in patients with severe valvular pathology or significant ischemic cardiomyopathy.

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Sample Rhythm Strip Part A: Rapid onset of decreased BP with commencing pacing.



Sample Rhythm Strip Part B: Consistent decrease in MAP for duration of pacing allows for accurate graft deployment followed by rapid recovery of hemodynamics when pacing is stopped.

S-39.

POSTOPERATIVE TROPONIN I LEVEL PREDICTORS AFTER NORMOTHERMIC BLOOD CARDIOPLEGIA FOR CORONARY BYPASS SURGERY

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AFFILIATION: Clinique du Millénaire, MONTPELLIER, France

INTRODUCTION: Postoperative (POSTOP) serum cardiac Troponin I (cTnI) elevation after coronary bypass grafting (CABG) with CPB is related to intraoperative (INOP) myocardial injury and is predictive of mortality up to 2 years after CABG even in the absence of new Q-Wave myocardial infarction (MI).¹⁻³ Using normothermic blood cardioplegia (NBC), we conducted a retrospective study aimed at determining perioperative predictors of cTnI elevation.

METHODS: We studied consecutive CABG using NBC. Reoperation, acute MI, emergency procedure and MI less than 30 days before surgery were excluded. Data collected were: age, sex, medical history, treatment and cardiac status, Anesthesia: Isoflurane/Sufentanyl or Propofol/Sufentanyl,¹ number of bypasses, duration of CPB and Aorta cross clamping (ACC), temperature (t°), hematocrit (Hct), pump type, need for transfusion. POSTOP morbid events (ME), ICU stay, hospital survival and cause of death. All cTnI measurements were routinely performed between the 16th and 20th POSTOP hour.

RESULTS: 328 patients were studied; 5 patients died in hospital (1.5 %). Preoperative characteristics of patients were: Sex Ratio M/F: 7/1; Age 65 +/- 9; Euroscore: 2.32 +/- 1.6; LVEF: 55 +/- 9%; Previous unstable angina: 82%; MI: 38%; coronary stenting: 28%; Diabetes mellitus: 37%. INOP characteristics were CPB and ACC time: 71.2 +/- 20 and 59 +/- 18 min; lowest t°: 35°C +/- 0.6; number of bypasses: 2.4 +/- 0.5; lowest Hct: 26.2 +/- 4.8. POSTOP data were: cTnI level: 2.18 +/- 3.18 ng/ml; ICU stay: 76 +/- 38 hours. Survivors and non survivors had no difference in POSTOP cTnI level; patients with ME had higher POSTOP cTnI (ME: 7.41 +/- 2.06; no ME: 1.82 +/- 0.31 p < 0.001). 6 factors were predictive of cTnI elevation after univariate analysis: Female gender (4.3 +/- 1.32 vs 1.87 +/- 0.18); previous coronary stenting (2.89 +/- 0.54 vs 1.83 +/- 0.22); pump type (roller 3.34 +/- 0.81 vs centrifugal 1.89 +/- 0.21); INOP transfusion (2.68 +/- 0.46 vs 1.63 +/- 0.22); INOP Hct under 21% (9.4 +/- 3.1 vs 1.7 +/- 0.6); CPB time over 85 min (3.9 +/- 3 vs 1.4 +/- 0.4). INOP Hct and CPB time remained significant after multivariate analysis.

DISCUSSION: Our results show that early cTnI elevation is predicted by INOP determinants rather than preoperative status or medication or anesthesia regimen.

Unlike previous reports early cTnI elevation is not predictive of in-hospital death.²

Our results emphasize for the first time the role of low hematocrit during CPB as a factor leading to cTnI elevation.

The suspected but never proven^{4,5} specific link between hematocrit level, myocardial dysfunction and outcome could be ascertained by further studies.

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S-40.**THE EFFECT OF SMALL-DOSE DEXAMETHASONE ON CLINICAL RECOVERY AFTER CARDIAC SURGERY**

AUTHORS: G. Murphy,¹ S. S. Sherwani,² J. Szokol¹, M. J. Avram,² K. Patel²

AFFILIATION: ¹NorthShore University HealthSystem, Evanston, IL; ²Northwestern University Feinberg School of Medicine, Chicago, IL

INTRODUCTION: Corticosteroid administration has been studied extensively as a pharmacologic anti-inflammatory treatment option in cardiac surgical patients. Despite four decades of research, use of high-dose steroids remains controversial.¹ The benefits and risks of low-dose steroids in this setting have been poorly defined. The aim of this randomized, double-blinded investigation was to assess the effect of dexamethasone (8 mgX2) on clinical recovery following cardiopulmonary bypass (CPB).

METHODS: 117 patients undergoing cardiac surgery with CPB were randomized to receive either dexamethasone (dexamethasone group-8 mg at induction of anesthesia and initiation of CPB) or saline (control group). Anesthetic management was standardized. Nausea, vomiting, and fatigue scores were obtained preoperatively and on postoperative days (POD) 1 and 2. Hemodynamic variables, pulmonary gas exchange parameters, febrile responses, shivering episodes, blood glucose values, and requirements for insulin were measured in the operating room and intensive care unit (ICU). Duration of intubation and ICU and hospital length of stay (LOS) was determined, as was the incidence of postoperative complications.

RESULTS: There were no differences between groups in preoperative demographic characteristics. Intraoperative variables were similar between groups (duration of anesthesia and CPB, intraoperative arrhythmias and treatments, use of vasoactive medication and insulin, serum blood glucose values). Patients in the dexamethasone group reported less fatigue on both POD 1 and 2 ($P < 0.0001$). The incidences of vomiting on POD 1 (8.8% vs. 27.1%, $P = 0.019$) and POD 2 (0% vs. 10.6%, $P = 0.017$) were less in the dexamethasone group compared to the control group. Postoperative febrile responses were measured less frequently in the dexamethasone group in the ICU (3.5% versus 38.8%, $P < 0.0001$), and fewer episodes of shivering were observed by nursing staff (0% versus 16.3%, $P = 0.001$). Hemodynamic variables in the operating room and ICU did not differ between the groups at any time. Arterial blood gases revealed no difference between groups in gas exchange variables (PaO₂ / FIO₂, and A-aDO₂). The duration of intubation and ICU and hospital LOS did not differ between groups. The incidences of postoperative complications (including atrial fibrillation) were similar between groups.

DISCUSSION: The administration of low doses of dexamethasone resulted in reductions the incidences or severity of febrile responses, shivering, vomiting, and fatigue in the early postoperative period. However, these improvements in recovery did not translate into reductions in ICU or hospital LOS.

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S-41.**SMALL-DOSE DEXAMETHASONE IMPROVES PATIENT-PERCEIVED QUALITY OF RECOVERY AFTER CARDIAC SURGERY**

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INTRODUCTION: Previous studies of steroid use in cardiac surgical patients have focused primarily on physiological end-points and on the incidence of major adverse events. As the safety of anesthesia and surgery has improved, assessment of quality of postoperative recovery has become an increasingly important outcome measure in clinical research. Therefore, a comprehensive assessment of postoperative recovery should include factors important to both clinicians (ICU length of stay) and patients (physical comfort, mood, pain). The QoR-40 is a 40-item scoring system developed to measure patient's health status after anesthesia and surgery.¹ We hypothesized that patient-perceived quality of recovery would be improved in fast-track cardiac surgical patients by the administration of small-dose dexamethasone.

METHODS: 117 patients undergoing cardiac surgery with CPB were randomized to receive either dexamethasone (dexamethasone group-8 mg at induction of anesthesia and initiation of CPB) or saline (control group). Anesthetic management was standardized. The baseline QoR-40 questionnaire was completed in the preoperative holding area. Five general quality-of-life dimensions were measured with the QoR-40: physical comfort (12 items); emotional state (9 items); physical independence (5 items); psychological support (7 items); and pain (7 items). Each item was graded on a five-point scale, and global scores range from 40 (poor quality of recovery) to 200 (excellent quality of recovery). The QoR-40 form was again provided to patients for completion on postoperative days (POD) 1 and 2.

RESULTS: Demographic characteristics and intraoperative management variables did not differ between groups. Baseline preoperative QoR-40 scores did not differ between the dexamethasone and control groups. The maximum decrease in QoR-40 scores in both groups was on POD 1. Global scores (median (range)) were significantly higher (improved) in the dexamethasone group compared to the control group on both POD 1 (167 (133-192) versus 157 (108-195); $P < 0.0001$) and POD 2 (173 (140-196) versus 166 (122-196); $P = 0.001$). QoR-40 values in the dimensions of emotional state ($P = 0.002$ on POD 1 and 2), physical comfort ($P = 0.0001$ and 0.006 on POD 1 and 2, respectively), and pain ($P < 0.0001$ on POD day 1 and 2) were higher (improved) in subjects administered dexamethasone. No differences between groups were observed in the dimensions of physical independence and psychological support.

DISCUSSION: Our findings demonstrated that the administration of low doses of dexamethasone intraoperatively resulted in significantly enhanced patient-perceived quality of recovery after cardiac surgery.

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S-42.**CRYOABLATION OF HORMONALLY ACTIVE ADRENAL ADENOMATA UNDER GENERAL ANESTHESIA - IS IT SAFE?****AUTHORS:** N. McGill, D. Breen**AFFILIATION:** Southampton University Hospital, Southampton, United Kingdom

INTRODUCTION: Cryoablation (CRA) of adrenal neoplasms is a novel and exciting new treatment modality. Preliminary data suggest that it is effective and potentially cheaper than laparoscopic adrenalectomy.¹ Malignant Hypertension is a theoretical risk of this procedure but its incidence and nature has not been reported in ablation of hormonally active tumours.

METHODS: Data was collected prospectively on patients referred to our institution for ablation of aldosterone-secreting adrenal adenomata. All patients were pre-assessed. The number of hypertensive years and number of anti-hypertensive drugs was recorded and all patients were given Nicardipine 30mg bd for 2 weeks in addition to their normal medication. Ablations were performed under general anesthesia (GA) with invasive intra-arterial blood pressure (BP) monitoring. Any BP surges were treated with intravenous boluses of esmolol, labetalol, propofol and magnesium. Peak BP surge was recorded and the BP and number of anti hypertensive drugs recorded at follow up six weeks later.

RESULTS: 5 lesions in 5 patients were treated between May 2008 and October 2010. This is the largest series known to date. Mean patient age 56 years (range 38-69). Mean lesion size 18mm (range 14-25). All patients were discharged without complication on the following day. BP surges were noted in all patients during CRA thaw cycle. Although short-lived (5-15 mins) these surges were profound in the 3 patients who had elevated pre-procedural blood pressure (nos 2, 3 and 4). see table

DISCUSSION: Thermal energy ablation is a promising therapeutic option for hormonally active adrenal adenomata. Intraprocedural blood pressure surges necessitate general anaesthesia with careful invasive blood pressure management. The risks of short-term BP surges are unknown but thought to be low in the absence of cardiac disease. The severity of these surges appears to be related to the degree of pre op blood pressure control. We suggest that addition of adrenergic blockade to calcium channel blockade is considered in patients whose blood pressure remains high. Normalising blood pressure before ablation may improve the safety profile of this technique.

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S-43.**CORRELATION BETWEEN PREOPERATIVE BNP AND INDICES OF LEFT ATRIAL FUNCTION IN THORACIC SURGERY PATIENTS****AUTHORS:** H. Gulati,¹ N. Roistacher,² H. Zhang,¹ D. Amar¹**AFFILIATION:** ¹Anesthesiology & CCM, Memorial Sloan-Kettering Cancer Center, New York, NY; ²Cardiology, Memorial Sloan-Kettering Cancer Center, New York, NY

INTRODUCTION: Recent studies have shown that elevated preoperative brain natriuretic peptide (BNP ≥ 30 pg/ml cutoff) or maximal left atrial volume (LAV ≥ 32 ml/m² cutoff) were independently associated with postoperative atrial fibrillation (POAF).^{1,2,3} Data on the preoperative correlation of BNP and LAV are sparse. Our goal was to examine the correlation between preoperative echocardiographic evidence of left atrial dysfunction and serum BNP levels in patients undergoing thoracic surgery.

METHODS: In a cohort of 61 patients who underwent thoracic surgery and had preoperative BNP as well as transthoracic echocardiograms, LAV and indices of LA function were assessed. Patients who were not in sinus rhythm prior to surgery were excluded. BNP and echocardiographic data were log transformed prior to analysis.

Challenging Case Report (only complete if your submission falls into the "Challenging Case Report" category. If you select the "Challenging Case Report" category on the next step, this section must be completed.): N/A.

RESULTS: Mean echocardiographic parameters shown in the Table were in the normal range. Significant correlations were found between increasing BNP and increasing LAV ($r=0.44$, $p<0.0001$) and inversely correlated with decreasing LA emptying fraction ($r=-0.29$, $p=0.02$). Compared to patients with BNP <30 pg/ml, those with BNP ≥ 30 pg/ml had a greater LAV ($p=0.007$) and LA emptying fraction ($p=0.05$), respectively. LAV ≥ 32 ml/m² was found in 21/61 (32%) and BNP ≥ 30 pg/ml in 38/61 (62%). Although, new onset POAF occurred in 17/61 (28%), the sample size limited subset analyses.

DISCUSSION: In this cohort of patients undergoing thoracic surgery, there was a significant correlation between preoperative BNP levels and increasing LAV and decreasing LA emptying fraction. These novel preliminary data show that sub-clinical abnormalities in left atrial function and size are more common than previously appreciated. A larger study is needed to assess the contribution of each of these markers to POAF risk and to help guide future efforts towards targeted prevention strategies.

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Patient characteristics and Echocardiographic Data (n=61)

| Variable | Mean (SD) or N (%) | Variable | Mean (SD) or N (%) |
|----------------|--------------------|------------------------|--------------------|
| Age (yr) | 70 \pm 6 | LA Emptying Fraction % | 55 \pm 16 |
| Male | 39 (64%) | LV Ejection Fraction % | 64 \pm 9 |
| HTN | 41 (67%) | E/E' Septal | 10.7 \pm 4.1 |
| CAD | 18 (30%) | E/E' Lateral | 8.5 \pm 3.2 |
| Lung resection | 49 (80%) | E/A ratio | 0.85 \pm 0.31 |
| Esophagectomy | 12 (20%) | Max LAV(ml/BSA) | 28.8 \pm 11.5 |

S-44.**PATIENTS WITH LEFT VENTRICULAR ASSIST DEVICES AND NON-CARDIAC SURGERY****AUTHORS:** A. Flores, B. S. Pershing, J. N. Pulido, W. J. Mauermann**AFFILIATION:** Mayo Clinic, Rochester, MN

INTRODUCTION: An increasing number of patients with end-stage congestive heart failure are being managed with left ventricular assist devices (LVADs) as destination therapy.¹ As the number of patients with these devices increase, the need for non-cardiac surgery (NCS) will increase. The risk and “best management” of NCS in the face of LVAD therapy is presently undefined.

METHODS: This retrospective review was approved by Mayo IRB. We reviewed the medical records of patients with axial flow LVADs that underwent subsequent NCS between 2006 and 2010 and recorded their perioperative characteristics and outcomes.

RESULTS: The charts of 24 patients who received a second generation LVAD (Heartmate II) and underwent subsequent NCS were reviewed. These patients underwent a total of 49 procedures (37 sedation cases and 12 general anesthetics (GA)). 92% of patients were male and the average age for all patients was 61. In 80% of procedures patients were anticoagulated or receiving antiplatelet medications and anticoagulation was reversed in 9 cases. Sedation cases largely utilized midazolam and fentanyl, with 3 patients receiving boluses of propofol. One patient required vasopressor boluses (phenylephrine) during sedation. In the 12 GA cases 7 patients required boluses of vasopressors and 3 required vasoactive infusions. Six patients in the general anesthesia group required transfusion in the form of packed red blood cells or fresh frozen plasma. No patients received platelet transfusions. Arterial lines were placed in 9 cases, 4 had CVP monitoring, 5 with PA monitoring, and 2 with intraoperative TEE. 8 procedures were performed on an outpatient basis and all other patients were monitored postoperatively in the intensive care unit. 3 patients were intubated postoperatively. There was one intraoperative mortality (2%) due to intrapulmonary hemorrhage during an interventional radiology procedure under general anesthesia. The remaining patients suffered 8 postoperative complications (16%) which included GI bleeding, transient cerebral ischemia, and CHF exacerbation.

DISCUSSION: In this small study the mortality and complication rate of patients with LVADs undergoing NCS was low. Most patients undergoing GA required vasoactive support and the transfusion rate was 50% due to preoperative anticoagulation. Judicious monitoring postoperatively in the ICU may, in part, account for our low complication rates.

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S-45.**INCREASED LEFT-VENTRICULAR MYOCARDIAL MASS IS ASSOCIATED WITH ARRHYTHMIAS AFTER CARDIAC SURGERY****AUTHORS:** M. M. Weiner, G. Fischer, H. Lin, D. Reich**AFFILIATION:** Mount Sinai School of Medicine, New York, NY

INTRODUCTION: Increased left ventricular mass as assessed by echocardiography is a powerful predictor of cardiovascular morbidity and mortality independent of conventional risk factors. Investigators in the Framingham Heart Study were among the first to demonstrate that increased left ventricular mass has a graded and continuous association with poor cardiovascular outcomes.¹ Increased left ventricular mass has been associated with increased risk for coronary heart disease, all cause mortality, as well as sudden death.² The reduction in coronary flow reserve associated with increased left ventricular mass, coupled with the increase in myocardial oxygen consumption, is thought to predispose patients to myocardial ischemia, arrhythmias and sudden death. The association of left ventricular mass with perioperative events and outcomes has not been studied extensively. We hypothesized that patients with elevated LV mass index (LVMI) measured by TEE will show an increase in postoperative rates of arrhythmias.

METHODS: After receiving IRB approval we reviewed the intraoperative TEE images from 1000 consecutive cardiac surgery patients. LV mass was calculated using the American Society of Echocardiography recommended linear formula. LV mass was indexed to body surface area calculated using the Mosteller formula. Patients were grouped as either having normal LVMI or elevated LVMI (> 115 g/m² for males, > 95 g/m² for females).³ A review of medical records was then conducted to determine which patients received intraoperative or postoperative amiodarone therapy.

RESULTS: Eight hundred forty four patients had adequate images for quantification of LVMI. Elevated LVMI was found in 473 patients (56.4%). 367 patients (43.4%) experienced a postoperative arrhythmia; 225 of these patients had an abnormal LVMI (odds ratio 1.476, 95% CI 1.12-1.945, p=0.006). This finding was independent of the effects of age, gender, preoperative atrial fibrillation, and preoperative LV ejection fraction.

DISCUSSION: Elevated LVMI calculated by linear TEE measurements may be useful for stratifying risk of perioperative arrhythmias requiring treatment in cardiac surgical patients. Amiodarone is a reasonable marker of clinically significant arrhythmia in current perioperative practice. Further research may be useful to investigate whether prophylactic treatment with amiodarone may confer a benefit for patients with increased LVMI.

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S-46.**EFFECT OF MAJOR THORACIC SURGERY ON VASCULAR FUNCTION: A PROSPECTIVE STUDY USING NOVEL NON-INVASIVE TECHNIQUE**

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INTRODUCTION: Vascular function plays a vital role in the perioperative setting via the regulation of vascular tone, thrombosis, and inflammation via elaboration of a number of paracrine factors, including nitric oxide.¹ It is increasingly recognized that inflammation induced by surgical injury adversely impacts vascular function, with consequent increased risk for cardiovascular complications.² However, early detection of patients with vascular dysfunction using a point-of-care assessment is not yet available but may allow for improved risk stratification for adverse perioperative cardiovascular and timely perioperative interventions.

We tested the hypothesis that Digital Thermal Monitoring (DTM), a new non-invasive FDA approved method measuring reactive hyperemia as a surrogate marker of vascular function, will be impaired by surgical injury and further be impaired in patients at cardiovascular risk.

METHODS: After IRB approval we enrolled 53 patients in observational study to evaluate the utility of perioperative vascular function monitoring and the effect of surgical injury on perioperative vascular function. All these patients were scheduled for major thoracic surgery and they were tested at baseline (Day 0 / preoperatively) and at postoperative days 1, 2, 3, and 5. Fingertip thermocoupling probes measured temperature during 2 minutes of upper arm cuff occlusion and subsequent reactive hyperaemia that followed cuff deflation. DTM variables included Temperature Rebound (TR = Tmax [observed during reactive hyperaemia] - TS [starting temperature prior to cuff inflation]), adjusted TR (aTR = TR/TS), and AUCTR (area under the curve between Tmax and Tmin [lowest value during cuff inflation]) (Figure 1).

RESULTS: DTM (N = 196) tests were performed in 53 patients (mean age 60.3±10.5 years) scheduled for major thoracic surgery. All temperature rebound measures (TR, aTR and AUCTR) decreased at 24 hours and peaked at 72 hours after surgery (Figure 2) Multivariate analysis showed significant (p <0.05) decrease in DTM variables postoperatively in patients with preoperative cardiac risk factors (Hypertension and Lee Cardiac Risk Index ≥2).

Discussion: Predicting the occurrence of impaired vascular function prior to morphological changes or the actual occurrence of adverse events has the potential to extend lives by allowing timely intervention. Despite all temperature rebound measures decreasing, our preliminary results indicate that preoperative cardiovascular risk factors may be associated with significantly impaired vascular reactivity, as measured by DTM. Larger studies are needed to examine the exact mechanism and detection of vascular dysfunction hence possibly improving prognosis and quality of care given to patients having major surgery.

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S-48.**THE EFFECT OF PROPHYLACTIC ADMINISTRATION OF SIVELESTAT ON CLINICAL COURSES AFTER ESOPHAGECTOMY WITH RESPIRATORY DYSFUNCTION**

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INTRODUCTION: It is known that preoperative respiratory dysfunction is a risk factor of postoperative pulmonary complications (PPCs).¹ PPCs such as pneumonia, systemic inflammatory response syndrome (SIRS), acute lung injury (ALI) and acute respiratory distress syndrome (ARDS) prolong the duration of mechanical ventilation and are strongly associated with morbidity and mortality after transthoracic esophagectomy. It has been shown that sivelestat sodium hydrate (Ono pharmaceutical Co., Osaka, Japan), a selective inhibitor of neutrophil elastase, improved the postoperative clinical courses after transthoracic esophagectomy.² The aim of this study was to evaluate the effect of prophylactic administration of sivelestat on clinical courses after esophagectomy with respiratory dysfunction.

Methods: The respiratory dysfunction was defined that the vital capacity of less than 80%, and or forced expiratory volume in 1 second of less than 70%. Thirty-two patients receiving esophagectomy with a carcinoma of the esophagus assigned to either normal respiratory function group or respiratory dysfunction group. The respiratory dysfunction group was divided into two groups. Twelve patients in the normal respiratory function group did not receive sivelestat (Group I). Ten patients were received sivelestat at 0.2 mg/kg/h from induction of anesthesia to the end of surgery (Group II) and the other ten patients received same amount of physical saline (Group III) in respiratory dysfunction group. The PaO₂/FIO₂ ratio was measured and the duration of SIRS, ALI, ARDS, and ICU stay were evaluated during the whole period of post surgery. Statistical significance (p < 0.05) was determined by ANOVA.

RESULTS: There were no significant differences between three groups in the PaO₂/FIO₂ ratio during the whole period of post surgery. The duration of SIRS was significantly shorter in the Group II than in the Group III (p < 0.05), although there were no statistically differences between three groups in the duration of ALI, ARDS, and ICU stay.

DISCUSSION: We demonstrated the possibility that prophylactic administration of sivelestat improves the postoperative clinical courses after esophagectomy with respiratory dysfunction.

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S-49.**EUROSCORE VERSUS CARE SCORE FOR PREDICTION OF MORTALITY IN CARDIAC SURGERY****AUTHORS:** D. T. Tran, J. Dupuis, L. Tong, S. Vranjes**AFFILIATION:** University of Ottawa Heart Institute, Ottawa, ON, Canada

INTRODUCTION: The EuroSCORE is the most universally used multifactorial risk model for prediction of mortality after cardiac surgery.¹ The Cardiac Anesthesia Risk Evaluation (CARE) score is a locally developed risk ranking system based on clinical judgment and basic risk factors in cardiac surgery.² Despite its simplicity, it performs as well as many multifactorial risk models.^{2,3} The EuroSCORE and CARE score were both developed between 1996 and 1998. All risk models can lose calibration over time and potentially lead to inaccurate risk-adjusted mortality (RAM) analysis.⁴ To determine the best model for RAM analysis in our institution, this study compares the predictive ability of the additive (Euro-Ad) and logistic EuroSCORE (Euro-Log) models versus the CARE score, a decade after their introduction into clinical practice.

Methods: After approval by our Human Research Ethics Board, this observational study extracted prospectively collected data from our perioperative cardiac surgery database, on 3818 consecutive surgical patients operated between April 1, 2006 and March 31, 2009. For each patient, Euro-Ad was calculated from the predefined values of the 17 EuroSCORE variables, and the Euro-Log probability of death determined from the original logistic regression model. A CARE score was attributed to each patient by an independent reviewer. Discrimination of the three classifications for mortality was assessed through receiver operating characteristic (ROC) curves and comparisons were made using Hanley's pairwise comparisons. The observed mortality was compared with the predicted mortality (mean and 95% CI) from each tested model. $P < 0.05$ was used to determine statistical significance.

RESULTS: The areas under the ROC curve for mortality prediction were 0.79 with the CARE score, 0.72 with Euro-Ad and 0.83 with Euro-Log ($P = 0.015$ between CARE and Euro-Ad; $P = 0.057$ between CARE and Euro-Log). For an observed mortality of 3.2%, the predicted mortality was 3.4% (95% CI: 3.2-3.6%) with the CARE score, 6.3% (95% CI: 6.1-6.4%) with Euro-Ad and 7.7% (95% CI: 7.4-8.1%) with Euro-Log.

DISCUSSION: The discrimination of the CARE score for prediction of mortality after cardiac surgery is slightly less than with Euro-Log. However, a decade after its development the CARE score accurately predicts the overall mortality while Euro-Ad and Euro-Log do not. This suggests that the CARE score maintains its calibration over time, making it a more appropriate model for periodic RAM analysis in our institution.

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S-50.**EFFECT OF BODY MASS INDEX ON PERIOPERATIVE ANESTHESIA MANAGEMENT, POSTOPERATIVE COMPLICATIONS AND POSTOPERATIVE EARLY OUTCOMES IN PATIENTS UNDERGOING OPEN HEART SURGERY****AUTHORS:** A. Demir, B. Aydinli, C. Yildirim Guclu, H. Yazicioglu, A. Sarac, O. Erdemli**AFFILIATION:** Turkey Yuksek Ihtisas Teaching and Research Hospital Anesthesiology and Reanimation Clinic, Ankara, Turkey

INTRODUCTION: AHA and WHO defines obesity as (body mass index) BMI >30 and morbid obesity as BMI >40 . Intraoperative and postoperative anesthesia management of obese patients are usually challenging.^{1,2} In this retrospective study, we evaluate the effect of obesity on anesthesia management, perioperative care, postoperative complications and short-term mortality and morbidity.

METHODS: Following Hospital Ethics Committee approval, files of 503 patients scheduled for open heart surgery were analyzed retrospectively beginning from February 2011. Demographic data, perioperative data about anesthesia and surgery, ICU follow-up and hospital discharge reports were examined. Patients were classified according to their BMI as: Group I ($n=156$); BMI= 18-24.5, Group II ($n=166$); BMI=30-34.9, Group III ($n=151$); BMI=35-39.9 and Group IV ($n=30$); BMI ≥ 40 . Statistical analysis was made by Chi-square, one-way ANOVA and Kruskal Wallis ANOVA. $p < 0.05$ was considered significant.

RESULTS: Results about preoperative, intraoperative and postoperative data were summarized in table 1. The incidence of number of female patients, patients with DM, hypertension and hyperlipidemia increased as the BMI increases. Patients with higher BMI, received more PRBC infusion. Postoperative infectious complications increased with higher BMI but this was statistically insignificant.

DISCUSSION: Postoperative respiratory complications increased with high BMI. However no postoperative respiratory complications happened in Group IV can be explained with the relatively few number of patients in this group. There was no significant difference in mortality and morbidity between the groups. This preliminary study shows that obesity alone is not a risk factor in cardiac surgery. This study is continuing with the inclusion of the missing BMI=25-29.9 group (the group between normal and obese BMI) and the results are pending.

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S-51.**IMPACT OF TRANEXAMIC ACID OR EPSILON AMINOCAPROIC ACID ON BLOOD LOSS IN CARDIAC SURGERY: A RANDOMIZED CONTROLLED TRIAL**

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INTRODUCTION: Antifibrinolytics are routinely used for surgery with cardiopulmonary bypass (CPB). Epsilon aminocaproic acid (E) and tranexamic acid (T) have been shown to reduce bleeding and blood transfusion in this population. While both have shown benefit compared to placebo, few studies have directly compared them.

METHODS: IRB approved, double blind, randomized trial (NCT01248104) comparing impact of E or T on blood loss following CPB, in consenting adults undergoing primary cardiac surgery. Exclusions included multiple valve, ascending aorta reconstruction or repeat sternotomy procedures. After induction of anesthesia: E received 100 mg/kg given over 15 minutes, followed by infusion of 10 mg/kg/hr; T received 10 mg/kg over 15 min, followed by infusion of 1 mg/kg/hr. This dosing reflects the relative potency of T to E. Infusions were continued throughout surgery until 4 hours after separation from CPB. Drugs were delivered in a blinded fashion in identical volumes and infusion rates based on patient weight. All other care decisions such as invasive monitoring, anesthetic technique, transfusion decisions, and postoperative care were at the discretion of the attending physicians.

Data collection included demographics, type of surgery, duration of CPB/surgery and outcomes including ventilator hours and length of stay. Impact on blood loss was determined by POD2 change in Hb and RBC volume (estimated blood volume * hematocrit change + PRBC*0.55; includes impact of blood loss and transfusion following CPB). Statistical analysis with p<0.05 considered significant was performed using JMP 8.0.2. Continuous data were compared using the t-test. Ordinal and nominal data were compared using Chi-Square.

RESULTS: Data from 51 patients (E=26; T=25) have been analyzed to date. There were no intergroup differences in age, gender, BMI, baseline lab values or surgery duration. Perioperative risk assessed by P-POSSUM was numerically higher in E. Outcome measures were numerically worse in T (Table 1) but did not reach statistical significance.

DISCUSSION: These results suggest E and T may have different impacts on outcome after CPB. While only 27% of subjects were transfused, lower than reported in a recent comparison, T had a larger decrease in Hb with a larger decrease in PRBC volume by POD2 despite more frequent and larger average volume PRBC transfusion. Assessment of blood loss following CPB may be improved by calculating change in Hb or RBC volume, since these reflect the result of both blood loss and transfusion and may be less affected by differences in blood volume.

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J Cardiothorac Vasc Anesth DOI 10.1053.

S-52.**EFFECT OF DIABETES MELLITIS ON CEREBRAL OXYGEN SATURATION DURING CABG SURGERY**

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INTRODUCTION: Near infrared spectroscopy (NIRS) has been used extensively to monitor oxygen delivery to the brain during cardiac surgeries.¹ Type 2 diabetes is associated with altered regional blood flow. The aim of this study was to investigate the effects of diabetes on regional cerebral oxygen saturation during cardiopulmonary bypass.

METHODS: This was a prospective observational study analyzing twenty adult patients with or without diabetes undergoing coronary artery bypass graft surgery. We measured the hemodynamic and respiratory parameters as well as cerebral oxygen saturation at baseline, after intubation, during cannulation, partial bypass, cooling (30 °C), rewarming and at the end of surgery. A desaturation greater than 20% of baseline or an rSO₂ absolute value less than 40% were treated by interventions.

RESULTS: There was no demographic difference between the groups. There was no significant difference between the diabetic and non diabetic groups in right and left regional cerebral oxygen saturations during the surgery, p<0.05. We observed desaturation greater than 20% in 5 patients at diabetic group (total 165 min) and in 6 patients at nondiabetic group (total 240 min), rSO₂ absolute value less than %40 were seen in one patient at each group (62 and 60 min respectively).

DISCUSSION: Diabetes mellitus has no effect on regional cerebral oxygen saturation during coronary arterial bypass surgery. The study is still continuing and the results of a total of thirty patients will be presented.

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S-53.**COMPARISON OF LABORATORY, CLINIC DATA AND APOPTOSIS IN PATIENTS UNDERGOING CABG OPERATION DONE EITHER WITH INTERMITTENT AORTIC CROSS CLAMPING WITH FIBRILLATION OR CARDIOPLEGIC CARDIAC ARREST TECHNIQUE**

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INTRODUCTION: Optimal myocardial protection during CABG operations is controversial especially when different approaches are used.^{1,2} In this prospective study we compared hemodynamic data, myocardial oxygen extraction and lactate production and apoptosis in the left ventricle transmural biopsy specimens in CABG operations done either with intermittent aortic cross-clamping with fibrillation (IAC) or with cardioplegic cardiac arrest (CCA) method.

METHODS: Following Ethics Committee approval and informed consent, consecutive patients who had two or three vessel disease with normal ventricular function determined with ECHO, with no comorbid disease other than regulated hypertension and/or type-2 DM were included in the study (IAC group n=13, CCA group n=8). Hemodynamic data, serial CK-MB values and ECG changes were recorded intraoperatively and postoperative 24hours. Myocardial oxygen extraction and lactate production were calculated from the blood samples withdrawn from the radial artery and the coronary sinus retrograde cannula during following periods; just before CPB, during cross-clamp and 5-10 minutes following cross-clamp removal. Biopsy specimens obtained from the anterior wall of the left ventricle before CPB and before cessation of CPB were analyzed for apoptosis. Chi-square, independent samples t tests and Wilcoxon test were used to determine the statistical differences. p<0.05 was considered statistically significant.

RESULTS: Demographic variables, total cross-clamp and CPB period and hemodynamic values were similar between the groups. The two groups were similar in terms of preischemic (before cross-clamp on) and postischemic (after cross-clamp off) myocardial oxygen extraction and lactate production values (Fig.1,2). Seven patients in IAC and one patient in CCA group needed low dose inotropic ($\geq 5 \mu\text{g}/\text{kg}/\text{min}$ dopamine) support during early postoperative period. All patients, except two, in both groups discharged from the ICU on the postoperative first day. Two patients in the IAC group, who were on low dose dopamine and one of whom had also short-term atrial fibrillation, stayed for an extra day. Left ventricle biopsies revealed no evidence in favour of apoptosis in both groups.

DISCUSSION: This study shows that for low risk CABG procedures, IAC and CCA methods were comparable to each other in protecting the myocardium from ischemic injury with respect to hemodynamic data, myocardial oxygen extraction and lactate production and analysis of apoptosis in myocardial transmural biopsy specimens and postoperative early outcomes.

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S-54.**ACUTE KIDNEY INJURY FOLLOWING CARDIAC SURGERY IS ASSOCIATED WITH INTRAOPERATIVE HEMOGLOBINEMIA AND OXIDATIVE STRESS****AUTHORS:** F. T. Billings, L. Roberts, M. Pretorius**AFFILIATION:** Vanderbilt University, Nashville, TN

INTRODUCTION: Acute kidney injury (AKI) complicates the postoperative course of 8-30% of cardiac surgery patients and independently predicts death.¹ Both hemoglobinemia and myoglobinemia predict AKI following cardiopulmonary bypass (CPB).^{2,3} Circulating hemoproteins can induce oxidative injury to the kidney through redox cycling.⁴ This study tested the hypothesis that intraoperative hemoprotein concentrations correlate with oxidative stress and that both predict AKI following CPB.

METHODS: Ten AKI (defined using AKIN criteria) and 10 risk-matched control subjects were selected from an ongoing cardiac surgery clinical trial. We measured free hemoglobin (Hb), myoglobin (Mb), and markers of oxidative stress [F2-isoprostanes (F2-isoPs) and isofurans (isoFs)] at anesthetic induction, 30 minutes into CPB, post CPB, at ICU admission, 6-hrs after ICU admission, and on postop days 1, 2, and 3. We compared hemoprotein concentrations and markers of oxidative stress between AKI and control groups, and assessed correlations between hemoproteins and oxidative stress.

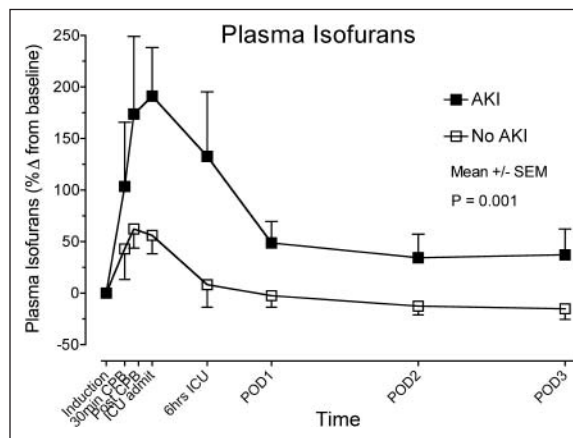
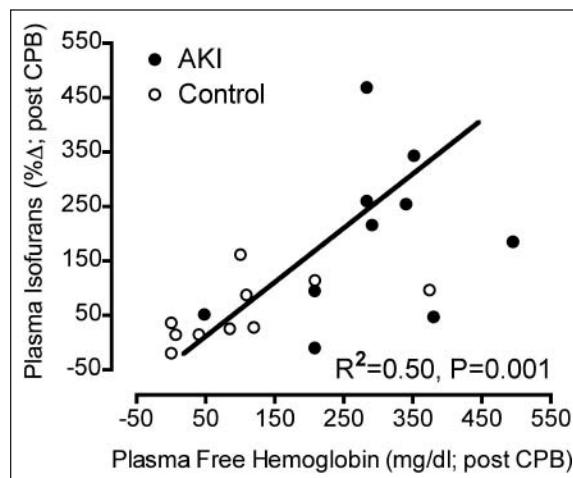
RESULTS: Age, baseline renal function, prevalence of diabetes, and duration of CPB were similar in AKI and control groups. Baseline plasma isoFs ($P=0.07$), urine F2-isoPs ($P=0.01$), and urine isoFs ($P=0.08$) were higher among control subjects; of note, 3 of the control subjects and none of the subjects who developed AKI were active smokers, and smoking was associated with baseline oxidative stress.

Plasma free Hb concentrations peaked post CPB and were higher in the AKI group (289 ± 38 vs. 104 ± 37 mg/dl, $P=0.01$), whereas Mb concentrations peaked at ICU admission and were similar between groups. Hb was the dominant hemoprotein released (molar ratio Hb:Mb = 821) and correlated with postoperative isoF levels in plasma ($r^2=0.50$, $P=0.001$) but not in urine. Plasma F2-isoP levels peaked during CPB and remained elevated in AKI subjects ($P=0.02$). Plasma isoF levels peaked post CPB and were greater in AKI subjects ($P=0.001$). Urine F2-isoP levels were similar between groups. Urine isoF levels were similar between groups during surgery but increased significantly in AKI subjects following surgery ($P=0.04$).

DISCUSSION: Hemolysis during CPB, but not myolysis, correlates with plasma isoF concentrations and predicts postoperative AKI. Plasma and urine markers of oxidative stress are higher during the perioperative period among AKI subjects, but prospective trials with effective antioxidants and/or hemoprotein reductants are needed to determine whether oxidative stress mediates hemoprotein-induced AKI.

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S-55.**RELATIONSHIP BETWEEN PLETHYSMOGRAPHIC WAVEFORM CHANGES AND HEMODYNAMIC VARIABLES IN ANESTHETIZED, MECHANICALLY-VENTILATED PATIENTS UNDERGOING CONTINUOUS CARDIAC OUTPUT MONITORING****AUTHORS:** R. H. Thiele, D. Colquhoun, S. Nie, J. Huffmyer**AFFILIATION:** University of Virginia, Charlottesville, VA

INTRODUCTION: Attempts have been made to correlate characteristics of the plethysmygraphic waveform to clinically useful cardiac parameters, including mean arterial pressure, stroke volume, and vascular resistance. Many of these studies were conducted in healthy volunteers. The purpose of this study was to assess these relationships in the setting of hemodynamic instability.

METHODS: After IRB approval, 10 patients undergoing cardiac surgery were enrolled. Continuous cardiac output (CCO) pulmonary artery catheters were placed (Edwards Lifescience, Irvine, CA) and ear photoplethysmographs (Nonin Medical OEM III, Plymouth, MN) were recorded prior to cardiopulmonary bypass. Standard monitoring parameters were recorded by the GE CPA System (Fairfield, CT).

Using an investigator-created MATLAB program, median values of maximum slope of upstroke, maximum slope of downstroke, peak to trough height, width, and area under the photoplethysmographic curve were calculated in one minute epochs.

Photoplethysmographic variables were compared to hemodynamic variables taken from the anesthesia information management system and compared using linear regression techniques.

RESULTS: A total of 693 minutes were available for analysis.

A linear line of best fit between each computed parameter and CO, SVR, SV, and MAP was calculated. R2 and P-Values were calculated and are displayed in Table 1.

DISCUSSION: Though our data suggest there is a statistically significant relationship between several photoplethysmographic parameters and their invasively-determined hemodynamic counterparts (Fig 1), the R2 values suggest that this relationship is not clinically useful. The reasons for this are multiple.

Conventional plethysmography is extremely sensitive to the environment. Small changes in temperature and position have marked effects produced via alteration of tissue bed perfusion. Using a firmly attached, temperature controlled reflectance photoplethysmograph may address this.

Additionally, standard CO monitoring has an appreciable lag time: 3-6 minutes. It is impossible to follow rapidly changing CO without error in the response variable. To counter this, a population with a relatively stable CO, such as post-op ICU patients, may be better to conduct these trials.

Lastly, arterial waveform analysis techniques are susceptible to significant changes in afterload that accompany large hemodynamic changes. This susceptibility may also limit the utility of plethysmography.

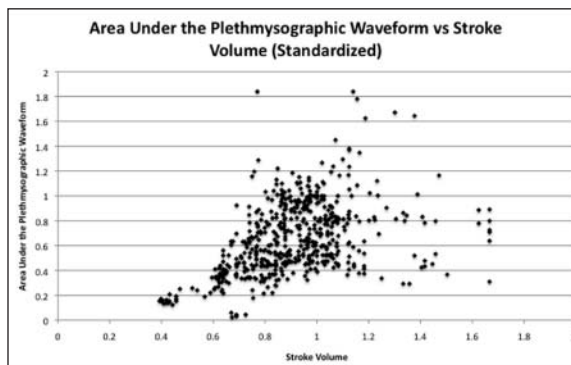
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Critchley LA. Anesth Analg 111: 1180. 2010

McGrath SP. Anesth Analg Jan 26, 2010 [Epub ahead of print]

| Predictor | Response | R2 | p |
|----------------|----------|-----|------|
| Pulse Pressure | SV | .14 | <.01 |
| AUC | SV | .15 | <.01 |
| Upstroke | SV | .05 | <.01 |
| Width | SV | .11 | <.01 |
| Downstroke | SV | 0 | .17 |
| Pulse Pressure | MAP | .01 | .06 |
| AUC | MAP | 0 | .17 |
| Upstroke | MAP | 0 | .44 |
| Width | MAP | .01 | .02 |
| Downstroke | MAP | .04 | <.01 |
| Pulse Pressure | SVR | .06 | <.01 |
| AUC | SVR | .04 | <.01 |
| Upstroke | SVR | .04 | <.01 |
| Width | SVR | 0 | .84 |
| Downstroke | SVR | 0 | 0.63 |



S-56.**EFFECT OF REMOTE ISCHEMIC PRECONDITIONING ON ACUTE KIDNEY INJURY IN PATIENTS UNDERGOING CARDIAC SURGERY****AUTHORS:** H. BAE, H. Son, E. Lee, I. Choi**AFFILIATION:** Department of Anesthesiology and Pain Medicine, University of Ulsan, College of Medicine, Asan Medical Center, Seoul, Republic of Korea**INTRODUCTION:** Postoperative acute kidney injury (AKI) frequently occurs in patients undergoing major cardiovascular surgery. Remote ischemic preconditioning (RIPC) has provided a potent myocardial protective effect in recent clinical trials. In this regards, we hypothesized that the RIPC might also have a renal protective effect and reduce the incidence of AKI after cardiac surgery.**METHODS:** This study is a retrospective analysis of 1,011 patients undergoing cardiac surgery in a single center from June 2009 to November 2010, which were recruited in previously reported randomized study. Patients on preoperative dialysis or patients with preoperative serum creatinine above 1.5 mg/dL were excluded. RIPC consisted of four 5-minute cycles of forearm ischemia, induced by inflating a blood pressure cuff on the upper arm to 200 mmHg, with an intervening 5 minutes of reperfusion before surgery. Only an uninflated blood pressure cuff was placed on the upper arm in control group. The incidence of AKI within the postoperative day 5 was measured using Acute Kidney Injury Network (AKIN) criteria.¹ Data were analyzed using Chi-square test. $P < 0.05$ was considered significant.**RESULTS:** After exclusion, 952 patients were analyzed. The incidence of AKI in RIPC group and control group were 47% ($n = 226/483$) and 42% ($n = 197/469$), respectively. There was no significant difference between two groups ($p = 0.155$).**DISCUSSION:** RIPC, which is induced by transient upper limb ischemia before surgery, did not reduce the incidence of AKI in patients undergoing cardiac surgery in this retrospective analysis.**REFERENCES:**

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S-57.**EXCEPTIONALLY USE OF DOUBLE LUMEN TUBE IN TWO 6-YEAR-OLD PATIENTS USING CT SCAN MEASUREMENTS TO GUIDE AIRWAY MANAGEMENT**

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INTRODUCTION: One of the most challenging techniques in pediatric anesthesia is achieving correct isolation for one-lung selective ventilation. Double-lumen tube(DLT) is a specific device used to isolate one side of the respiratory system allowing ventilation of only one lung at a time. However, smallest tube is 26F, which can only be used in children from 8 to 10 years.¹

We present the case of two six year old patients undergoing bilateral thoracotomy. Due to the computed tomographic scan (CT) measurements, we were able to decide the use of a DLT, which based on standard criteria would not have been an appropriate choice in these cases; thus, we achieved optimal ventilation and early extubation in both cases.

METHODS: N/A

Challenging Case Report (only complete if your submission falls into the “Challenging Case Report” category. If you select the “Challenging Case Report” category on the next step, this section must be completed.): Case 1: 6-year-old female with removed primary bilateral Wilms tumor, presenting bilateral lung metastasis that had increased in size during previous 3 months.

Case 2: 6-year-old female with primary Bronchopulmonary bilateral inflammatory myofibroblastic tumor.

Measurements of trachea and left main bronchus diameter in both cases were taken by using a CT. Table 1 summarizes diameters of trachea, left main bronchus in both children and DLT.

Intubation was accomplished using a left DLT 26F BroncoPart (Rusch, Duluth, GA) following standard procedure by an anesthesiologist who had at least 10 years experience after anaesthetic and CT evaluation. Tumor or metastasis were removed through bilateral thoracotomy and children moved to pediatric intensive care unit.

RESULTS: N/A

DISCUSSION: Several methods have been proposed over the last decade to calculate the correct DLT size. A study performed in Singapore in 1999 showed the possibility of predicting DLT size by means of measuring the diameter of the left bronchus using a CT; this is especially useful when choosing smaller DLTs.² We believe this method is not too sophisticated and expensive for our colleagues in the radiology department, with the advantage that most thoracic surgery patients have already had chest CT.

In this case, DLT allowed easy and fast isolation of each lung, simultaneous clearance of secretions in both lungs, quick access to bilateral ventilation if necessary, and opportunity to use continuous positive pressure to improve oxygenation.^{3,4} Other alternative techniques for one-lung ventilation would be long and difficult.

These CT studies in our opinion should be considered, in agreement with radiologists, and maybe included in clinical protocols of preoperative evaluation in this type of surgery, as they are extremely useful in selective cases, considering individual variability.

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Table 1. Measures of Trachea and Left Main Bronchus for case 1 and 2 and Double Lumen Tube Dimensions

| Trachea* (mm) | ID Left Main Bronchus (mm) | DLT-26F**: Main Body OD (mm) | DLT26F: Bronchial Lumen OD (mm) |
|---------------|----------------------------|------------------------------|---------------------------------|
| 9,5 | 6,1 | 9,3 | 5,7 |
| 9,5 | 5,9 | 9,3 | 5,7 |

DLT: double lumen tube; ID: inner diameter; OD: outer diameter.

*Sagittal diameter; ** Rusch (Inc. Duluth, GA)

S-58.**SUPPRESSIVE EFFECTS OF HIGH DOSE REMIFENTANIL ON STRESS RESPONSE IN PATIENTS UNDERGOING CARDIAC SURGERY WITH CARDIOPULMONARY BYPASS**

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AFFILIATION: Department of Anesthesiology, Kanazawa University Hospital, Kanazawa City, Japan

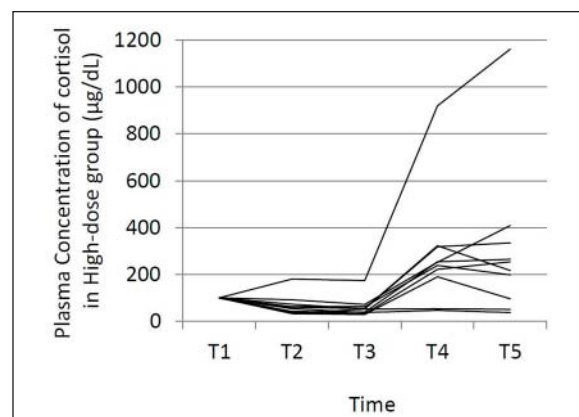
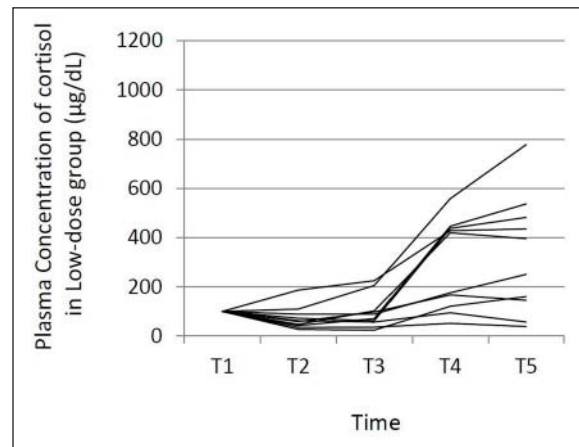
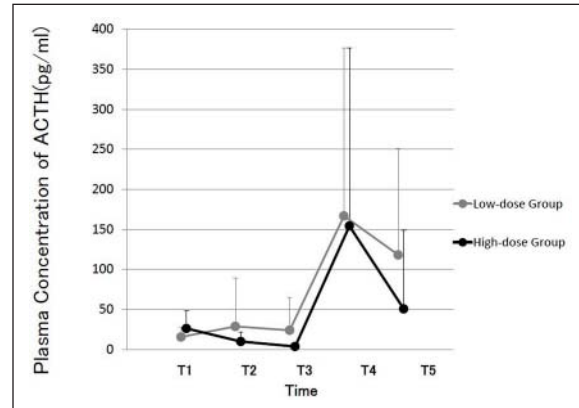
INTRODUCTION: Cardiopulmonary bypass (CPB) causes extreme inflammatory responses which may develop to postoperative complications. Opioids are known to effectively reduce the release of stress hormones, which play a major role in inflammatory responses. Remifentanyl is an ultra-short acting opioid and can be used at high dose in cardiac cases without residual effects. However, the suppressive effect of remifentanyl on stress hormones is controversial. The purpose of this study is therefore to evaluate whether high dose of remifentanyl suppresses the excess stress hormone responses compared to low dose.

METHODS: This study was approved by the ethics committee of our institute. Twenty patients scheduled for elective cardiac surgery with CPB were recruited and all of them gave written informed consent. They were randomly assigned into two groups: low dose group (L group) and high dose group (H group). While remifentanyl was continuously infused at a rate of 0.25mcg/kg/min, infusion rate was changed to 0.15 and 1.0 mcg/kg/min in L (n=10) and H group (n=10), respectively. Other anesthetic technique and condition were comparable in both groups. Arterial blood samples for measurement of stress hormones were collected just before anesthetic induction (T1), at the beginning of cardiopulmonary bypass (T2), end of CPB (T3), 4 and 8 hours after the end of CPB (T4 and T5).

RESULTS: In H group, the release of ACTH was suppressed at T3 compared with L group, but this difference was not observed at other points (Mann Whitney U-test, $P < 0.05$, Fig.1). The plasma concentration of cortisol in H group was not significantly increased from T2 to T5 compared with T1, but in L group, there was a statistically significant increase at T4 and T5. (ANOVA followed by Dunnett's test, $P < 0.05$, Fig2 and 3)

DISCUSSION: These results suggest that high dose remifentanyl during CPB suppresses excess stress hormone response in cardiac cases.

REFERENCES: N/A



S-59.**INTRAOPERATIVE DETERMINATION OF MITRAL VALVE AREA AFTER MITRAL VALVE REPAIR SURGERY: 3-D PLANIMETRY VS. PRESSURE-HALF TIME****AUTHORS:** J. Song, W. Kang, S. Kim, T. Yoon, T. Kim, S. Koh**AFFILIATION:** Konkuk University Medical Center, Seoul, Republic of Korea

INTRODUCTION: Pressure-half time (PHT) of mitral inflow Doppler is not regarded in accurate tool for measuring mitral valve area (MVA) in many clinical situations. Authors investigated the efficacy of pressure-half time (PHT) and 3 dimensional (3D) planimetry in intraoperative MVA determination during mitral valve repair surgery (MVP) which using flexible posterior band annuloplasty band in mitral stenosis (MS) patients.

METHODS: In MVP patients due to mitral stenosis (n = 19), MVAs were determined by using 3D planimetry (MVA-3D TEE) and pressure-half time (PHT, MVA-PHT) before and after application of cardiopulmonary-bypass (CPB). In 16/19 patients, MVA was also evaluated by planimetry of computed tomography scan (MVA-CT) in postoperative 7th day.

RESULTS: No patients showed residual mitral regurgitation greater than mild. Mean pressure gradients in pre-CPB and post-CPB were 6 (5-7) mmHg and 4 (3-5) mmHg, respectively ($P < 0.001$ by Wilcoxon Signed Rank Test). In pre-CPB, MVA-3D and MVA-PHT were 1.17 ± 0.47 cm, 1.02 ± 0.30 cm², respectively, ($P = 0.327$ in paired t-test). In post-CPB, MVA-3D (2.35 ± 0.57 cm²) was significantly greater than MVA-PHT (2.00 ± 0.61 cm²) ($P < 0.001$ in paired t-test). MVA-CT ($2.26 [2.07-2.56]$ cm²) was significantly different from MVA-PHT ($2.00 [1.59-2.45]$ cm²) ($P = 0.021$ in Wilcoxon Signed Rank test), MVA-PHT was not significantly different from MVA-3D.

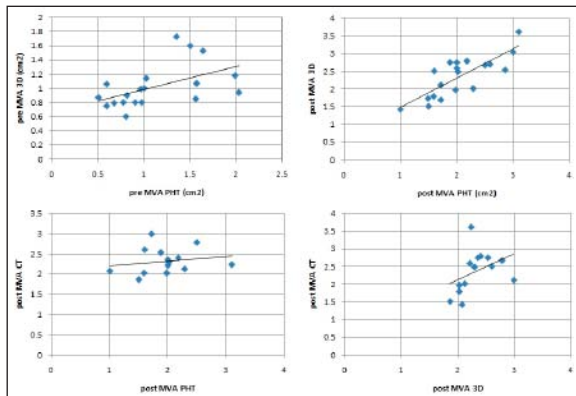
DISCUSSION: After taking MVP in MS patients, MVA determined by 3D planimetry is relatively greater than that by PHT and it is much closer to planimetric MVA of postoperative CT scan, while they were not significantly different before taking MVP. This result suggests that planimetric MVA determination by 3D TEE is useful and more reliable than that by PHT during intraoperative TEE, especially after taking MVP for MS patients.

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**S-60.****A COMPARISON OF HEPARIN MEASUREMENT STRATEGIES FOR ON- AND OFF-PUMP CARDIOVASCULAR SURGERY****AUTHORS:** M. Kodaka, K. Tsukamoto, T. Okada, J. Ichikawa, M. Komori**AFFILIATION:** Tokyo Women's Medical University Medical Center East, Arakawa, Japan

INTRODUCTION: Recent investigations have suggested that a heparin concentration-based anticoagulation protocol using a Hepcon heparin measurement system™ (HMS) during cardiopulmonary bypass (CPB) reduces generation of thrombin, fibrinolysis, neutrophil activation, and consumption of factor VIII^{1,2} significantly compared to standard weight-based heparin doses (Hemocron™). Nevertheless, few studies have compared HMS advantages of on-pump and off-pump cardiovascular surgery simultaneously. Therefore, we examined differences of perioperative bleeding loss, blood transfusion, total heparin/ protamine doses, and total/ partial operative times, such as the time from protamine iv to leave operating room (OR) with/without HMS for on- and off-pump cardiovascular surgery.

METHODS: We obtained written informed consent from 59 patients before elective cardiovascular surgery (on-pump cases n=34, off-pump cases n=25) with IRB during Jan.-Sep. 2010. Each group was divided randomly into a control group (without HMS) and an intervention group (with HMS). The control group patients were administered weight-based heparin 300 U/kg for on-pump surgery and 200 U/kg for off-pump surgery. Both groups were targeted as ACT > 400 s and >250 s, respectively using either Hemocron™ or HMS. We compared differences of perioperative bleeding loss in OR and ICU, total heparin/ protamine doses, and total and partial operative time, i.e., the time from protamine IV to leave OR, blood transfusion, and extubation time in the ICU.

RESULTS: Measurements of clinical outcome between control and HMS using off- and on-pump were presented in Table 1.

Regarding on-pump cases, those of the HMS group had 12.0% less ACT immediately after protamine IV, 21.4% shorter time from protamine iv to leave OR and 67.0% less blood transfusion than those of the control group. For off-pump cases, ACT of the HMS group immediately after protamine IV was 12.6% less than that of control. No difference was found between the groups for any other factor.

DISCUSSION: The values of ACT immediately after protamine IV using HMS were lower than those of Hemocron™ for both on- and off-pump cases. Moreover, results suggest that the time from protamine IV to leave OR, important for bleeding control,² and total blood transfusion in OR were shortened significantly using HMS only for on-pump cases. HMS is a useful device for on-pump surgery to shorten the partial operating time after protamine IV and to decrease blood transfusion.

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S-61.

WITHDRAWN.

S-62.**INTRATHECAL MORPHINE IS SUPERIOR TO INTRAVENOUS PCA IN PATIENTS UNDERGOING MINIMALLY INVASIVE CARDIAC SURGERY****AUTHORS:** E. Koch,¹ C. Mukherjee,¹ M. Scholz,² J. Banusch,¹ J. Ender¹**AFFILIATION:** ¹Department of Anesthesiology and Intensive Care Medicine II, Heartcenter, University Leipzig, Leipzig, Germany; ²Institute of Medical Statistics and Epidemiology, University Leipzig, Leipzig, Germany**INTRODUCTION:** Pain therapy in patients undergoing minimally invasive mitral and tricuspidal valve repair is challenging. Intrathecal morphine is of benefit but has the potential for postoperative apnoe. This effect is dose dependent. Aim of our study was to evaluate the potential benefit of low dose intrathecal morphine on postoperative analgesia in minimally invasive cardiac surgery using Fast Track anaesthesia.**METHODS:** In this prospective study patients undergoing minimally invasive mitral or tricuspidal valve repair were randomly assigned to receive either intravenous PCA with piritramide (Control group) or a single dose of intrathecal morphine (1.5µg per kgBW) in combination with intravenous PCA (Morphine group). Primary endpoints were: time to extubation, pain score, sedation score, amount of piritramide in post anaesthesia care unit (PACU) and on first postoperative day. Values are expressed as mean with standard deviation.**RESULTS:** 37 patients, in the age of 26 to 78 years (Control = 59.65±8.87, Morphine =56.05±13.69) with a BMI between 18.87 and 30.90 (Control = 25.54 ± 2.96, Morphine =25.62 ± 2.87) were included. The morphine group showed significantly reduced pain scores on the day of operation and on first postoperative day. The demand for intravenous opioids in post anaesthesia care unit was significantly lower in morphine group, whereas sedation scores did not differ in both groups. Furthermore there was no significant increase of time to extubation in the morphine group. PaCO₂ values after extubation in the PACU showed no significant difference (47.8 ± 3.4 mmHg in the control group vs 48.9 ± 6.8 mmHg in the morphine group)**DISCUSSION:** Low dose intrathecal morphine reduces the amount of opioids and increases postoperative analgesia, still allowing early extubation.**REFERENCES:**

Chaney. Mark A., Intrathecal and Epidural Anesthesia and Analgesia for Cardiac surgery. Anesth Analg 2006;102:45-64

| | Control n= 17 | Morphine n= 20 | p |
|-------------------|---------------|----------------|--------|
| PainScore OP | 4.31 ±1.97 | 2.0 ±1.54 | 0.001 |
| PainScore PostOP1 | 4.12 ±1.86 | 2.25 ±0.91 | 0.001 |
| SedationOP | 3.06 ±1.19 | 2.55 ±1.05 | 0.23 |
| Sedation PostOP | 1.06 ±0.65 | 1.10 ±0.64 | 0.85 |
| OpioidPACU(mg) | 13.88 ±7.83 | 2.88 ±4.19 | <0.001 |
| OpioidPostOP1(mg) | 38.24 ±31.59 | 24.30 ±35.06 | 0.052 |
| Extub.Time(min) | 106 ±73 | 121 ±102 | 0.89 |

S-63.**IN PATIENTS WITH MILD TO MODERATE MITRAL REGURGITATION THE MITRAL VALVE DOES NOT CHANGE ITS THREE DIMENSIONAL STRUCTURE OR FUNCTION IMMEDIATELY FOLLOWING CORONARY ARTERY REVASCLARIZATION**

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INTRODUCTION: Acute ischemic mitral regurgitation (MR) may resolve after isolated coronary artery bypass grafting (CABG). Patients undergoing CABG with incidental mild or moderate mitral regurgitation usually do not have their valve surgically corrected. The short and long term prognosis in these post CABG patients with MR is unstudied. Recent advances in transesophageal echocardiography (TEE) techniques and data analysis software have allowed for a better understanding of the mitral valve's (MV) three dimensional (3D) structure.^{1,2} By using 3D TEE we have studied the MV's geometry and function in patients who require CABG to see if there are any changes immediately following surgical revascularization.

METHODS: In this preliminary exploratory study, we recruited patients with mild or moderate MR who were scheduled to have CABG. Patients who required other valvular surgeries as part of their procedure, had prior cardiac surgery, congenital cardiac anomalies, or contraindication to TEE were excluded from the study. Study patients had 3D TEE imaging of their mitral valve performed in the operating room pre and post-CABG. The included MV software analysis tools allow for the collection and reconstruction of geometric and functional data related to the mitral valvular structure. For each patient we also collected demographic and detailed echographic data. Paired T-testing was used to determine statistical significance.

RESULTS: A total of 26 patients were included in preliminary exploratory study. Of these, 5 patients were excluded for incomplete data sets. We found no statistically significant difference in 3D mitral valve structure or function in the immediate post-bypass period (see Table 1).

DISCUSSION: The surgical approach to the mitral valve in patients presenting for CABG with incidental mild to moderate MR has been unclear. Recent advances in TEE have allowed for detailed visualization of the MV's 3D structure and function. We found no changes in 3D mitral valve geometry or function in the immediate post-bypass period following coronary revascularization.

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S-64.**OUTCOME AND EVALUATION OF POSTOPERATIVE ACUTE KIDNEY INJURY FOLLOWING ENDOVASCULAR STENT GRAFT REPAIR IN SINGLE CENTER**

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INTRODUCTION: Contrast-induced nephropathy(CIN), also known as contrast-induced acute kidney injury, is associated with rapid and often irreversible decline in kidney function following the administration of iodinated contrast agents. CIN is a common and serious complication of radiocontrast administration, and is the third leading cause of acute kidney injury (AKI) in hospitalized patients¹. Endovascular repair (EVAR) for thoracic or/and abdominal aortic aneurysms was established around 1992, is some literatures and reviews have been reported. We therefore retrospectively analyzed the anesthetic management for EVAR in our single center, and speculated the relative risk factor concerning AKI associated with CIN.

METHODS: Following IRB approval, from April 1, 2008, to December 31, 2009, a total 441 patients who underwent EVAR surgery were identified. We also evaluated the serum creatinine perioperatively, defined AKI by criteria ,more than a 25% rise or 0.5 mg/dl in serum creatinine from the preoperative value within 72 hours after EVAR. We identified that 36 patients(8.2%) were assigned as AKI,CIN group, 405 patients in control group (C group). A retrospective database and medical record review was performed to evaluate anesthesia and surgery time, intraoperative blood loss, urine volume and contract volume, anesthetic technique. These variables were compared between the two groups using the chi-square, Fisher's exact test. The relation between anesthetic managements and AKI after EVAR surgery was assessed using univariate analysis and multivariate logistic regression analysis. P< 0.05 was considered as statistically significant.

RESULTS: The demographics of the patients in each group are similar. General anesthesia was the predominant type of anesthesia in two group. Surgical and Anesthesia times were significantly longer in the AKI group. Blood loss and contract volume were not also significantly difference between two groups. Urine volume was significantly less in the AKI group than the C group. (table1)

Multivariate logistic regression analysis revealed that Urine volume had likely associations with AKI after EVER (Urine volume; Odd ratio 1.36, 95% confidence interval 1.11-1.79).

DISCUSSION: Although EVAR is feasible patients otherwise considered high risk group, those challenges may be often caused those patients of the serious comorbidity.

This results in the present study might be supposed to the exceed fluid managements peritoperatively, consequently this will be one of strategy as prevention of CIN after EVAR surgery.

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Table 1. Inoperative Data

| | Control-group | CIN-group | Pvalue |
|--------------------------------------|---------------|-----------|--------------|
| Anesthesia Time (min) | 271±87 | 389±163 | <0.0001 |
| Blood Loss (ml) | 153±291 | 344±565 | 0.005 |
| Crystalloid administration(ml/kg/hr) | 13.0±58.2 | 8.5±2.4 | 0.022 |
| Urine Volume (ml/kg/hr) | 7.9±73.3 | 3.1±1.9 | 0.034 |
| Volume of contrast media(ml/kg) | 3.1±1.6 | 3.8±2.2 | 0.025 |

Mean ± SD

S-65.**PERIOPERATIVE OUTCOMES AFTER CARDIAC SURGERY IN RENAL TRANSPLANT RECIPIENTS****AUTHORS:** A. Kumar, B. Subramaniam, A. Lerner, J. D. Mitchell**AFFILIATION:** Beth Israel Deaconess Medical Center, Boston, MA

INTRODUCTION: Improved immunosuppressive therapy and prolonged survival for renal transplant patients has lead to an increase in cardiac surgical interventions amongst this cohort. We performed a retrospective analysis of kidney transplant patients who underwent open heart surgery at our institution from 2000 to 2008 to determine their perioperative outcomes and compared it with the non-transplant patients during the same time frame.

METHODS: Using the STS Database, 31 patients with previous renal transplants were identified who underwent cardiac surgery (55 % CABG, 34% Valve, 11% CABG plus Valve). These patients were compared with 4873 adult non-transplant patients. Data were expressed as numbers and percentages. Continuous variables were compared using the Chi-Square test for independent samples and p values of 0.05 or less were considered significant. Patient characteristics and different variables that were analyzed are listed in the graphs along with the comparison with our non-transplant population.

Challenging Case Report (only complete if your submission falls into the “Challenging Case Report” category. If you select the “Challenging Case Report” category on the next step, this section must be completed.): N/A

RESULTS: Univariate analysis showed that the transplant group had a significantly higher incidence of diabetes, history of dialysis, immunosuppressive therapy, hypertension and peripheral vascular disease ($p < 0.05$). There was no statistically significant difference between the two groups regarding preoperative hematocrit, serum creatinine or ejection fraction. There was also no statistically significant difference in the postoperative complication rate between the groups except for perioperative MI ($p = 0.025$).

DISCUSSION: Although data analyses from various institutions has suggested that open heart surgery can be performed safely in patients with renal transplantations,^{1,2,3} only one 1 compared patient outcomes to the non-transplant population at their respective institutions. Our data reinforces the finding that the perioperative outcomes in this subset of population are comparable to the general population. Therefore, these patients should be considered for cardiac surgery in reference centers with expertise in the perioperative management of these highly complex patients.

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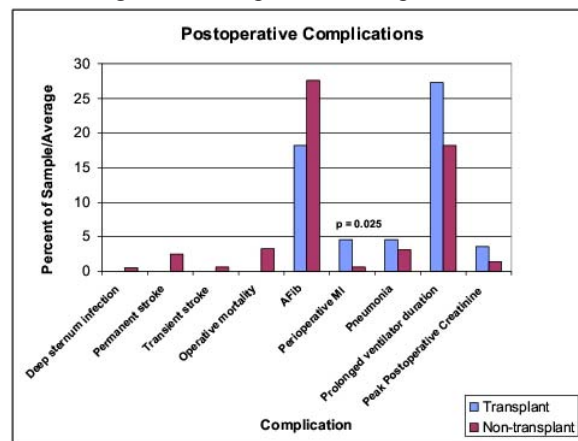
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Table 1: Demographic Data

| Preoperative Characteristics | | | |
|------------------------------|----------------------|----|----------------------------|
| | Transplant n = 31 | % | Non-transplant n = 4753 |
| Age (Years) | 54.8 ± 8.6 | | 65.4 |
| Preoperative Creatinine | 2.9 ± 2.7 | | 1.1 |
| Preoperative HCT | 34.1 ± 5.1 | | 36.8 |
| EF | 46.8 ± 12.2 | | 50.5 |
| Male gender | 22 | 71 | 3223 |
| CABG procedure | 21 | 68 | 2404 |
| CABG/valve procedure | 2 | 6 | 577 |
| Valve procedure | 4 | 13 | 755 |
| Elective case | 16 | 52 | 2595 |
| Dialysis | 11 | 35 | 100 |
| Diabetes mellitus | 23 | 74 | 1502 |
| Hypertension | 30 | 97 | 3736 |
| Peripheral vascular disease | 9 | 29 | 713 |
| Chronic lung disease | 3 | 10 | 618 |
| Congestive heart failure | 7 | 23 | 1036 |
| Immunosuppressive therapy | 21 | 68 | 119 |

HCT = Hematocrit
EF = ejection fraction
CABG = coronary artery bypass graft surgery

Figure 1: Postoperative Complications



Critical Care & Trauma

S-68.**PROGNOSTIC VALUE OF KING'S COLLEGE CRITERIA, MELD SCORE AND APACHE II IN PATIENTS WITH FULMINANT HEPATIC FAILURE**

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AFFILIATION: ¹Department of Anesthesiology, University of Pittsburgh Medical Center, Pittsburgh, PA; ²Department of Critical Care Medicine, University of Pittsburgh Medical Center, Pittsburgh, PA; ³Okayama University Hospital, Okayama, Japan

INTRODUCTION: Assessing the severity of fulminant hepatic failure (FHF) is essential for appropriate timing of liver transplantation (LT). Currently used scoring systems (KCC, APACH II, MELD) may be useful in assessing the severity of FHF but leave much in terms of predicting patient outcome. The aims of the study were, 1- to investigate the sensitivity and specificity of the 3 scoring systems in predicating the need for LT and subsequent outcome, 2- to determine factors that predict the 30-days mortality in patients with FHF.

METHODS: After IRB approval, the medical records of 53 LT patients with FHF for 9-year period (1/1/2000 - 12/31/2009) were reviewed. A matched control group (matched in age, gender, etiology and MELD score) that included patients with FHF without LT (80) was used for comparison. Data were collected at 2-time points, on ICU admission and at the worst point (achieved worst clinical and laboratory values) during the study period. Data included; age, gender, etiology of FHF, degree of hepatic encephalopathy, serum creatinine, INR, bilirubin, 30-day survival, MELD score, APACH II score and KCC. The impact of utilizing the three scoring systems on the 30-day mortality of both groups was analyzed.

RESULTS: Table-1, represents the demographic data of the groups. The ROC analysis revealed that the APACHE II score was significantly better prognostic indicator than KCC and MELD score (at admission and at worst time) (AUC: 0.988, 0.715, 0.449 and 0.81, respectively)(Figure). The univariate analysis showed that non-acetaminophen etiology, hepatic coma level (\geq III) on admission and high serum creatinine, INR, bilirubin at worst time was significant factors for 30-day mortality. Higher Apache II score and hepatic coma III and VI at admission were significant predictors for 30-day mortality with an odd ratio of 1.8 [95% confidence interval (CI): 1.3-2] and 1.6 (CI: 1.3-1.9), respectively (table-2).

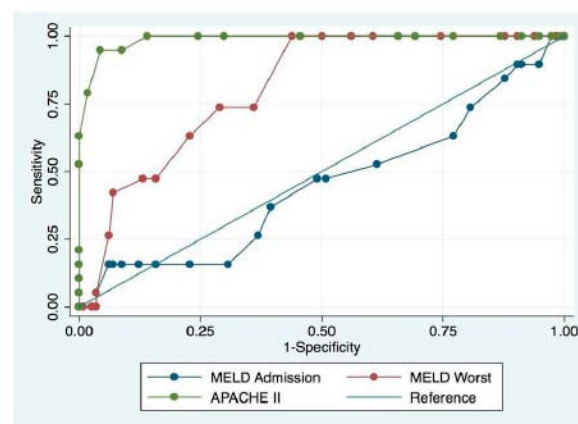
DISCUSSION: Hepatic coma \geq III and high APACHE II score on admission can be early prognostic indicators for FHF.

REFERENCES: None

Demographic Data

| Total N=133 | LT=53 | No LT=80 | P value |
|------------------|-------------|------------|---------|
| Age (year) | 39 \pm 12 | 36 \pm 8 | 0.26 |
| Male/Female | 18/35 | 30/50 | 0.18 |
| BMI | 26 \pm 1 | 25 \pm 3 | 0.36 |
| 30-day mortality | 6(11%) | 15(18%) | 0.1 |
| Etiology of FHF | | | |
| Acetaminophen | 23(43%) | 48(60%) | 0.04 |
| Other drugs | 4(8%) | 8(10%) | 0.85 |
| Viral | 12(23%) | 3(4%) | 0.01 |
| Unknown | 14(26%) | 18(23%) | 0.62 |

Abbreviation: LT:Liver Transplantation, BMI:Body Mass Index



S-69.**HYPOCHLOREMIA IS ASSOCIATED WITH MORTALITY IN CRITICALLY ILL PATIENTS**

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INTRODUCTION: Chloride is the major anion in the extracellular fluid and we can measure its concentration with blood gas analyzer. However, its value is often ignored and limited investigations have been done on the role of chloride in critical care settings. The aim of this research is to understand the characteristics of acid-base balance in critically ill patients from the perspective of chloride.

METHODS: By retrospective chart review, we evaluated 488 patients stayed in our intensive care units (ICUs) over 24 hours. We collected the data of clinical variables including patient demographics, length of ICU stay and ICU mortality. In addition, we recorded laboratory data of arterial blood gases, sodium, potassium, chloride, bicarbonate, ionized calcium, albumin, and lactate. Patients were divided into 3 groups according to their lowest chloride levels; hypochloremia (less than 98 mmol/L), normochloremia (98-106 mmol/L), hyperchloremia (more than 106 mmol/L). The groups were compared by ANOVA, Tukey's-HSD test, and χ^2 test as appropriate. Data were expressed as mean \pm SD or proportions. $P < 0.05$ was considered significant.

RESULTS: The proportions of patients categorized into hypochloremia, normochloremia and hyperchloremia were 8.8%, 74.6% and 16.6% respectively. Table.1 shows the data of blood gas analysis in each group. The values of the hypochloremic group were significantly different from the other two groups. pH was higher ($P < 0.0001$) and 22 (51.2%) patients showed alkalemia. Strong ion difference (SID) was higher ($P < 0.0001$), but both of sodium ($P < 0.0001$) and strong anions were lower ($P < 0.0001$). By contrast, PaCO₂ ($P < 0.0001$) and lactate ($P < 0.0001$) were also higher in the hypochloremic group. The hypochloremic patients, compared with the normochloremic and the hyperchloremic patients, had higher ICU mortality rates (14.0%, 1.9%, and 2.5%, respectively) and longer length ICU of stay (14.3 \pm 13.3 days, 7.3 \pm 9.6 days, and 4.4 \pm 2.5 days, respectively).

DISCUSSION: Hypochloremia is not rare in critically ill patients, and it is related to metabolic alkalosis. In this study, the hypochloremic patients had mild alkalemia with standard base excess of 4.4 \pm 5.1 mEq/L. However, only 9 (20.9%) patients had high SID secondary to low strong anions with high strong cations. In the hypochloremic patients, it is possible that hypochloremia occurs due to some effects lowering some cations like sodium not due to compensation of other high anions like lactate. Hypochloremia is associated with longer ICU stay and higher mortality. Clinicians tend to pay attention to metabolic acidosis which suggests higher mortality. However, this study suggests hypochloremia with alkalemia possibly is a sign of severe patients.

REFERENCES: N/A

Table 1. Acid-base variables in hyper-, normo-, hypo-chloremic groups

| | Hyperchloremia (N=81) | Normochloremia (N=364) | Hypochloremia (N=43) | P value |
|-------------------------------|--------------------------|---------------------------|-------------------------|---------|
| pH | 7.41 \pm 0.04 | 7.42 \pm 0.035 | 7.44 \pm 0.065 | <0.0001 |
| pCO ₂ [mmHg] | 38.0 \pm 4.8 | 40.7 \pm 5.0 | 42.3 \pm 7.3 | <0.0001 |
| HCO ₃ [mEq/L] | 23.8 \pm 2.2 | 26.0 \pm 2.4 | 28.5 \pm 5.0 | <0.0001 |
| Anion gap [mEq/L] | 7.0 \pm 3.3 | 7.9 \pm 2.9 | 11.3 \pm 6.9 | <0.0001 |
| Standard base excess [mEq/L] | -0.16 \pm 2.1 | 2.0 \pm 2.3 | 4.4 \pm 5.1 | <0.0001 |
| Sodium [mEq/L] | 135.7 \pm 3.1 | 132.6 \pm 3.4 | 130.0 \pm 7.0 | <0.0001 |
| Strong ion difference [mEq/L] | 30.5 \pm 3.1 | 33.9 \pm 3.5 | 38.2 \pm 4.4 | <0.0001 |
| Lactate [mmol/L] | 1.4 \pm 0.99 | 1.2 \pm 0.8 | 2.2 \pm 4.4 | <0.0001 |
| Lactate + Chloride [mEq/L] | 110.1 \pm 2.1 | 103.6 \pm 2.6 | 96.1 \pm 6.3 | <0.0001 |

S-70.**VALIDATION OF SIMPLIFIED ACUTE PHYSIOLOGY SCORE 3 (SAPS 3), FOR PREDICTING MORTALITY IN THE RESPIRATORY INTENSIVE CARE UNIT****AUTHORS:** V. Prasad, S. Mantha, G. Ramachandran**AFFILIATION:** Nizam's Institute of Medical Sciences, Hyderabad, India

INTRODUCTION: Several scoring systems have been developed over the years to predict ICU outcome. Of all the models developed, SAPS 3 is a recent one and has gained in popularity due to its large and varied developmental cohort.¹ Most of the outcome prediction models do not perform equally well in other geographical settings. In this prospective study, we sought to validate SAPS 3 in a respiratory intensive care unit (ICU) in a tertiary care university-based hospital in South India.

METHODS: The sample size was calculated by standard methods using the odds ratio and was estimated to be 150 with a power of >0.8. Outcome of interest was ICU mortality. SAPS 3 data within 24 hours was collected in 150 adult patients admitted in ICU over a period of 12 months. Multivariate logistic regression analysis was applied after univariate analysis of the data. The data were validated using Hosmer-Lemeshow Goodness of Fit tests for calibration and ROC analysis for discrimination.

RESULTS: The ICU mortality was 24.67% (35/150). The median (interquartile range) of SAPS 3 score in ICU survivors was 50 (41 to 59) and 69 (59 to 83). SAPS 3 was found to predict ICU mortality on logistic regression analysis with good calibration ($p=0.173$) and discrimination ($AUC=0.821$ with 95% $CI=0.74$ to 0.89). Analysis also found that the ideal cut-off was 57 at which the sensitivity and specificity would be 84% and 71% respectively. Results of logistic regression analysis are depicted in the Table. Mortality predicted from our model for some SAPS 3 scores found in our sample are as follows: score (% mortality): 20 (1%), 40 (5.7%), 57 (21%), 60 (26%), 80 (66%), 100 (92%).

DISCUSSION: Risk prediction models developed in another country require validation and recalibration before being used to provide risk-adjusted outcomes within a new country setting.² SAPS 3 score was validated in Central and Western Europe.³ Whereas, in another study, in a cohort of 28,357 patients from 147 Italian intensive care units, although discrimination was good, calibration turned out to be poor.⁴ Our findings indicate consistency in both calibration and discrimination of SAPS 3 scoring in predicting ICU mortality in our setting that consists of medical and surgical cases in need for ventilatory support.

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Logistic Regression Analysis for SAPS 3 Score

| Predictor | Co-efficient | P value | Odds ratio | 95% CIs for Odds ratio |
|--------------|--------------|---------|------------|------------------------|
| Constant | -6.31276 | 0.000 | | |
| SAPS 3 Score | 0.08747 | 0.000 | 1.09 | 1.06 to 1.13 |

P value for overall predictive ability of SAPS 3 score for ICU mortality is 0.000 (Log-Likelihood = -64.181). Goodness-of-fit testing with Hosmer-Lemeshow method revealed P value of 0.173

S-71.**AMONG NUTRITION CRITERIA, ADMISSION DAY HYPOALBUMINEMIA PREDICTS ICU MORTALITY****AUTHORS:** S. Mantha, G. Ramachandran, V. Prasad**AFFILIATION:** Nizam's Institute of Medical Sciences, Hyderabad, India

INTRODUCTION: The role of nutrition criteria in influencing mortality in intensive care units (ICUs) is controversial.¹⁻³ In this prospective study, we sought to evaluate nutrition criteria in predicting mortality in a respiratory intensive care unit (ICU) in a tertiary care University-based hospital in South India. The ICU setting consists of medical and surgical patients requiring ventilatory support.

Methods: During a prospective observational study related to validation of SAPS 3 scoring system, nutrition criteria were collected in 150 adult patients admitted in ICU over a period of 12 months. Outcome of interest was ICU mortality. The data included body mass index (BMI), mid-arm circumference, triceps skin-fold thickness, abdominal girth, serum albumin, albumin/globulin (A/G) ratio, and hemoglobin. Data were collected in the first 24 hours of admission. For BMI, possible influence of malnutrition and obesity was studied. Multivariate logistic regression was applied after univariate analysis of the data. ROC analysis was done for discrimination.

RESULTS: The ICU mortality was 24.67% (35/150). Of the variables studied, albumin/globulin ratio and serum albumin were found to be significant on univariate analysis. Multivariate analysis by logistic regression analysis identified serum albumin as the sole independent predictor of ICU mortality. The results of logistic regression are depicted in the Table. The area under the ROC curve was 0.686 with 95% $CI=0.594$ to 0.778). Analysis also found that the ideal cut-off was 2.6 gm/dl at which the sensitivity and specificity would be 68% and 66% respectively.

DISCUSSION: Nutritional status of an individual can affect the ICU outcome in several ways. Both Low BMI (malnutrition)⁴ and high BMI (obesity) are equally important. Low serum albumin is an indicator for pre-existing malnutrition and liver disease.⁵ Obesity with its adverse affects on respiratory physiology complicates the ICU course especially in those requiring ventilatory support. Paradoxically, obesity may improve outcome related to increased fat reserves to sustain the metabolic stress.² In the present study, among the nutrition criteria, we could identify only the admission day serum albumin as the sole independent predictor of ICU mortality. Further studies are required to verify whether therapy targeted to correct hypoalbuminemia in the ICU improves the outcome.

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Results of Logistic Regression Analysis

| Predictor | Co-efficient | P value | Odds ratio | 95% CIs |
|-----------|--------------|---------|------------|--------------|
| Constant | 1.73916 | 0.045 | | |
| Albumin | -0.85788 | 0.007 | 0.42 | 0.23 to 0.79 |
| A/G ratio | -0.55893 | 0.396 | 0.57 | 0.16 to 2.08 |

The P value for overall predictive ability of the model is 0.002 (Log-likelihood = -77.506). Goodness-of-fit testing with Hosmer-Lemeshow method revealed P value of 0.499. Mortality predicted from our model for some serum albumin values (gm/dl) found in our sample are as follows: albumin (% mortality): 1.0 (71%), 2.0 (51%), 2.6 (48%), 3.0 (30%), 4.0 (16%), 5.0 (7%).

S-72.**PREDICTORS ASSOCIATED WITH TERMINAL RENAL FUNCTION IN DECEASED ORGAN DONORS AND DELAYED GRAFT FUNCTION IN KIDNEY TRANSPLANT RECIPIENTS**

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INTRODUCTION: Hyperglycemia has been reported to aggravate organ injury in several experimental and clinical studies. We aimed to investigate whether glucose homeostasis in the deceased organ donor is a predictor of terminal calculated glomerular filtration rate (GFR) and to examine donor factors that influence the rate of delayed graft function (DGF, hemodialysis within 7 days of transplantation) in corresponding kidney recipients.

METHODS: 699 adult deceased organ donors were identified through the California Transplant Donor Network database and 543 were matched with their respective kidney recipients. Data collected included demographics, medical history, laboratory values, mechanism of death, and medical treatment in the ICU. Donor terminal GFR and occurrence of DGF in the recipients were used as primary endpoints. Multivariate models were constructed to test factors that were significant in the univariate analyses along with other relevant variables.

RESULTS: Univariate analysis of donor factors for terminal GFR resulted in significant association for ethnicity ($P=0.031$), age, BMI, admission creatinine and GFR, mechanism of death and hypertension (all $P<0.0001$), average and maximum glucose ($P=0.0006$ and 0.001), and glucose standard deviation ($P<0.0001$). In a multivariate model average glucose remained a significant predictor of terminal GFR. Univariate analysis of donor factors for recipient DGF showed that age ($P=0.011$), glucose standard deviation ($P=0.035$), baseline creatinine ($P=0.014$), and terminal GFR ($P<0.0001$) were significantly correlated with DGF. Cold ischemia time (CIT) ($P=0.001$) and recipient age, gender and BMI ($P=0.001$, 0.001 , and 0.002 , respectively) were also significant. In a multivariate model terminal GFR was a highly significant predictor of DGF ($P<0.0001$), with CIT ($P=0.0058$), recipient gender ($P=0.0017$) and recipient BMI ($P=0.0025$) also significant.

DISCUSSION: Most variables (i.e. age and BMI) associated with terminal renal function in the donor and DGF in the recipient are not modifiable. Our preliminary results indicate that poor glucose homeostasis in deceased donors correlates strongly with worsening terminal renal function, which is closely associated with the development of DGF. We are currently prospectively collecting data to better control for other variables.

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S-73.**EFFICACY OF SCAVENGING INHALATIONAL ANESTHETIC AGENTS USED FOR POSTOPERATIVE SEDATION IN THE INTENSIVE CARE UNIT.**

AUTHORS: V. V. Sharma, A. Jerath, R. Devine, J. Karski, P. Ma, M. Wasowicz

AFFILIATION: Toronto General Hospital, Toronto, ON, Canada

INTRODUCTION: Although inhalational anesthesia is often the mainstay of anesthesia practice in the operating room, its use in postoperative sedation in the Intensive Care Unit (ICU) is limited.¹ The Anesthetic Conserving Device (AnaConDa, Sedana Medical, Sweden), a modified heat-moisture exchanger can be used to administer inhalational anesthetic agents for postoperative sedation in the ICU. Given the potential for adverse effects on cognitive function or health due to environmental pollution by exhaled anesthetic agents, the ASA recommend that the residual level of exhaled anesthetic agent should be < 2 parts per million (ppm). We conducted a study to evaluate the efficacy of the Deltasorb anesthetic collection service (Blue-Zone Technologies, Concord, Canada) in scavenging inhalational anesthetics used for postoperative sedation in ICU.

METHODS: After ethics and Health Canada approval, patients undergoing elective coronary bypass grafting were consented to participate in the study. Postoperative sedation with inhalational anesthetic agent was administered via AnaConDa with end-tidal concentration of 0.2-0.3 MAC. The scavenging system consisted of two Deltasorb canisters in series, one connected to the expiratory limb of the ICU ventilator and the other to the central scavenging system. The exhaled concentration of anesthetic gas was measured using the InfraRan specific vapour analyser (Wilks Enterprise Inc, USA), one hour after admission to ICU, and recorded in ppm. Exhaled anesthetic agent concentrations were measured on the expiratory limb of the breathing circuit and after passage through each Deltasorb canister. Finally, room air in immediate proximity to the patient was sampled to measure residual environmental anesthetic agent concentration.

RESULTS: See table 1. The concentration of anesthetic agent in ambient room sample conformed to the international safe standard in all patients.

DISCUSSION: Recent studies report a favorable experience with the use of inhalational anesthetic agents for postoperative sedation in ICU patients.^{2,3} While delivery of inhalational anesthetic agents can be achieved by a variety of methods, a caveat that ICU ventilators do not routinely scavenge exhaled gases exists. The results of our pilot study indicate that the Deltasorb system provides an efficient means of scavenging exhaled anesthetic agents when patients are being sedated with inhalational anesthetic agents via the AnaConDa. The results of this study will help us evaluate the role of AnaConDa as alternative to intravenous agents for long-term sedation of mechanically ventilated patients in the ICU.

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Table 1

| Patient number | Level of anesthetic vapor measured in parts per million | | | |
|----------------|---|--------------------|--------------------|--------------|
| | Expiratory limb | Post 1st Deltasorb | Post 2nd Deltasorb | Ambient room |
| 1 | 32 | 10 | 8 | 0 |
| 2 | 8 | 5 | 4 | 0 |
| 3 | 5 | 2 | 1 | 0 |
| 4 | 18 | 8 | 4 | 1 |
| 5 | 1 | 1 | 1 | 0 |
| 6 | 1 | 0 | 0 | 0 |
| 7 | 10 | 1 | 2 | 0 |
| 8 | 4 | 4 | 1 | 1 |
| 9 | 1 | 1 | 1 | 1 |
| 10 | 10 | 5 | 3 | 1 |

S-74.**SULFANEEN SODIUM AND COBINAMIDE COMBINATION TREATMENT IN A PIGLET MODEL OF LETHAL CYANIDE TOXICITY****AUTHORS:** H. Singh, D. S. Beebe, R. Adhikari, S. Patterson, K. Belani**AFFILIATION:** University of Minnesota, Minneapolis, MN

INTRODUCTION: Cyanide (CN) toxicity can occur following smoke inhalation, during sodium nitroprusside infusion, and possibly bioterrorism. A new prodrug of 3 mercaptopyruvate, sulfanegen sodium, can provide effective quantities of sulphur needed to interact with CN intracellularly to form thiocyanate. Cobinamide, the penultimate compound in cobalamin biosynthesis, binds cyanide with about a 10 times greater affinity and solubility than hydroxycobalamin. In this investigation, we developed and evaluated the efficacy of combination treatment of sulfanegen sodium (SS) and Cobinamide (C) administered intravenously in a piglet model of CN toxicity.

METHODS: After approval by University of Minnesota animal care committee, 10 piglets (22-28 kg) were anesthetized using an infusion of propofol plus ketamine. The piglets were then administered sodium cyanide (NaCN) at an infusion rate of 2.2 mg/kg/hr until the piglets developed 4 minutes of apnea. Five piglets were then administered SS + C [sulfanegen sodium (75mg/kg) plus cobinamide (7mg/kg) administered simultaneously at 2 different intravenous sites] and 5 were administered placebo. If the piglets survived they were metabolically tracked for another 3 hours. Necropsy was conducted in all pigs that died during the experiment and 1 week later in the surviving piglets. Significance ($p < 0.05$) was determined by paired and unpaired t tests and Fisher's exact test.

Challenging Case Report (only complete if your submission falls into the "Challenging Case Report" category. If you select the "Challenging Case Report" category on the next step, this section must be completed.): N/A

RESULTS: The CN levels increased from 0.04 ± 0.01 mg/L to 5.18 ± 1.68 mg/L ($p < 0.0001$), the serum lactate levels increased from 0.8 ± 0.3 to 10.2 ± 3.2 mmol/L ($p < 0.0001$), and the pH decreased from 7.37 ± 0.04 to 7.15 ± 0.13 ($p = 0.016$) with the NaCN infusion. In the 5 piglets that received SS+C the CN levels were lower than those that received placebo (1.60 ± 1.44 vs 5.37 ± 2.57 mg/L; $p = 0.03$) at the end of the experiment or prior to death. The lactate levels also were lower in the pigs that received SS+C than those that received placebo (5.36 ± 2.46 vs 10.06 ± 3.67 mmol/L; $p = 0.055$), and the pH was higher (7.24 ± 0.10 vs 6.95 ± 0.2 ; $p = 0.038$). All the 5 piglets that received placebo died within one hour after receiving the placebo. In contrast, all the 5 piglets that received SS+C survived until sacrificed 1 week after the study ($p = 0.0079$).

DISCUSSION: This study demonstrates that the sulfanegen plus cobinamide treatment is effective in reversing acutely induced cyanide toxicity. Further studies are needed to compare this combination treatment to currently available cyanide antidotes.

REFERENCES: N/A**S-75.****CYANIDE TOXICITY REVERSAL WITH A NEW INTRAMUSCULAR 3 MERCAPTOPYRUVATE PRODRUG****AUTHORS:** H. Singh, D. S. Beebe, S. Patterson, K. Belani**AFFILIATION:** University of Minnesota, Minneapolis, MN

INTRODUCTION: Cyanide is a high priority chemical threat owing to its potential use as a weapon of mass destruction. Current available treatments suffer from significant side effects (Sodium Thiosulphate and Nitrites) or serious limitations due to poor solubility (Hydroxycobalamin) and must be administered intravenously. An ideal antidote would be given intramuscularly as intravenous injection is impractical in a mass casualty scenario. In this study, we investigated the intramuscular use of a new prodrug of 3 mercaptopyruvate (3 MCP) to reverse cyanide toxicity-induced physiologic changes in a sub lethal cyanide exposure animal model.

METHODS: After approval by IACUC, piglets (22-28 kg) were anesthetized by an infusion of propofol plus ketamine and invasive monitors were placed. Sodium cyanide (NaCN) was given at an infusion rate of 2.2 mg/kg/hr in all piglets until 3 minutes of apnea occurred. In one group of 5 pigs (Group A) 3 MCP (2.5g) was administered intramuscularly. The second group of 5 pigs (Group P) received intramuscular normal saline as placebo. If these pigs survived, another dose of 3 MCP and placebo were repeated intramuscularly at 1 hour after the first dose, and the pigs were metabolically tracked for another 2 hours. Necropsy was conducted in all pigs that died in the experiment and a week later in surviving pigs. Data were reported as mean \pm SD. Significance ($p < 0.05$) was determined by paired t tests or Mann-Whitney tests as appropriate.

Challenging Case Report (only complete if your submission falls into the "Challenging Case Report" category. If you select the "Challenging Case Report" category on the next step, this section must be completed.): N/A

RESULTS: The NaCN infusion increased the CN levels in all piglets (0.15 ± 0.35 to 5.04 ± 0.81 mg/L; $p < 0.0001$) and the serum lactate levels (0.8 ± 0.3 to 9.7 ± 4 mmol/L; $p < 0.0001$). The pH decreased from 7.36 ± 0.06 to 7.11 ± 0.11 , $p = 0.0016$. Two pigs died in Group P and 1 pig died in Group A after the administration of placebo and 3 MCP, respectively, prior to completing the experiment. The CN levels were lower at the end of the experiment in the surviving piglets in group A than Group P (0.43 ± 0.42 vs 2.13 ± 0.09 mg/L; $p = 0.0571$) as were the lactate levels (4.02 ± 2.31 vs 7.63 ± 1.75 mmol/L; $p = 0.0571$). The pH was slightly higher in the surviving piglets in group A (7.31 ± 1.5) than in group P (7.25 ± 0.03 ; $p = 0.1074$).

DISCUSSION: 3 Mercapto Pyruvate administered intramuscularly can reverse acutely induced CN toxicity. Further studies are needed to study the efficacy of this drug and route of administration in lethal animal models.

REFERENCES: N/A

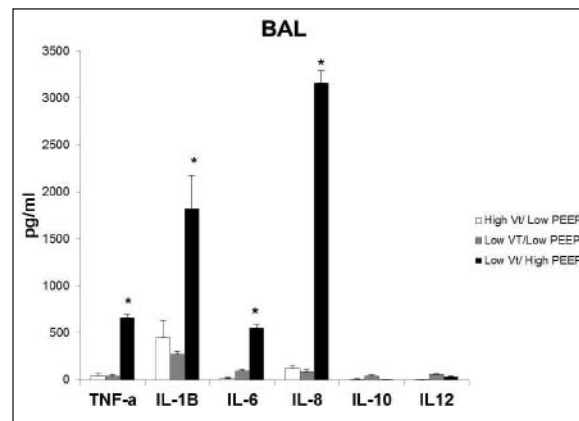
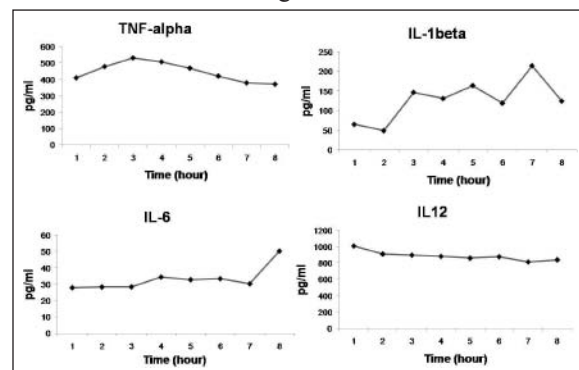
S-76.**SIMILAR SYSTEMIC INFLAMMATORY RESPONSE FROM DIFFERENT MECHANICAL VENTILATION STRATEGIES IN NORMAL LUNGS****AUTHORS:** C. M. Hong,^{1,2} E. Delphin^{3,2}**AFFILIATION:** ¹University of Maryland, Baltimore, MD; ²University of Medicine and Dentistry of New Jersey, Newark, NJ; ³Albert Einstein School of Medicine of Yeshiva University, Bronx, NY

INTRODUCTION: Mechanical ventilation (MV) can lead to ventilator induced lung injury (VILI) secondary to direct trauma and associated increases in pulmonary inflammatory cytokines. There is some controversy regarding the associated systemic inflammatory response. MV associated with the least inflammatory response may possibly protect normal lungs may improve postoperative outcomes. An animal study was performed comparing three ventilation strategies in normal lungs and the effects on systemic and pulmonary inflammatory mediators.

METHODS: Female pigs randomized into three groups: H-Vt/3 (n=6) ventilated with Vt of 15 mL/kg predicted body weight (PBW)/PEEP of 3 cm H₂O (H-Vt/3), L-Vt/3 (n=6) with Vt of 6 mL/kg PBW/PEEP of 3 cm H₂O (L-Vt/3), and L-Vt/10 (n=6) with Vt of 6 mL/kg PBW/PEEP of 10 cm H₂O (L-Vt/10), for 8 hours. Hemodynamics, airway mechanics, arterial blood gases and systemic inflammatory markers were monitored hourly. Bronchoalveolar lavage was analyzed for inflammatory markers and protein concentration. This study represents a part of a previous study that has already been published.

Results: Group L-Vt/10 exhibited a 6-fold increase in inflammatory mediators in bronchoalveolar lavage (p<0.001) [Figure 1]. There were no significant differences in any systemic cytokines between each group, pre-lung or post-lung. All three groups demonstrated similar trends of all serum inflammatory markers [Figure 2].

DISCUSSION: This study was designed to evaluate the effects of three different ventilator strategies on the pulmonary and systemic inflammatory response in anesthetized animals with non-injured lungs. We have evidence that although ventilation with low Vt/high PEEP is associated with increased levels of pulmonary inflammatory mediators when compared to ventilation with high Vt/low PEEP, high and low Vt strategies is associated with similar systemic inflammatory mediator trends. Most studies have focused on the pulmonary inflammatory response with no systemic correlation. Whereas other, such as Michelet, et al, demonstrated “protective” ventilation with lower Vt/PEEP resulted in less systemic and pulmonary inflammatory response(1). This study questions whether different ventilation strategies affect the pulmonary and systemic inflammatory process similarly and whether all positive pressure ventilation has similar systemic effects in non-injured lungs. Large human clinical trials with outcome analysis need to be done to determine the best strategy for ventilation of uninjured lungs and possibly improve postoperative recuperation and morbidity.

REFERENCES:Michelet P, et al. *Anesthesiology* 2006;105:911**Figure 1****Figure 2**

Serum cytokines.

S-77.**VENTILATOR-ASSOCIATED RESPIRATORY INFECTIONS (VARI): MICROBIOLOGIC CRITERIA FOR DIAGNOSIS USING ENDOTRACHEAL ASPIRATES (EA).**

AUTHORS: J. Hudcova,^{1,2} A. Sarwar,^{1,2} R. Ruthazer,² Y. Lei,¹ K. Wener,^{1,2} D. E. Craven^{1,2}

AFFILIATION: ¹Lahey Clinic Medical Center, Burlington, MA; ²Tufts Medical Center, Boston, MA

INTRODUCTION: Bacterial colonization of the lower airway in ventilated patients is common and may progress to ventilator-associated tracheobronchitis (VAT) and/or pneumonia (VAP).¹ Because of difficulties in discriminating between VAT and VAP in the absence of a bronchoscopic or nonbronchoscopic bronchoalveolar lavage (N)BAL,² we examined specific microbiologic criteria for the diagnosis of VARI when only EA are used.

METHODS: After IRB approval we collected daily EA and clinical data on 168 medical and surgical patients who were intubated and ventilated >48h. Patients were followed until extubated, had tracheostomy, died, or comfort measures only. Microbiologic data included: (N)BAL, quantitative and semiquantitative EA (Q-EA, SQ-EA), Gram stain (GS) bacteria (BAC), and GS polymorphonuclears (polys). All but (N)BAL were not reported back to providers. We compared EA tests with the (N)BAL as the gold standard for VAP diagnosis and SQ tests to Q tests to look for the best method to diagnose VARI. Different microbiologic thresholds for VARI were compared in terms of sensitivities, specificities and tests of correlated proportions.

Challenging Case Report (only complete if your submission falls into the "Challenging Case Report" category. If you select the "Challenging Case Report" category on the next step, this section must be completed.): N/A

RESULTS: (N)BAL was performed in 46 patients and 13 (28.3%) of them had VAP defined as >104 cfu/mL. Of the 168 patients, we identified subjects that met different microbiological thresholds at least once. Q-EA >106 cfu/mL was positive in 29 (17.3%) and Q-EA >105 cfu/mL in 64 (38.1%) patients. SQ-EA many (++++), and SQ-EA moderate (+++) or many was detected in 47 (28%) and 74 (44%) patients, respectively. Moderate or many BAC on GS were isolated in 50 (29.8%) and GS polys moderate or many in 153 (91.1%) patients.

Patients' characteristics are in Table 1.

Comparisons of microbiologic criteria in terms of sensitivities, specificities, and tests of correlated proportions are shown in Table 2 and Figure 1.

GS BAC many or moderate is acceptably sensitive and specific test, while GS polys moderate or many displays excellent sensitivity but poor specificity.

DISCUSSION: We tried to identify the best Q-EA technique for a diagnosis of VAP if (N)BAL is not available. Our data show that Q-EA 105 is much more sensitive and only slightly less specific than Q-EA 106 and appears to be a marginally better test to diagnose VAP when compared to (N)BAL as the gold standard.

Since differentiation between VAP/VAT may be hard in the absence of (N)BAL we defined Q-EA and SQ-EA criteria for the diagnosis of VARI (VAT and/or VAP). Microbiologic values not meeting these thresholds should be considered colonization. GS BAC moderate or many and GS polys moderate or many also support diagnosis of infection rather than colonization.

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1. Chest 2009; 135:521-528
2. Chest 2009; 135:252-255

Table 1. Patients' characteristics

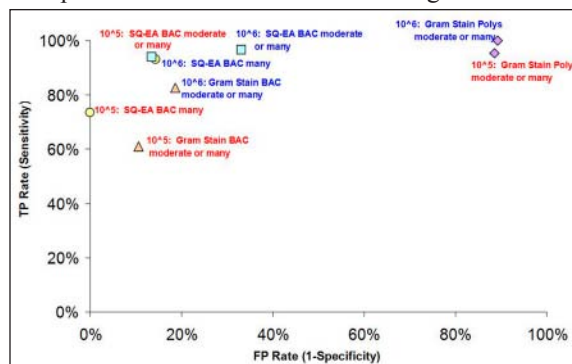
| Age | % male gender | BMI | Charlson Comorbidity Index | APACHEII | Antibiotics at study start | ICU admit site |
|-------------|---------------|------------|----------------------------|------------|----------------------------|----------------------------|
| 65.2 ± 14.3 | 61.3% | 30.0 ± 8.8 | 2.1 ± 2.0 | 17.2 ± 5.8 | 86.9% | MICU: 61.3% SICU: 38.7% |

Table 2. Comparisons of different microbiologic criteria by sensitivities, specificities, and tests of correlated proportions

| Gold standard (GS) | Micro criteria | Sensitivity [%] | Specificity [%] | % Agree | Test of Correlated proportions | | | Kappa |
|-------------------------|------------------------|-----------------|-----------------|---------|--------------------------------|-------------|---------|-------|
| | | | | | GS % pos | Micro % pos | p-value | |
| (N)BAL >10 ⁴ | Q-EA 10 ⁶ | 62 | 85 | 78 | 28% | 28% | 1.0 | 0.46 |
| (N)BAL >10 ⁴ | Q-EA 10 ⁵ | 85 | 73 | 76 | 28% | 43% | <.03 | 0.49 |
| Q-EA 10 ⁶ | SQ-EA many | 93 | 86 | 87 | 17% | 28% | 0.0001 | 0.63 |
| Q-EA 10 ⁶ | SQ-EA moderate or many | 97 | 67 | 82 | 17% | 44% | <.0001 | 0.39 |
| Q-EA 10 ⁵ | SQ-EA many | 73 | 100 | 90 | 38% | 28% | <.0001 | 0.77 |
| Q-EA 10 ⁵ | SQ-EA moderate or many | 94 | 87 | 89 | 38% | 44% | <.02 | 0.70 |

*Results based on n=46 pairs for (N)BAL GS, n=168 Pairs for Q-EA Gold Standard

Figure 1. Diagram depicting sensitivities and specificities of different microbiologic criteria



S-78.**EFFICACY AND SAFETY OF THE INTUBATING LARYNGEAL MASK AIRWAY IN OUT-OF-HOSPITAL CARDIOPULMONARY RESUSCITATION BY PARAMEDICS****AUTHORS:** L. TRITSCH,^{1,4} S. Boët,² G. P. Joshi,³ P. Diemunsch⁴**AFFILIATION:** ¹Service Départemental d'Incendie et de Secours, Strasbourg, France; ²University of Toronto, Toronto, ON, Canada; ³University of Texas, Dallas, TX; ⁴Université de Strasbourg, Strasbourg, France**INTRODUCTION:** Paramedics often perform pulmonary ventilation, using bag-and-mask technique, during out-of-hospital cardiopulmonary resuscitation (OH-CPR). Mask ventilation can prove difficult due to upper airway obstruction by macroglossia and other airway abnormalities, which may cause inappropriate oxygenation as well as regurgitation and pulmonary aspiration of gastric contents. The intubating laryngeal mask airway (ILMA) is easy to place and has a steep learning curve. We present the final results of an observational study aimed at evaluation of the efficacy and safety of the ILMA used by paramedics of an emergency service during OH-CPR.**METHODS:** After University Research Board approval, paramedics of the local fire and rescue service were trained to the use of the ILMA during CPR and the device (Fastrach*, LMA Company, UK; sizes 3, 4 and 5) were included among the equipment of the ambulances. We recorded the success rates with ventilation and subsequent tracheal intubation (TI) through the ILMA, as well as the incidence of regurgitation during airway management performed by the paramedics. Cases with TI performed by emergency physicians were excluded from the analysis.**RESULTS:** Between December 1 2005 and November 30 2010, the paramedics placed 448 ILMA during OH-CPR. Criteria for potential difficult tracheal intubation were present in 49 cases. After ILMA placement, but before TI, ventilation was considered as adequate in 390 (87%) cases. The main reasons for failure to ventilate included major leaks (n=35), obstruction to ventilation (n=16) and failure to introduce ILMA due to trismus (n=7). Of the 397 attempts at TI through the ILMA, 345 (87%) were successful. Main causes of failure to intubate included inability to forward the tracheal tube (n=32) and major leaks (n=10).

TI via the ILMA was successful in 13 of the 23 attempts where an ILMA ventilation was ineffective due to leaks while TI via the ILMA was successful in only one of the 16 cases with obstructed ventilation.

Regurgitation of gastric contents occurred in a total 62 cases (13.8%). This occurred in 31 cases before the rescue team arrival, and in 27 cases before, 1 case during and 3 cases after ILMA placement.

DISCUSSION: The ILMA allows effective airway management during OH-CPR management by paramedics. The incidence of regurgitation (13.8%) was lower than that reported previously (28%) during OH-CPR.¹**REFERENCES:**

1. Simons RW et al. Resuscitation 2007; 74: 427-31.

S-79.**AN ACUTE RESPIRATORY DISTRESS SYNDROME (ARDS) CASE WITH HOMOZYGOUS FUNCTIONAL VARIANT OF T-BET (T-BOX EXPRESSED IN T CELLS) SHOWS DRAMATIC PHARMACOGENETIC RESPONSE TO THE THERAPY WITH CORTICOSTEROIDS.****AUTHORS:** H. Nishie, D. Sun, T. Nagasaka, S. Mizobuchi, H. Morimatsu, H. Katayama**AFFILIATION:** Okayama University Hospital, Okayama, Japan**INTRODUCTION:** ARDS is a life threatening condition with mortality rates of about 40-60%. Since inflammation is thought to contribute to the pathogenesis of ARDS, it is rational to explore modulating therapies for this inflammation. Corticosteroids would seem to be one of logical choice for treatment of ARDS. A transcriptional factor T-bet, responsible for the induction of T helper (Th)1 cells and the repression of Th2 cells from naive T lymphocytes, is encoded by the gene TBX21. Only one common (estimated heterozygosity > 5%) nonsynonymous TBX21 SNP has been described to date, which codes for a replacement of histidine 33 with glutamine (H33Q). Therefore, herein this study, we thought that H33Q in TBX21 will also be a predictor for improvement in ARDS with the use of corticosteroids.**METHODS:** To examine influence of H33Q of the TBX21 gene to the therapy with corticosteroids in ARDS patients, we developed a Restriction Fragment Length Polymorphism (RFLP) method. The status of common nonsynonymous TBX21 SNP was compared with clinical outcome and status of ARDS patients.**RESULTS:** We found a case with homozygous functional variant of Q33Q of the TBX21 gene. The case shows dramatic pharmacogenetic response to the therapy with corticosteroids. The PaO₂/FiO₂ ratio increased from 49 to 220 and pulmonary edema clearly improved after administration of corticosteroids.**DISCUSSION:** Generally, over 80% of people possess the homozygous H33H in the TBX21 gene, and the heterozygosity H33Q is estimated around 10 to 20%. Obviously, the other homozygous Q33Q is rare. Tantisira KG et al reported that the nonsynonymous variation in TBX21 coding for replacement of H33Q is associated with significant improvement in the PC20 (a measure of airway responsiveness) of asthmatic children in a large clinical trial spanning four years. Additionally, Tantisira KG et al also reported the TBX21 variant H33Q increases T helper 1 and decreases T helper 2 cytokine expression comparably with wild type H33H. Hence, the TBX21 variant H33Q, in addition Q33Q, will have a potential to improve airway responsiveness. We considered the TBX21 variants will be a predictor for improvement in ARDS with the use of corticosteroids. To examine our hypothesis, we examined the TBX21 variants in ARDS patients with administration of corticosteroids. We found a case with homozygous functional variant of Q33Q of the TBX21 gene. The case shows a dramatic pharmacogenetic response to the therapy with corticosteroids. Although this is only a case report, the TBX21 variants have a possibility to become powerful biomarker to predict the efficiency of the use of corticosteroids to patients with ARDS.**REFERENCES:**

- PNAS, 101, 18099-104, 2004

S-80.**EFFECTS OF MECHANICAL VENTILATION ON INTESTINAL MICROCIRCULATION IN SEPSIS OR ACUTE LUNG INJURY IN RATS**

AUTHORS: D. Henzler, N. Ismaiel, F. Hoffmann, H. Schuster, J. Zhou, C. Lehmann

AFFILIATION: Dalhousie University, Halifax, NS, Canada

INTRODUCTION: Mechanical ventilation can cause an inflammatory reaction and injury of distant organs by multiple mechanisms, especially in pathologic conditions of sepsis or acute lung injury (ALI). We studied inflammation and intestinal microcirculation during controlled vs. assisted ventilation in experimental sepsis and acute lung injury.

METHODS: After approval by the animal care committee, male SD rats were anesthetized and tracheotomized. 20 animals served as controls and ALI was induced in 20 animals by intra-tracheal instillation of 2.5 ml/kg HCl (pH 1.25). Sepsis was induced in 20 animals by Colon Ascendens Stent Peritonitis (CASP) surgery using aseptic technique 15 h prior to the start of an experiment. Animals were randomized to either pressure support (PSV) or volume controlled ventilation (CMV) with lung protective settings. Pharmacologic paralysis was maintained during CMV. After 4 hours of ventilation the intestinal microcirculation in the terminal ileum was visualized using intravital microscopy. Adhering leukocytes (n/mm²) and functional/nonfunctional capillary density (mm/mm²) were analyzed.

RESULTS: There were no differences in baseline hemodynamics and gas exchange. ALI increased the elastance of the respiratory system by 65% and wet/dry ratio was increased as compared to controls. Although CASP animals appeared sick, macro-circulation remained stable and septic acute lung injury did not occur.

MICROCIRCULATION EFFECTS: In ALI, the functional capillary density in the longitudinal and circular layers of the muscularis and the mucosa was lower than in controls ($p < 0.0001$). The effect was similar whether animals were ventilated in PSV or CMV. In septic rats ventilated in PSV the functional capillary density in the longitudinal muscularis layer was preserved compared to controls ($p = 0.006$), but not in animals ventilated in CMV.

INFLAMMATION EFFECTS: In CMV ventilated rats the leukocyte adhesion in submucosal collecting venules was higher in sepsis (301 ± 100) and ALI (219 ± 83) than in controls (121 ± 24) ($p < 0.001$). For PSV ventilated rats leukocyte adhesion was significantly higher in sepsis (237 ± 81) and ALI (181 ± 73) than in controls (89 ± 37) ($p < 0.001$). The differences between CMV and PSV were not significant ($p = 0.29$ (ALI) and $p = 0.14$ (sepsis)).

DISCUSSION: Sepsis and ALI cause an inflammatory reaction in the small intestine regardless of ventilation mode. Intestinal microcirculation was impaired despite preserved hemodynamics in sepsis and ALI. The deleterious effects were less pronounced with PSV, although the differences between CMV and PSV were not significant in direct comparison.

REFERENCES:

Shock 2007; 28: 59-64

S-81.**INCIDENCE AND RISK FACTORS FOR ACUTE LUNG INJURY FOLLOWING EMERGENT SURGERY**

AUTHORS: M. J. Stentz,¹ P. Park,² R. E. Dechert,³ J. Blum¹

AFFILIATION: ¹Department of Anesthesiology and Critical Care, University of Michigan, Ann Arbor, MI; ²Department of Surgery, University of Michigan, Ann Arbor, MI; ³Critical Care Support Services, University of Michigan, Ann Arbor, MI

INTRODUCTION: Acute lung injury (ALI) is a grave complication in postoperative patients, with significantly increased mortality. Many studies have focused on high-incidence groups, such as thoracic surgery patients,¹ but little is known about the risk factors of ALI in a general surgical population. The authors sought to determine the incidence and risk factors for ALI following emergent surgery in a general surgical population.

METHODS: Prospectively collected clinical data were analyzed for all surgical procedures during a five-year period at a single large tertiary care facility. All adult patients undergoing emergent non-thoracic, non-cardiac surgeries were included. Patients who developed ALI on postoperative days 1-7 were identified using an institutional research database of ventilator-dependent patients meeting ALI criteria. Backwards stepwise logistic regression was used to determine preoperative predictors of ALI. A propensity score was calculated from this model for each patient, representing the odds of developing ALI based on preoperative risk factors. A second backwards stepwise logistic regression was constructed with data pertaining to intraoperative ventilator and fluid management, and incorporating the preoperative propensity score to account for baseline patient risk. Those variables that were significant ($p < 0.05$) were considered independent predictors of ALI.

RESULTS: There were 3,323 hospital admissions that included at least one emergent surgery during the study period. Of these admissions, 45 (1.4%) were complicated by postoperative ALI. Two independent preoperative predictors were identified: ASA status III - V (OR 19.4, CI 5.9-63.9) and renal failure (OR 2.0, CI 1.0-3.8). The receiver operating characteristic-area under the curve (ROC-AUC) for this model is 0.801 (CI 0.748-0.854). While accounting for differences in preoperative risk of ALI, analysis of intraoperative variables showed that driving pressure (OR 1.092, CI 1.040-1.146) and transfusion of any blood product (OR 3.209, CI 1.679-6.132) were both predictive of ALI. This model had ROC-AUC of 0.869 (CI 0.837-0.901), demonstrating an incremental increase in predictive ability when incorporating intraoperative information.

DISCUSSION: We report that the incidence of ALI in patients undergoing emergent non-thoracic, non-cardiac surgery is 1.4%. Patients with higher ASA status and specifically renal failure are more likely to develop ALI following an emergent surgery. After accounting for preoperative comorbidities, higher intraoperative driving pressures and use of blood products is associated with increased risk of postoperative ALI.

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S-82.**HIF STABILIZATION AS PHARMACOLOGICAL STRATEGY IN ACUTE LUNG INJURY (ANIMALS INVOLVED)**

AUTHORS: T. Eckle,¹ K. Brodsky,¹ M. Koeppen,¹ E. Kewley,¹ M. Mittelbronn,² H. Eltzschig¹

AFFILIATION: ¹Department of Anesthesiology, University of Colorado Denver, Denver, CO; ²Institute of Neurology (Edinger Institute), University of Frankfurt, Frankfurt, Germany

Introduction: Acute lung injury (ALI) represents a life-threatening disorder that can develop in the course of different clinical conditions, including pneumonia, acid aspiration, major trauma, or prolonged mechanical ventilation. ALI is among the most significant contributors to morbidity and mortality of critical illness. At present, specific therapeutic approaches beyond mechanical ventilation or supportive measures are not available. Here, we hypothesized that alterations in gene transcription could represent an endogenous pathway for lung protection during ALI.¹⁻³

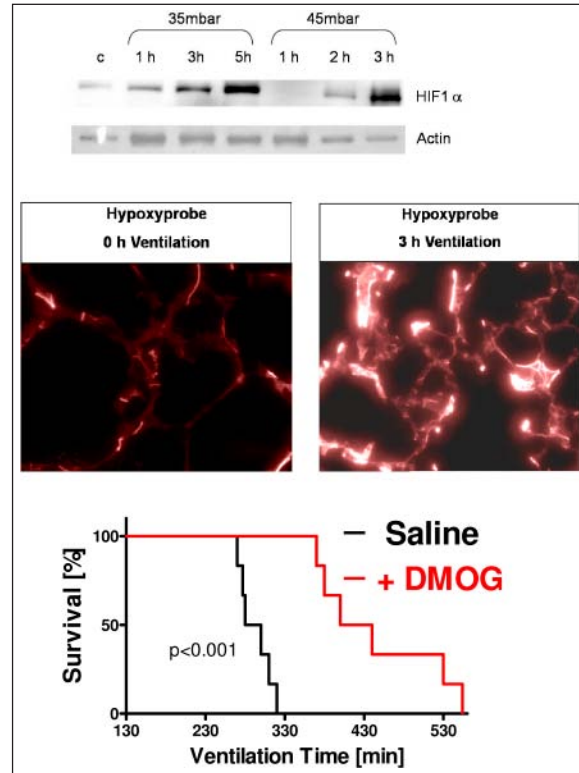
METHODS: All animal experiments had IACUC/IRB approval were performed in accordance with the APS/NIH guidelines for the use of laboratory animals. Expression levels of HIF-target genes were assessed by real-time RT-PCR and Western blotting. Functional studies of acute lung injury were performed using a murine model of ventilator induced lung injury as described previously.²

RESULTS: We gained first insight from microarray studies of pulmonary epithelial cells exposed to cyclic mechanical stretch as occurs during mechanical ventilation. Surprisingly, these studies revealed induction of a set of over 30 known hypoxia-inducible factor (HIF) target genes. We confirmed time-dose-dependent induction of transcript and protein levels in a subset of 10 HIF-target genes in murine ALI induced by mechanical ventilation. Consistent with these studies, we observed stabilization of HIF-1 protein with cyclic mechanical stretch in vitro, or during murine ventilator induced lung injury in vivo. Moreover, pharmacological strategies to stabilize HIF revealed attenuation of lung injury, as assessed by pulmonary edema or survival time. Profiling studies using tissue specific mice for HIF-1 deficiency in the endothelium, the alveolar epithelium or the conducting airway revealed that genetic deletion of HIF-1 in the alveolar epithelium was selectively associated with reduced survival-time and increased pulmonary albumin leakage during VILI.

DISCUSSION: Taken together, these studies indicate activation of hypoxia-dependent signaling pathways during ALI and suggest alveolar HIF-1 as a potential pharmacological target for the treatment of acute lung injury.

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HIF stabilization in Acute Lung Injury

S-83.**HYPOXANTHINE, BIOMARKER OF MYOCARDIAL ISCHEMIA****AUTHORS:** L. C. Gehr, D. Farthing, T. Gehr**AFFILIATION:** VCU, Richmond, VA**INTRODUCTION:** Elevation of plasma hypoxanthine levels may be indicative of myocardial ischemia/injury as demonstrated in animal studies^{1,2} and human studies.^{3,4}

Traditionally, CK-MB, myoglobin and troponin are measured to aid in the diagnosis of myocardial injury. These are relatively large protein components which are released from necrotic heart tissue. Hypoxanthine is an ATP catabolic by-product and smaller polar substance transported by passive diffusion from affected heart tissue into the blood stream during acute ischemia. Since an acute cardiac ischemic event may occur prior to acute myocardial infarction, hypoxanthine may appear in the bloodstream prior to troponin, CK-MB and myoglobin elevations.

METHODS: In a recent study we examined the relationship between hypoxanthine and troponin in patients presenting to the emergency room with acute chest pain.⁵ An inverse relationship was found between plasma hypoxanthine levels and troponin such that it may be of great benefit to follow hypoxanthine levels in patients at risk for myocardial ischemia. Here we present levels of troponin (cTnI) and hypoxanthine from several patients in populations at risk for myocardial ischemia/infarction: elective CABG patients, patients presenting for elective PCI, and those with acute STEMI.

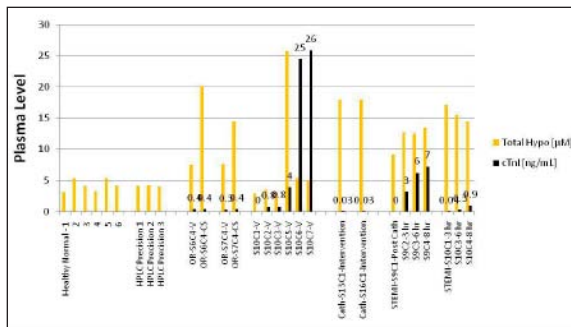
RESULTS: As can be seen in the figure, hypoxanthine levels were significantly elevated in CABG patients as well as for the patients presenting for elective PCI. In 2 STEMI patients, serial hypoxanthine and troponin levels showed increased hypoxanthine prior to troponin levels. This data supports the notion that measurement of hypoxanthine levels in patients at risk of ischemia may be useful in predicting those at risk for infarction.

DISCUSSION:

1. Hypoxanthine levels are elevated with acute myocardial ischemia.
2. Surveillance of hypoxanthine levels may provide a timely diagnosis of myocardial ischemia before myocardial infarction and necrosis has occurred allowing earlier treatment/intervention potentially promoting better patient outcome.

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3. Lewis GD, Weir, Lui E, Yang E, Journal of Clinical Investigator doi: 10.1172/JCI35111, pages 1-10.
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HYPOXANTHINE/TROPONIN: normals/instrument precision/
CABG=ORS6,ORS7, S10; CS= coronary sinus, V=venous/PCI=cath with
intervention/STEMI=ST segment elevation MI

S-84.**EPINEPHRINE INDUCES PULMONARY EDEMA INDIRECTLY, WHILE PROTECTING THE LUNG DIRECTLY**

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INTRODUCTION: In current ACLS protocols, intravenous epinephrine holds paramount importance in resuscitation from cardiac arrest. Despite the beneficial effects of epinephrine on systemic vascular resistance and coronary perfusion pressure, several studies documented the phenomenon of pulmonary edema following high-dose administration of epinephrine. In addition, a decrement in gas exchange has been observed after high-dose epinephrine injection. Using an isolated, perfused lung preparation, we determined effects of epinephrine on pulmonary capillary pressure and resultant pulmonary edema.

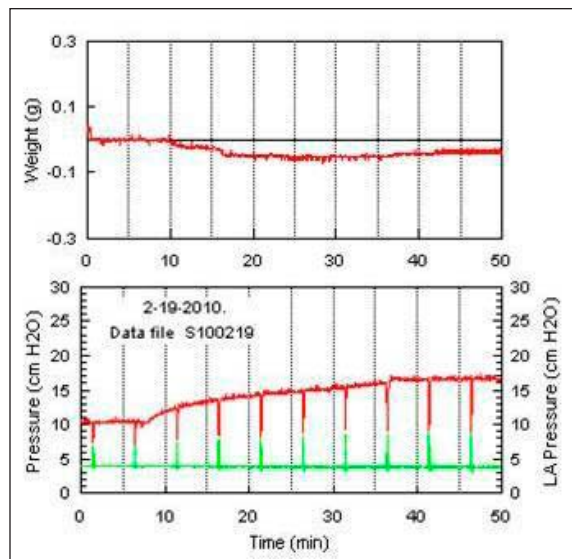
METHODS: Murine lungs were isolated under anesthesia (2.5% isoflurane), ventilated at 120 breaths/min (PIP, 10 cm H₂O), and perfused at constant flow (RPMI medium, 2-4 ml/min), temperature (37°C), and venous pressure (4 cm H₂O). We continuously monitored lung wet weight, pulmonary arterial pressure (Ppa), and left atrial pressure (Ppv) during experiments. Pulmonary capillary pressure (Ppc) was estimated by the measured double-occlusion pressure at 5-min intervals, using electronic valves.

RESULTS: In 10 isolated, perfused lung preparations, when epinephrine was given (100 µM), a small increase in pulmonary capillary pressures was observed (2 cm H₂O), while lung wet weight was modestly decreased. Calculations confirmed that epinephrine increased pre-capillary resistance in the pulmonary circulation, which thus limited the rise in Ppc. In subsequent preparations, increasing the perfusion rate to simulate the beta effect of epinephrine (from 2 to 4 ml/min and 5 ml/min), significant pulmonary edema was encountered.

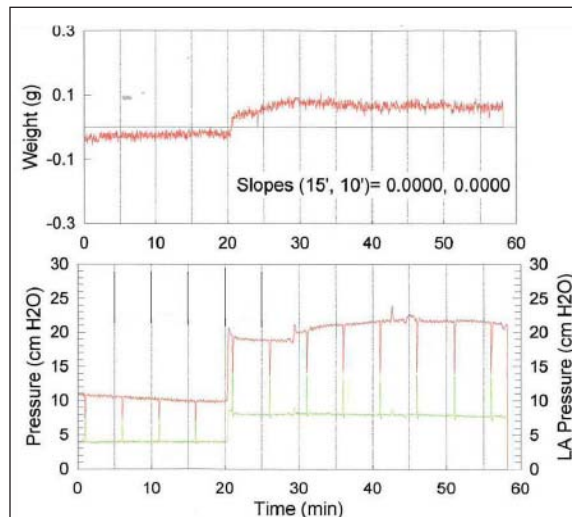
DISCUSSION: In our model, epinephrine administration did cause an increase in capillary pressure, although lung weight modestly decreased. As epinephrine increases cardiac output in vivo, we simulated the effects of higher lung perfusion rates on Ppc. In this situation, we observed higher Ppc at the elevated flow rate and accompanying pulmonary edema. Thus, it is our conclusion that higher cardiac output induced by epinephrine leads to increased pulmonary capillary pressure with the potential to cause pulmonary edema, while the direct effect of epinephrine on the lung circulation is likely protective.

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Epinephrine infusion (100 µM) was begun 7 min after start of perfusion (zero time). Lower chart shows Ppa in red and Ppv in green. Vertical excursions in Ppa and Ppv resulted from the periodic double occlusions.



Increase in flow rate from 2 cc/min to 4 cc/min was begun 21 minutes after start of perfusion (zero time). Epinephrine infusion (100 µM) was begun at 30 minutes. Ppa in red and Ppv in green. Vertical excursions in Ppa and Ppv resulted from the periodic double occlusions.

S-85.**GENERAL ANESTHESIA AFTER HEMODIALYSIS:
HOW LONG TO WAIT?****AUTHORS:** J. Lenart, R. L. Applegate, J. Deng**AFFILIATION:** Loma Linda University Medical Center, Loma Linda, CA**INTRODUCTION:** End-stage renal disease patients need hemodialysis (HD) for volume, electrolyte, and blood pressure homeostasis. The need for HD prior to general anesthesia (GA) is well-established, but the optimal length of time between HD and GA has not been studied.**METHODS:** We reviewed adults on chronic HD undergoing GA from 11/2009-12/2010 (n=200). Liver transplant, intraoperative HD and cardiopulmonary bypass cases were excluded. Demographic, severity of illness, perioperative data, and complications in the 48 hrs after surgery were recorded. Patients were grouped: Group 1 GA >24 hrs after HD; Group 2 GA 7-23.9 hrs after HD; Group 3 GA 0-6.9 hrs after HD. Complications were compared using 2-tail chi-square analysis with Pearson co-efficients using Fisher's exact test. Numerical data were compared using 2-tail Student's t-test with unequal variances. A p value ≤ 0.05 was considered significant.**RESULTS:** As shown in Table 1, demographic and illness scores did not differ between groups. Hypotension (HYPOTN) was more common in Group 3 than Group 1 (51.9% vs. 12.1%, $P < 0.0001$, RR=4.45, CI=2.3-8.6) or Group 2 (51.9% vs. 12.5%, $P < 0.0001$, RR=4.25, CI=2.2-8.4). Differences in hypertension (HTN) failed to reach statistical significance. Grouped by surgery, we found no significant differences in complication rates for Minor, Minor Vascular, and Open Orthopedic surgeries. There was a trend towards significance in HTN rates between Group 3 and Group 2 Minor Vascular cases (50% vs. 8.3%, $P=0.052$, RR=6, CI=0.72-50). Group 1 and Group 3 differed in HYPOTN rates for Laparoscopy (10% vs. 100%, $P=0.046$, RR=10, CI=1.6-64). HYPOTN was also more common in Group 3 than Group 1 for Major surgeries (66.7% vs. 17.6%, $P=0.045$, RR=3.8, CI=1.2-12) and Transplants (50% vs. 9.5%, $P=0.015$, RR=5.3, CI=1.3-22).**DISCUSSION:** GA less than 7 hrs after HD is associated with a higher incidence of HYPOTN. This is most significant in major surgeries and is independent of volume removed at HD. This may be due to a systemic inflammatory response to HD, which accentuates inflammation from surgical stress and subsequent third spacing. We also note that GA less than 7 hours post-HD may not be protective from HTN which may be related to the complicated cardiovascular physiology in these patients.**REFERENCES:**

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S-86.**SAFETY AND ACCURACY OF GOAL-DIRECTED TRANSTHORACIC ECHOCARDIOGRAPHY BY INTENSIVISTS IN A CARDIAC SURGERY ICU**

AUTHORS: M. J. Griffée, P. Schulman, M. P. Hutchens, M. Merkel, K. Wei

AFFILIATION: Oregon Health and Science University, Portland, OR

INTRODUCTION: We assessed the accuracy and impact of goal-directed transthoracic echocardiography (TTE) by intensivists in a surgical ICU population. The primary aim for the retrospective study was to assess the safety of goal-directed TTE by intensivists who were undergoing a proctoring process to learn goal-directed TTE. The secondary aim was to describe the clinical implications of integration of TTE data into bedside hemodynamic assessments in a surgical population. The novelty of this investigation is that literature on the role of TTE in critical care focuses predominantly on the medical ICU population.^{1,2}

METHODS: Over a 12 month period, intensivists underwent a unique training process for acquisition of knowledge and skills needed to perform goal-directed TTE in collaboration with our cardiologists. The study subjects are adults who presented with hemodynamic instability in the cardiac surgery ICU of a tertiary care teaching hospital. We reviewed 30 patient charts, and compared preliminary readings by intensivists with formal reports by cardiologists certified in echocardiography.

RESULTS: Table 1 compares readings by intensivists with those of cardiologists for each category of the goal-directed TTE exam. The correspondence between trainee and expert readings ranged from 69-100%. Each case in which the preliminary reading conflicted with the final report was scrutinized to ascertain the potential harmful impact of a mistaken bedside TTE finding. No cases of injury from delayed diagnosis or from therapy based on incorrect interpretation were discovered. 55% of focused TTE studies lead to a new diagnosis, and 59% lead to a change in therapy. Table 2 summarizes examples of new diagnoses based on goal-directed TTE and the corresponding therapeutic interventions

DISCUSSION: National and international critical care societies have recently published guidelines for training and credentialing in limited TTE by intensivists.^{3,4} The practical strategy for ICU faculty and trainees of diverse backgrounds to acquire goal-directed TTE knowledge and skill safely in a variety of specialty environments will vary from hospital to hospital. Our audit of intensivists who are in the midst of TTE education provides an example of a quality control method based on working closely with cardiology colleagues to provide formal readings. Our preliminary data suggest that goal-directed TTE is an important resource in a population of cardiac surgery patients.

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Table 1
Accuracy of TTE by Intensivists vs. Formal Readings

| Category | Proportion with congruence between preliminary intensivist reading and final reading | Proportion with discordant readings | Total number of cases with available data in category | Ambient room |
|----------------------------|--|-------------------------------------|---|--------------|
| Quality of Exam | 74% | 26% | 23 | 0 |
| Left Ventricular Function | 87% | 13% | 23 | 0 |
| Right Ventricular Function | 73% | 27% | 22 | 0 |
| Valve Function | 80% | 20% | 10 | 1 |
| Volume Status | 69% | 31% | 13 | 0 |
| Pericardial Effusion | 100% | 0% | 17 | 0 |

S-87.**RECIPROCAL MODULATION OF THE ENDOCANNABINOID SYSTEM INHIBITS LEUKOCYTE ACTIVATION DURING EXPERIMENTAL SEPSIS**

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INTRODUCTION: Sepsis is defined as systemic inflammatory response to an infection. Typically in the early phase of sepsis hyperactivation of immune cells leads to tissue damage and organ dysfunction. The endocannabinoid system (ECS) is upregulated during sepsis.¹ However, the functional outcomes of modulating endocannabinoid signaling during sepsis are currently unclear. There is an increasing body of evidence that inhibition of cannabinoid 1 receptors (CB1R), but stimulation of cannabinoid 2 receptors (CB2R) have anti-inflammatory effects (reciprocal modulation^{2,3}). We tested this hypothesis in an experimental sepsis model (endotoxemia) by studying the iridial microcirculation using non-invasive intravital microscopy.

METHODS: Four groups of Lewis rats were studied (n = 5-6 each group): placebo controls; endotoxemia (20 mg LPS/kg i.v.); endotoxemia+CB1R antagonist (2.5 mg/kg AM281 i.v.) and endotoxemia+CB2R agonist (1 mg/kg WIN55212-2 i.v.). All treatments were given 15 minutes after LPS administration. Intravital microscopy of the iridial microcirculation was performed at 0, 1, and 2 hours post-LPS/placebo administration. Leukocyte adhesion was measured offline in a blinded fashion.

RESULTS: We observed a significant increase in the number of adhering leukocytes in endotoxemic animals at 2 hours in both vessels <25 µm in diameter and >25 µm in diameter (p < 0.001 and p < 0.01, respectively). In comparison to untreated animals, treatment with WIN55212-2 resulted in a significant attenuation of leukocyte adhesion in vessels of <25 µm in diameter (p < 0.01) and >25 µm in diameter (p < 0.05) at the 2 hour time point. The drug treatment group AM281 showed a significant decrease in leukocyte adhesion in vessel of <25 µm in diameter at the 2 hour time point only (p < 0.01).

DISCUSSION: The data suggest that the endocannabinoid system plays a functional role in leukocyte activation during experimental sepsis. Activation of the CB2R by WIN55212-2 appears to modulate the inflammatory response (leukocyte adhesion) in the iris. This effect was greater in vessels with diameter of <25 µm, than in vessels with a diameter >25 µm. AM281, a CB1R antagonist, also significantly reduced leukocyte adhesion in the iris microcirculation. Drugs targeting either the CB1R or CB2R may have therapeutic potential in inflammatory diseases such as sepsis.

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S-88.**COMPONENTS OF LECTIN COMPLEMENT PATHWAY IN CRITICALLY ILL PATIENTS WITH SEPTIC SHOCK**

AUTHORS: J. Wei, G. Labaze, Y. Hou, B. Babarshi, J. G. Charchafieh, M. Zhang

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INTRODUCTION: Mannan-binding Lectin (MBL) recognizes microorganisms and activates the lectin pathway via MBL-associated serine proteinase (MASPs). We investigated whether changes of plasma concentrations of MBL or MASP-2 overtime were associated with hospital mortality in critically ill patients with septic shock.

METHODS: Patients admitted to a medical surgical intensive care unit (MSICU) at an academic medical center were screened for development of septic shock. Plasma concentrations of MBL and MASP-2 were measured over the first 5 days after initiation of vasopressor therapy with the use of enzyme-linked immunosorbent assay (ELISA).

RESULTS: 16 patients were enrolled in the study from August 2008 to May 2010. 79 plasma samples were collected and measured for both MBL and MASP-2 levels. 10 (62.5%) patients died in hospital. Plasma levels of MBL and MASP-2 were significantly correlated (r = 0.383, p < 0.001). There was no difference in the distributions of baseline MBL levels between survivors (294.1 [0-874.2] ng/ml) and non-survivors (491.7 [289.7-691.0] ng/ml, p = 0.416). Similarly, there was no difference in the distributions of baseline MASP-2 levels between survivors (300.7 [54.4-777.2] ng/ml) and non-survivors (330.2 [70.1-857.0] ng/ml, p = 0.79). All 3 patients with >10% increase in MASP-2 level at 24 h from baseline survived whereas patients (n=7) with decrease in MASP-2 level had a survival rate of 28.6% (p = 0.038). The decrease in MASP-2 levels at 24 h after septic shock was significantly correlated with hospital mortality (r=0.655, p=0.04). Similarly, survival rate was 100% in patients with >10% increase in MBL levels at 24 h (n=3) vs. 33.3% in those with decrease in MBL levels (n=6) (p=0.26).

DISCUSSION: This preliminary study indicates that decrease in plasma MASP-2 levels at 24 hours from initiation of vasopressor support is associated with higher hospital mortality in patients with septic shock.

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S-89.**NOISE REDUCTION BY EARPLUGS AFTER CARDIAC SURGERY AND PATIENT COMFORT**

AUTHORS: K. Kühn, B. Urbanek, H. Rinösl, K. Skhirtladze, M. Dworschak

AFFILIATION: Div. of Cardiothoracic and Vascular Anesthesia and Intensive Care, Medical University of Vienna, Vienna, Austria

INTRODUCTION: High noise levels in the ICU are not uncommon and cause sleep disruption, which has a major impact on well-being and recovery from illness. Postoperative delirium, compromised immune function, and prolonged weaning from mechanical ventilation have all been associated with sleep deprivation.¹ In healthy volunteers, the use of earplugs resulted in improved sleep quality during exposure to ICU typical noise as evidenced by polysomnography. We therefore investigated if wearing earplugs would also enhance subjective patient comfort during the first night on the ICU after cardiac surgery.

METHODS: Up to date, 59 patients volunteered to participate in this investigation. Patients with a history of sleep apnea, substance abuse, mental and pain disorders were excluded from the study. Twenty-four extubated patients wore earplugs between 10 PM and 6 AM, 35 patients received no earplugs and served as controls. Patient comfort was evaluated the next morning with a standardized questionnaire. Chi-square test and One-way ANOVA were employed to determine differences between groups. A P-value < 0.05 was considered significant.

RESULTS: The two groups were identical regarding demographic data, type of surgery, time to extubation (mean: 4.5 hrs), and the time they were admitted to the ICU. Tolerance of earplugs was generally reported as being good. According to attending nurses, communication with the patients was not impaired. Of the control patients, 35% (vs. 21%) and 79% (vs. 71%) reported delayed sleep onset and nocturnal awakening, respectively ($P > 0.05$). Pain assessed with the VAS-score was 4.0 ± 2.0 in patients who wore earplugs and 4.7 ± 2.8 in control patients ($P > 0.05$). There was no difference in dosage of administered opioids and adjuvant pain medication. On a scale from 1 (best) to 5 (worst), quality of sleep was rated 3.4 ± 1.2 by control patients and 2.8 ± 1.1 by treatment patients ($P < 0.05$). Furthermore, patient comfort, evaluated with the same scale, was significantly better in patients wearing earplugs as compared to controls (1.7 ± 0.8 vs. 2.3 ± 1.2 ; $P < 0.05$).

DISCUSSION: These preliminary data indicate that patient comfort during the first night on the ICU after cardiac surgery could most likely be improved with the help of this simple measure. Underlying this finding is a significantly better quality of sleep as judged by the patients who slept with earplugs. The large percentage of patients in both groups complaining of nocturnal awakening may be due to residual pain, anxiety, the uncommon environment, and the sleep position of the patients (i.e. strictly supine).

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S-90.**TEG-GUIDED MASSIVE TRANSFUSION IN TRAUMA PATIENTS**

AUTHORS: B. M. Messenger,¹ R. M. Craft,¹ R. C. Carroll,¹ B. J. Daley,² B. Enderson,² C. G. Snider¹

AFFILIATION: ¹The University of Tennessee Medical Center - Knoxville Department of Anesthesiology, Knoxville, TN; ²The University of Tennessee Medical Center - Knoxville Division of Trauma Surgery, Knoxville, TN

INTRODUCTION: Traumatically injured patients are often hemorrhagic and coagulopathic requiring significant amounts of blood and blood products.¹ Massive transfusion of blood products is associated with numerous complications including increased mortality, and current massive transfusion protocols (MTP) in trauma patients are essentially empiric and not targeted at specific deficits in the coagulation cascade. TEG and RapidTEG provide extensive data about the coagulopathy in the traumatically injured patient.² This is the first prospective study utilizing TEG to guide massive transfusion. Mortality, amount of blood and blood products used, ICU days, assisted ventilation days, and laboratory results (including TEG) of trauma patients treated per the institutional MTP were compared to that of trauma patients treated by TEG guidance. The specific aim was to goal-direct the transfusion of blood products while restoring coagulation and oxygen delivery, potentially reducing complications.

METHODS: 26 adult trauma patients requiring massive transfusion (>12 units PRBCs in 24 hours or >4 units in 4 hours) treated according to the current institutional MTP were compared to 24 adult patients treated according to a TEG-guided protocol in this prospective, cohort trial. See Tables 1, 2 and Figure 1.

RESULTS: There were no statistically significant differences between groups nor trends when comparing Death, ARDS, SIRS, Multi-system organ failure, Sepsis, DVT, Stroke, Acute Coronary Syndrome, Days to discharge. However there was a trend, although not statistically significant, toward reduced pneumonia, days on the ventilator, and ICU days. There was no difference in PRBC:FFP ratio, but there was a trend toward increasing platelet use in the TEG treated group. Four of 24 TEG treated patients had hyperfibrinolysis in association with hypoperfusion, and all 4 died.

DISCUSSION: Although there were no statistically significant differences between the cohort and the study group, there was no demonstrable harm to patients in using TEG to guide transfusion, and there is a potential benefit of decreased ICU days and ventilator days in the TEG treated group. The 100% mortality associated with hyperfibrinolysis suggests that anti-fibrinolytics may have an important role in directed, non-empiric massive transfusion protocols, and that hyperfibrinolysis is associated with poor outcome, which may be a consideration in resource allocation. Due to the small study size, the study lacks the power necessary to detect a statistically significant difference in outcomes between the two groups, and a multi-institutional trial may be necessary.

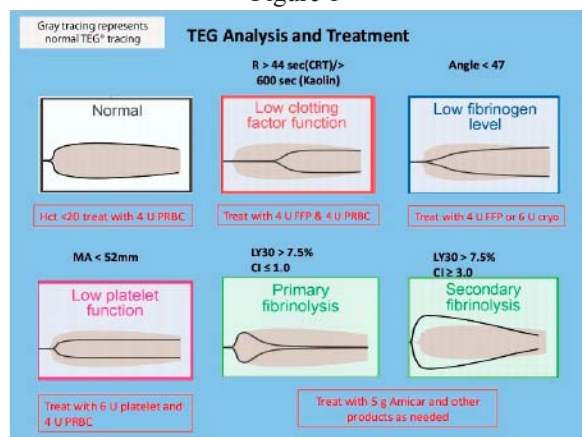
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| Table 1: Institutional Massive Transfusion Protocol | | |
|---|--|---|
| MTP Blood Pack # | Perform Point-of-care (POC) Hematocrit assay | Blood Components Administration |
| 1 | For Hct < 20 | Alternate PRBCs and FFP (1:1 ratio) After 4 th round (4PRBC & 4FFP) Administer 6-pack of Platelets |
| 2 | For Hct < 20 | Alternate PRBCs and FFP (1:1 ratio) After 4 th round (4PRBC & 4FFP) Administer 6-pack of Platelets |
| 3 | For Hct < 20 | Repeat PRBC, FFP and Platelets as above |
| *** Assure cryoprecipitate available ***Consider activated factor VII - administer at 100 mcg/kg | | |

| Table 2: TEG-Guided Transfusion Protocol | | |
|--|--|--|
| TTP Blood Pack # | Perform Point-of-care (POC) Hematocrit assay & TEG | Blood Components Administration |
| 1 | For Hct < 20 If rapid TEG r > 44 sec If rapid TEG r < 44 sec, but Kaolin r > 10 min If rapid TEG MA < 52 If LY 30 > 7.5% | Administer 4 units PRBCs Administer 4 units FFP Administer 4 units FFP Administer 6-pack of Platelets Consider aminocaproic acid 5 grams |
| 2 | For Hct < 20 If rapid TEG r > 44 sec If rapid TEG r < 44 sec, but Kaolin r > 10 min If rapid TEG MA < 52 If LY 30 > 7.5% | Administer 4 units PRBCs Administer 4 units FFP Administer 4 units FFP Administer 6-pack of Platelets Consider aminocaproic acid 5 grams |
| 3 | | Repeat PRBC, FFP and Platelets as above |

Figure 1



S-91.

FAMILIAL/GENETIC CONTRIBUTION TO SURGICAL SITE INFECTION IN A LARGE POPULATION DATABASE

AUTHORS: J. P. Lee¹, H. W. Hopf¹, L. A. Cannon-Albright²AFFILIATION: ¹University of Utah, Department of Anesthesiology, Salt Lake City, UT; ²University of Utah, Department of Internal Medicine, Salt Lake City, UT

INTRODUCTION: The genetics of microbial pathogens have been extensively studied, but there has been little work on human genetic susceptibility to SSI (SSI).¹ Chronic Granulomatous Disease, which results in recurrent, severe infections with wound pathogens such as *Staph aureus*, is caused by a number of possible mutations in the phagosomal oxidase (phox). The genetics of these catastrophic mutations have been studied in detail, but the possibility of less severe mutations that increase susceptibility to SSI through a milder reduction in oxidative bacterial killing has not been investigated. We therefore studied the familial contribution to SSI using a large genealogical population database that has links to healthcare records for 2 million individuals.^{2,3}

METHODS: With IRB approval, the database was queried for individuals with ICD-9 codes for SSI. Subjects who also had genealogical data (cases) were then analyzed for evidence of excess relatedness (n=651). To match for characteristics that could affect the quality and quantity of genealogical data or record-linking success, matched hospital controls with linked genealogical data were randomly selected from the database. Control cohorts were created for age, sex and birthplace. The average relatedness of all possible pairs of cases, and separately of controls (x1000 sets) was compared empirically. The relative risk for SSI was estimated by comparing the number of observed affected individuals among the relatives of cases to the number of affected individuals observed among relatives of matched hospital controls who were also hospital patients.

RESULTS: The Genealogical Index of Familiarity in patients diagnosed with SSI showed significant excess relatedness in close and distant relationships (p< 0.01); this excess was observed when close relationships (closer than 3rd degree) were ignored (p=0.02). The relative risk of SSI in first- and second-degree relatives of cases were elevated (RR=1.32, 1.71, respectively), but not significantly. The RR for third-degree relatives of cases was significantly elevated for third degree relatives (1.76, p = 0.01).

DISCUSSION: A group of patients with diagnosed SSI and known genealogy was used to describe the familial clustering of individuals with SSI. The significant excess relatedness and the significantly elevated relative risk to distant relatives strongly support a genetic predisposition to acquiring SSI. Our next step will be to investigate these pedigrees for analysis of involved genes.

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S-92.**DELAYED DETECTION OF A UNIQUE PERIPHERALLY INSERTED CENTRAL CATHETER (PICC) COMPLICATION****AUTHORS:** U. Sasso, M. Afifi, S. Wolf**AFFILIATION:** Northwestern University Feinberg School of Medicine, Chicago, IL

INTRODUCTION: PiCCs are used to administer drugs and parenteral nutrition, provide access for blood draws, and trend CVP. Though PiCCs offer convenience of long-term use, they also carry risks of arterial puncture, thrombophlebitis, infection, line fracture, embolization, hemothorax and migration.¹ We report an unusual complication of a PiCC as a complex malposition along its course, associated with thrombosis

METHODS: A 30 year old man with presented to hospital unconscious. He was in refractory epilepsy despite treatment with multiple anticonvulsants, including divalproex, levatiracetam, phenytoin, Phenobarbital, topiramate, lamotrigine, clonazepam, and ativan. Persistent subclinical epilepsy (EEG-monitored) necessitated intubation for airway and lung protection, and he was sedated with Diprivan (140 mg/hour). Treatment failed to suppress burst activity, and a 5-day pentobarbital coma was started. Pentobarbital was discontinued, but recurrent seizures necessitated a second 5-day pentobarb coma. He was intubated for 12 days. Prophylaxis for deep vein thrombosis (DVT) with daily dalteparin 5000U SQ was initiated on 2nd hospital day.

RESULTS: On the 8th hospital day, a bedside PiCC was placed in the right antecubital vein by a specialized PiCC team nurse using ultrasound (us) guidance. A portable chest X-ray (CXR) confirmed catheter tip position at the junction of superior vena cava and right atrium [fig1]. On 17th hospital day, the patient was noted to have right upper extremity edema, not associated with fever or hypoxemia. A duplex us study revealed acute right axillary and brachial DVT. Moreover, PiCC line appeared to exit then re-enter the axillary vein along its course. Interestingly, the PiCC tip was confirmed in central vein by repeat CXR, venous blood gas, and transduction of CVP waveform. CT imaging verified a portion of the PiCC was outside the axillary vein [fig2]. A vascular surgery consult concluded no surgical intervention was necessary, the PiCC was removed, and therapeutic anticoagulation was started with daily dalteparin 12,500U SQ for line-associated thrombosis. The patient was discharged on the 42nd hospital day on 7 scheduled anticonvulsants and therapeutic anticoagulation with enoxaparin for 3 months.

DISCUSSION: Current practice verifies PiCC insertion using ultrasound guidance at insertion and CXR for distal tip position. This case report describes a unique PiCC malposition that could not be detected by a CXR. Centrally inserted lines are typically seen in their entirety on post insertion imaging, and our case suggests a similar surveillance of the entire length of PiCCs might be considered.²

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S-93.**DIAGNOSTIC CRITERIA FOR TRAUMATIC BRAIN INJURY: SERUM S-100 B AND COMPLEMENT ACTIVATION****AUTHORS:** H. F. Gonzalez,^{1,2} J. Simoni,² G. Simoni,² A. Halldorsson,² J. Wasnick,¹ J. A. Griswold²**AFFILIATION:** ¹Department of Anesthesiology, Texas Tech University Health Sciences Center, Lubbock, TX; ²Department of Surgery, Texas Tech University Health Sciences Center, Lubbock, TX

INTRODUCTION: Each year in the US approximately 1.4 million people suffer from traumatic brain injury (TBI).¹ Although elevated serum levels of S-100 B could potentially reflect the degree of brain tissue damage, this biochemical marker may also be elevated in other traumatic injuries.² The focus of this research was an assessment and comparison of serum S-100 B with other biochemical markers that are associated with early breakdown of the blood-brain barrier (BBB) that facilitate S-100 B leakage into the peripheral circulation.

METHODS: In this study, blood samples obtained from five TBI patients, with closed head injuries and a positive CT scan, were screened for S-100 B protein, complement activation (C), C-reactive protein (CRP), lipid radicals (CD), lipid peroxides (MDA), 8-isoprostane PGF2 alpha (8-iso), plasma antioxidant capacity (SH), endothelin-1 (ET-1) and plasma free hemoglobin (fHb), immediately after emergency hospital admission, then every 6 hours during the first 2 days, and once daily until discharge. S-100 B, CRP, C, 8-isoprostane and ET-1 levels were measured with commercially available ELISA kits. MDA, CD, SH and fHb were assessed by spectrophotometric methods. The correlation between S-100 B and all measured parameters was then established.

RESULTS: Results indicate that the highest S-100 B level (0.689-1.012 µg/L) can be detected in the serum during the first 48 hours after TBI and continues to be present in relatively small concentrations (approx. 0.5 µg/L) during the entire observation period. The initial high level of S-100 B correlates with C activation ($R^2=0.334$, $p<0.002$). This effect was the most severe in the first 48 hours. While C activation correlates with CRP ($R^2=0.157$, $p<0.04$), no correlation was found between CRP and S-100 B ($R^2=0.001$). The early appearance of S-100 B in serum did not correlate with the oxidative stress parameters (CD, MDA, 8-iso, SH) and ET-1 that only correlates with CRP ($R^2=0.385$, $p<0.001$).

DISCUSSION: It appears that complement activation and subsequent release of anaphylatoxins could be responsible for a higher permeability of BBB during the first 48 hours,³ which resulted in elevated serum S-100 B. The observed lower level of S-100 B after 48 hours was associated with increased synthesis of 8-iso (approx. 400 pg/mL), which is a potent constrictor of cerebral arterioles,⁴ perhaps slowing the leakage of S-100 B.

In conclusion, S-100 B can be considered as a reliable indicator of traumatic brain damage, when detected up to 48 hours after TBI and measured together with the complement.

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4. Stroke 28(4):844-9, 1997.

S-94.

WITHDRAWN.

S-95.**INTRAOPERATIVE FLUID MANAGEMENT AND OUTCOMES FOLLOWING HIPEC****AUTHORS:** G. Wilson,¹ S. Hariskov,³ H. Wurm,² R. Schumann²**AFFILIATION:** ¹Naval Health Clinic New England, Newport, RI; ²Tufts Medical Center, Boston, MA; ³MetroWest Medical Center, Framingham, MA**INTRODUCTION:** Intra-abdominal tumor and peritoneal resection combined with cytoreductive hyperthermic intraperitoneal chemotherapy (HIPEC) is often a prolonged procedure. We conducted this study to determine a possible influence of intraoperative anesthetic and fluid management on postoperative complications and outcomes.**METHODS:** Following IRB approval we reviewed the medical records of patients undergoing HIPEC 2 years following implementation this oncologic surgical program. Data collection included demographics, intraoperative fluid administration, postoperative complications and outcome parameters. Patients with postoperative complications (PC) were compared to those without (NC) using the Chi-square, Fisher's exact and Wilcoxon tests. Data are presented as means \pm SD, a $p < 0.05$ was significant.**RESULTS:** 34 patients (12M, 22 F) were identified with a mean age of 53 \pm 11.5 years. All received balanced general anesthesia using sevo - or isoflurane in air plus a thoracic epidural catheter, invasive arterial and central venous pressure monitoring and planned postoperative ventilation. Diagnosis, not different between groups, were: pseudomyxoma peritonei (n= 5), appendiceal cancer (n=16), colonic adenocarcinoma (n= 7), ovarian cancer (n= 3), and miscellaneous cancer (n=3). Postoperative complications occurred in 16 patients(47%), 12 (35%) of whom had 1 or more pulmonary complications including pulmonary edema/respiratory distress (n=4), pneumonia (n=7), pleural effusion (n=4) and pneumothorax (n = 4), requiring prolonged ventilation in 6 patients. Fluid management, operative variables and outcome parameters are summarized in Table I. Hourly and cumulative crystalloid administration and the proportion of patients receiving colloids was not different between groups.**DISCUSSION:** Patients undergoing HIPEC in a newly implemented surgical oncology program had a high postoperative complication rate, mostly pulmonary in origin, extending mechanical ventilation and significantly prolonging hospitalization. Intraoperative fluid replacement was not different between patients with and without complications. The finding of a significantly lower starting hematocrit in patients with postoperative complications needs further investigation. A larger prospective study is needed to determine intraoperative factors that may contribute to postoperative morbidity and identify those that could be may be modified or corrected.**REFERENCES:** None**Table 1. Patients without (NC) vs with complications (PC)**

| | NC | PC | p-value |
|--|------------------------|--------------------------|--------------|
| Age | 50 \pm 12 | 58 \pm 10 | 0.06 |
| OR Time (mins) | 558 \pm 200 | 618 \pm 120 | 0.1 |
| EBL (cc) | 431 \pm 345 | 762 \pm 781 | 0.83 |
| Max Intra Op Temp | 38 \pm 1 | 38.2 \pm 1 | 0.83 |
| Pre Op HCT (mg/dl) | 36 \pm 4.8 | 32 \pm 4.2 | 0.01 |
| Crystalloid cumulative (cc) | 11886 \pm 6470 | 13970 \pm 5680 | 0.23 |
| Crystalloid hourly (cc) | 1268 \pm 554 | 1348 \pm 472 | 0.4 |
| % patients receiving colloids | 61.1 | 62.5 | 0.9 |
| End CVP | 10 3 | 10 3 | 0.96 |
| Days intubated (range) | 1.5 \pm 0.6 (1 - 3) | 4.3 \pm 7.4 (1 - 31) | 0.27 |
| Length of hospital stay (range) | 8.4 \pm 2.5 (6 - 16) | 15.9 \pm 11.5 (7 - 42) | 0.006 |

The PC group had a significantly lower starting hematocrit and longer hospital stay. The difference in blood loss, crystalloid administration and age was not significant.

S-96.**IN VITRO EVALUATION OF LIDOCAINE RELEASE THROUGH POLYURETHANE ETT CUFF**

AUTHORS: J. C. Estebe,^{1,2} M. Treggiari¹, S. Deem,¹ F. Chevanne,² P. Le Corre²

AFFILIATION: ¹Department of Anesthesiology and Pain Treatment, Seattle, WA; ²University of Rennes1, Rennes, France

INTRODUCTION: Awareness of the endotracheal tube (ETT) at emergence from anesthesia or in the ICU can be associated with pain and anxiety. Previous studies suggested that intracuff lidocaine (L) might enhance tolerability of the ETT,¹ and that alkalinizing the L solution can potentiate its action.² The effect of cuff inflation with a mixture of L and bicarbonate (B) has not been evaluated in newly designed polyurethane (PU) ETTs. In a pre-clinical study, we evaluated the in vitro kinetics and safety of PU cuff ETT inflation with LB solutions

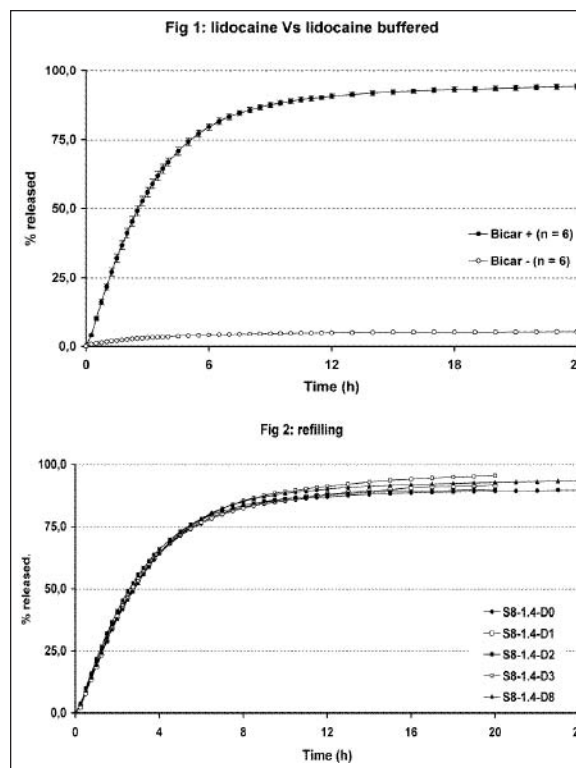
METHODS: PU cuff ETTs (Kimberly Corp) were inflated using different B concentrations in L solution. Release of L from ETT cuffs was performed using a dissolution system.³ The L concentration was measured continuously. Each ETT cuff was tested in only one experiment. We determined, at various concentration of B (1.4 to 8.4%), the required volume to obtain pH of 7.4 with 1% L (pH 4.8). We compared the release of L after cuff inflation with 40mg of 1% L with or without B (n=6). A dose ranging study with various volumes of 1.4% B (n=3) was performed. Using the same ETT, we compared the release profile at day 0 to 3, and 8, with the cuff emptied and refilled with the same concentration solution every 24hrs or 120hrs) using the same ETT (n=6). To compare the release profiles we used mathematical models used by registration authorities.⁴

RESULTS: To achieve a pH of 7.4, 2mL of 1.4% B, 0.8mL of 4.2%, and 0.4mL of 8.4% were needed to be added to 4 mL of 1% L. With L alone, we observed low trans-cuff diffusion (<8%/24hrs), while the LB solution had high diffusion (>90%/24hrs, Fig 1). There were not appreciable differences in the LB release profiles using 1.4% B volumes of 2, 3, or 4mL. When an LB solution (4mL of 1% L and 2mL of 1.4% B) was re-injected daily into the same cuff, the LB release profiles were similar from day 0 through day 8 (Fig 2). There were no instances of cuff rupture over the 8-day study period

DISCUSSION: The safety of the procedure was confirmed by the lack of rupture of the thin PU cuff membrane in all in vitro experiments. Due to the achievement of a physiological pH (7.4) and the small dose of L used (40mg), this solution should be safe also in case of unexpected rupture. While plain L displayed very low diffusion, L-B allowed 90% release over 24hrs. Repeated cuff injections with the same solution showed similar release profiles. These findings confirmed previous in vitro studies using PVC cuffed ETT

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1. Review Cochrane database Syst Rev; Jul 8 (3); CD004081; 2009.
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S-97.**ADMINISTRATION OF ANTI-THROMBIN3 IN CONJUNCTION WITH DANAPAROID IMPROVES NERVE CONDUCTION DETERIORATION IN THE PERIPHERAL NERVES OF RATS ADMINISTERED WITH LPS OVER A PERIOD OF 48HRS****AUTHORS:** H. Hino,¹ A. Miura,² M. Shin,¹ W. Kon,¹ T. Tateda¹**AFFILIATION:** ¹Department of Anesthesiology, St.Marianna Univ. School of Medicine, Kawasaki, Japan; ²Department of Anesthesia, Tohmei Atsugi General Hospital, Atsugishi, Japan

INTRODUCTION: Although peripheral nerve disorders are associated with sepsis, the pathogenic mechanisms involved have yet to be clarified. We previously reported that lipopolysaccharide (LPS) caused a reduction of amplitude evoked by stimulation, along with reduced nerve blood flow. We also demonstrated that danaparoid sodium (DS), an anticoagulant and anti-inflammatory agent, improves these phenomena. Since, earlier studies showed that low amplitude caused by LPS was improved by increased stimulus intensity, we speculated that the responsible mechanisms might include alteration of threshold. In the present study, we investigated whether LPS causes an increase in the threshold of action potentials within the sciatic nerve in rats administered with LPS over a period of 48hrs and investigated whether anti-thrombin3 (AT3) in conjunction with DS influenced this deterioration.

METHODS: 50 rats were divided randomly into 5-groups: a control group (C-group), a group administered with LPS (3mg/kg/day; L-group), a group administered with both LPS and 400 units of DS (LD-group), an LPS group administered with 500 Units of AT3 (LAT3-group), and a group administered with LPS and AT3 with DS (LDAT3-group). After 48hrs administration, nerve conduction studies were performed on the sciatic nerve and nerve blood flow (NBF) determined under mechanical ventilation. After the experiment, both sciatic nerves were removed and degeneration determined by electro-microscopy.

RESULTS: It was evident that severe reductions in NBF were more pronounced in the L-group than in the C-group. Electrophysiological analysis showed that LPS did not affect absolute refractory period, but rheobase ($p < 0.001$, vs C). Electro-microscopy failed to detect degeneration in the sciatic nerve of any group after 48hrs LPS exposure. Administration of DS, and AT3 with DS, successfully resulted in a return to normal rheobase values (C: 0.35 ± 0.07 , LDAT3: 0.41 ± 0.17 . vs. L: 1.29 ± 0.66 mA, $p < 0.05$).

DISCUSSION: The increase of rheobase without electro-microscopic degeneration implied that alteration of threshold, rather than degenerative changes, might develop in peripheral nerve tissue in the early phases of sepsis. This suggests the possibility that these factors are likely to be associated with peripheral nerve disorders such as critical illness polyneuropathy. Furthermore, since the combined effect of DS and AT3 resulted in clinical improvement, our data suggests the involvement of mechanisms of hitherto unknown etiology involving the inhibition of embryonic sodium channel development.¹

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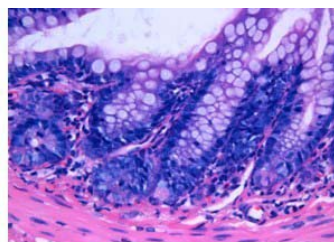
S-98.**ROLE OF 15-F2t-ISOPROSTANE IN INTESTINAL INJURY INDUCED BY INTESTINAL ISCHEMIA/ REPERFUSION IN RATS****AUTHORS:** K. Liu, S. Wen, Y. Li, Y. Li, C. Li, X. Zhang**AFFILIATION:** Department of Anesthesiology, The First Affiliated Hospital, Sun Yat-sen University, Guangzhou, China**INTRODUCTION:** It was demonstrated that 15-F2t-Isoprostane(15-F2t-IsoP) could reflect the degree of oxidative stress and confer deleterious effects via activating thromboxane A₂(TXA₂) receptor.¹⁻⁴ The present study aimed to investigate the role of 15-F2t-IsoP in intestinal injury induced by intestinal ischemia/reperfusion(I/R) in rats.**METHODS:** The study was approved by the Animal Care Committee of Sun Yat-sen University(China). 32 healthy male SD rats weighing 230~255g were randomly divided into 4 groups(n=8 each):(i)sham operation(group S); (ii)intestinal I/R(group I/R); (iii) TXA₂ receptor antagonist SQ-29548+I/R(group SQ); (iv)dimethyl sulfoxide(DMSO)+I/R(group DMSO). In group I/R, superior mesenteric artery(SMA)was occluded for 60 min followed by 120 min reperfusion. In group S, SMA was just isolated but not occluded. In group SQ and group DMSO,SQ-29548 and DMSO 2μmol/kg were injected into lateral abdominal subcutaneous at 30 min before intestinal ischemia, and the rest procedures were performed using the method described in group I/R. Rats were killed at 120 min of reperfusion. The intestinal tissues were removed for determination of myeloperoxidase (MPO) and superoxide dismutase (SOD) activities, malondialdehyde (MDA) and lactic acid (LD)content and the degree of damage to intestinal mucous was scored according to Chiu's score. Arterial blood samples were also taken for determination of plasma diamine oxidase (DAO) activity and concentrations of 15-F2t-IsoP, ET-1 and TXB₂.**RESULTS:** Compared with group S, Chiu's score, DAO activity, and plasma concentrations of 15-F2t-IsoP and TXB₂ in the other 3 groups were significantly increased(P<0.05). Meantime, content of LD, MDA and MPO activity, plasma concentration of ET-1 were significantly increased, whereas SOD activity decreased in group I/R and group DMSO compared with group S. Chiu's score, LD content, DAO and MPO activities, and plasma concentration of ET-1 were significantly lower, whereas SOD activity higher in group SQ than in group I/R and group DMSO(P<0.05). No significant differences were detected in the content of MDA and 15-F2t-IsoP between group SQ and group I/R and group DMSO(P<0.05). No significant differences were found between group I/R and group DMSO(P>0.05). 15-F2t-IsoP concentration was positively correlated with Chiu's score, ET-1 and TXB₂ concentrations(P<0.05).**DISCUSSION:** 15-F2t-IsoP could exacerbate intestinal injury induced by intestinal I/R in rats via activating TXA₂ receptor, and TXA₂ receptor antagonist SQ-29548 can attenuate the deleterious effects of 15-F2t-IsoP.**REFERENCES:**

1. Antioxid Redox Signal,2008,10:1405-34.
2. Circulation,2000,101:2833-40
3. FASEB J,2005,19:443-5.
4. Am J Physiol Heart Circ Physiol,2005,289:H1366-72

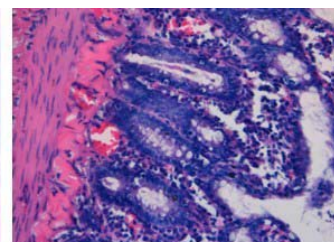
The Chiu's score, MPO , DAO and SOD activites and LD, MDA, 15-F2t-IsoP,ET-1 and TXB₂ levels in intestinal mucosa and plasma

| Groups | Chiu's score | MPO(U/mg) | DAO(U/L) | SOD(U/mg) | LD(nmol/mg) | MDA(nmol/mg) | 15-F2t-IsoP(pg/ml) | ET-1(pg/ml) | TXB ₂ (pg/ml) |
|--------|--------------|--------------|------------|-------------|-------------|--------------|--------------------|-------------|--------------------------|
| S | 0.15±0.23 | 0.71±0.13 | 0.9±0.4 | 98.7±23.1 | 1.33±0.24 | 9.9±1.7 | 208.7±56.4 | 52.4±10.7 | 56.9±9.6 |
| I/R | 3.40±0.60a | 1.07±0.29a | 3.6±0.8a | 48.7±22.2a | 1.78±0.59a | 15.5±5.4a | 394.1±115.1a | 86.0±8.9a | 73.3±8.9a |
| SQ | 2.69±0.76abc | 0.41±0.28abc | 1.6±0.5abc | 94.9±17.2bc | 1.26±0.26bc | 13.3±3.7 | 329.1±111.7a | 61.2±15.9bc | 69.4±11.3a |
| DMSO | 3.45±0.64a | 1.02±0.23a | 3.0±0.6a | 45.6±33.0a | 1.79±0.25a | 14.2±4.9a | 383.3±86.1a | 81.9±14.7a | 71.4±8.1a |

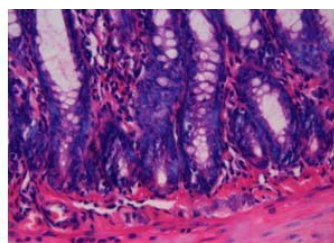
Date are mean±SD;n=8. aP<0.05 VS the S group; bP<0.05 VS the I/R group; cP<0.05 VS the DMSO group



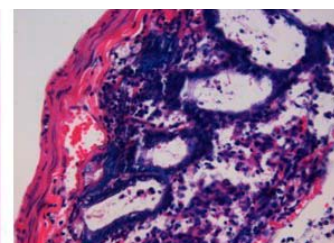
Group S



Group I/R



Group SQ



Group DMSO

S-100.**TRAUMATIC CRICOID CARTILAGE FRACTURE****AUTHORS:** C. Pena, J. Wasnick**AFFILIATION:** Texas Tech University Health Sciences Center, Lubbock, TX**INTRODUCTION:** Although rare, laryngeal fractures may lead to life-threatening airway compromise. Laryngeal trauma is often the result of a motor vehicle accident or clothesline injury, with less than 50% resulting in cricoid injury. Historically, laryngeal trauma resulting in a detectable fracture was managed by emergent tracheostomy.**METHODS:** NA

Challenging Case Report (only complete if your submission falls into the “Challenging Case Report” category. If you select the “Challenging Case Report” category on the next step, this section must be completed.): A 23-year-old male presented to the emergency department within hours of suffering direct blunt trauma to the anterior aspect of his neck. The patient was pitching a softball game when struck by the ball. He denied loss of consciousness, reporting immediate pain and minimal shortness of breath. He admitted mild odynophagia and hoarseness. On physical exam, patient was negative for stridor, in no acute distress, and saturating 100% on room air. Anterior neck was observed to be erythematous, inferior to the mandible, at the site of impact; however, full range of motion was maintained and minimal tenderness noted. CT scan of the neck demonstrated a displaced fracture of the cricoid ring posteriorly, with the fracture fragment abutting the subglottic airway. Air loculi were visualized in the prevertebral space from the C2 to T1 level, as well as, around the cervical esophagus at the level of the thoracic inlet (Fig). Patient was admitted to the surgical ICU for close monitoring of his respiratory status with plans to perform fiberoptic laryngoscopy and esophogram on the following morning. Glucocorticoids and prophylactic antibiotics were administered, and patient was placed on humidification with elevation of the head of the bed. Flexible fiberoptic exam was performed at the bedside revealing mobile, but misaligned true vocal cords, suggesting cricoarytenoid dislocation. The decision was made to perform microdirect laryngoscopy with closed reduction of the cricoid fracture endoscopically through the endolarynx. Patient was taken to the OR, spontaneously ventilating, approximately 12 hours after injury. Airway was maintained with mask ventilation following intravenous induction. Procedure was well tolerated and patient returned to the SICU on nasal canula. He was discharged home on hospital day 3.

RESULTS: NA

DISCUSSION: Here is presented a case of evident cricoid fracture following blunt neck trauma. Traditional algorithms indicate such a fracture would suggest impending airway obstruction requiring a surgical airway. Our patient presented with hoarseness, odynophagia, and laryngeal fracture; however, he was successfully managed by closed reduction under fiberoptic visualization. Avoiding a tracheostomy allowed for the patient to be discharged on hospital day 3.

REFERENCES:

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S-101.**ALTERATIONS IN TISSUE OXYGENATION AND METABOLIC VARIABLES DURING ACUTE CYANIDE TOXICITY IN PIGLETS****AUTHORS:** D. S. Beebe, J. Srikanthan, H. Singh, S. Patterson, K. Belani**AFFILIATION:** University of Minnesota, Minneapolis, MN

INTRODUCTION: Cyanide (CN) toxicity has been reported following smoke inhalation, industrial accidents, sodium nitroprusside overdose and could potentially occur as an act of bioterrorism. In this study, we describe the changes in tissue oxygenation and metabolic variables during acutely induced CN toxicity in a young pig model. For the first time we report on brain and skeletal muscle regional saturation of oxygen by using a non-invasive externally applied regional oximetry system (Nonin Medical Inc, Plymouth, MN). This utilizes near infrared spectroscopy to measure the balance of oxygenated and deoxygenated hemoglobin in the cerebral cortex and skeletal muscle.

METHODS: Twenty six piglets (19-29 kg) were anesthetized, allowed to spontaneously breathe via an endotracheal tube and were percutaneously cannulated (arterial and pulmonary artery catheters). In addition to standard metabolic and hemodynamic measurements, we determined the regional brain O₂ (cerebral cortex) and skeletal muscle O₂ saturation (rSO₂). These were measured via sensors placed on the forehead and the deltoid muscle. After obtaining baseline control data, all animals were started on an infusion of NaCN (0.55 mg/kg/hr). The infusion continued until the occurrence of sustained apnea (≥ 3 minutes). Scatter plots were made of all the data points and the cubic spline trend lines were provided. Significance was determined by ANOVA for repeated measures or by using the generalized estimating equation with a compound symmetric correlation structure within each pig. Where relevant, Pearson correlations between two variables were calculated.

Challenging Case Report (only complete if your submission falls into the "Challenging Case Report" category. If you select the "Challenging Case Report" category on the next step, this section must be completed.): N/A

RESULTS: CN infusion resulted in a progressive increase in the blood CN from 0.155 ± 0.364 to 2.432 ± 0.714 mg/L ($p < 0.0001$) 60 minutes after beginning the infusion. The serum lactate level increased from 0.807 ± 0.336 to 4.44 ± 1.61 mmol/L ($p < 0.0001$) over the same time period resulting in lactic acidosis. Skeletal muscle rSO₂ progressively and significantly decreased throughout the experiment. The decrease in rSO₂ correlated significantly with increase in serum lactate levels. There was no significant change in brain rSO₂, however (figure).

DISCUSSION: For the first time we have shown that during CN toxicity there are peripheral skeletal muscle oxygenation changes detectable by a non-invasive regional oximetry system as demonstrated by the significant decline in skeletal muscle rSO₂. Surprisingly, the brain rSO₂ did not follow the same pattern as did skeletal muscle. This may be due to protective mechanisms aimed at delaying toxic manifestations in the brain and deserves further elucidation.

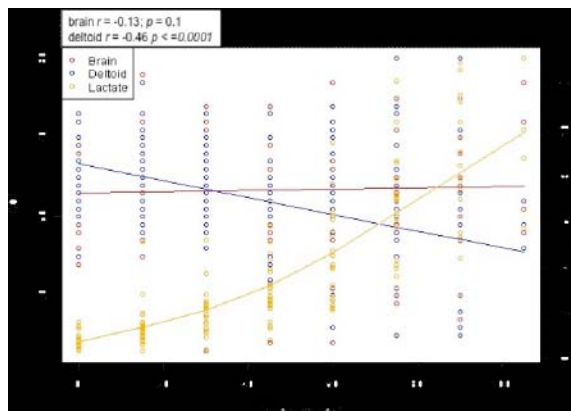
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Figure: Lactic acidemia secondary to cyanide toxicity resulted in progressive decline in skeletal muscle oxygen saturation. The brain oxygen saturation remained steady.

Economics

S-102.**TIME IMPACT OF PREOPERATIVE EVALUATION SOFTWARE ON PEDIATRIC PREOPERATIVE CLINIC WORKFLOW**

AUTHORS: B. Kadry,^{1,2} W. W. Feaster,^{2,1} B. Wagner,² B. Kadry,³ A. Macario^{1,2}

AFFILIATION: ¹Stanford University Medical Center, Stanford, CA; ²Lucile Packard Children's Hospital, Stanford, CA; ³Wayne State University-Eugene Applebaum College of Pharmacy, Detroit, MI

INTRODUCTION: Despite the advancements in electronic medical records (EMRs), many facilities continue to record preoperative anesthesia evaluations on paper. The goal of this study was to prospectively measure the impact of a customized preoperative software tool—Cerner PowerForm (part of the Cerner Millennium Powerchart EMR)—on the time required to complete a preoperative anesthesia evaluation of a pediatric patient. We compared the time required to complete an initial evaluation to that required to complete subsequent evaluations on the same patient for repeat surgery. Lucile Packard Children's Hospital (LPCH), affiliated with Stanford University, is a 300-bed, tertiary women's and children's hospital with the fourth-highest case-mix index of 82 US children's hospitals. Because of the acuity and complexity of patients that present for surgery, LPCH established a preoperative clinic, staffed by nurse practitioners (NPs) who collect and evaluate clinical data on patients prior to surgery. NPs review the EMR, place phone calls to caregivers; conduct patient visits; and obtain pertinent collateral information from outside institutions. Before LPCH had the Cerner EMR software, NPs manually transcribed information they obtained onto a preoperative evaluation paper form. Comparison data on the time required to document an equivalent evaluation on paper forms was not available at the time this abstract was submitted.

METHODS: After obtaining IRB approval, we used the custom-designed Cerner Millennium PowerForm to create 465 electronic, preoperative histories on 392 patients. Each chart evaluation was time-stamped twice, once at the beginning of the evaluation and again at its completion. We identified repeat patients and recorded the amount of time required to complete the subsequent evaluations.

RESULTS: (See Table 1 & Figure 1)

DISCUSSION: EMR software that can extract clinical data of interest and automatically populate a preoperative evaluation form saves time and reduces time variability of evaluation. This type of software may be most useful for institutions, like LPCH, which have a high-acuity case mix. The initial evaluation was the most time-consuming one, but once the data were stored in the EMR, subsequent evaluations were quicker. We compared the times for initial and second visits. We had an insufficient number of patients making a third or fourth visit to the preoperative clinic to be able to compare their times and draw conclusions. However, the duration of the third and fourth visits was less than or equal to that of the second visit.

REFERENCES: N/A

Table 1: Time Duration of Evaluation based on "Visit" Number

| Patient "Visit" Number | Average Time (Minutes) |
|------------------------|-------------------------------|
| 1 | 11 (SD 3.1, Range 1-7, n=393) |
| 2 | 5 (SD 2.4, Range 1-23, n=64) |
| 3 | 5 (SD 2.1, Range 1-10, n=6) |
| 4 | 2.5 (2, 3, n=2) |

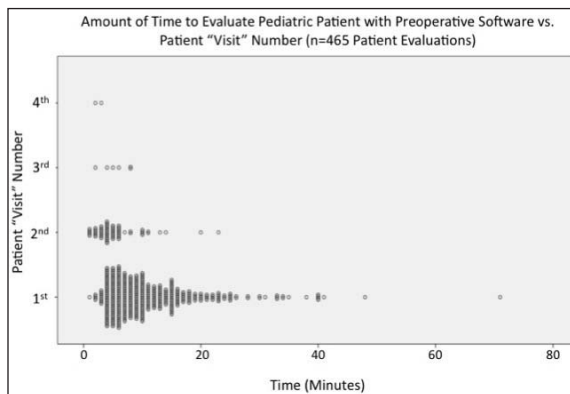


Figure 1: Time (Minutes) to evaluate patient vs "Visit Number." Each dot represents a patient evaluation.

S-103.

STUDY OF 4999 ONLINE PHYSICIAN REVIEWS SHOWS THAT MOST PATIENTS GIVE PHYSICIANS FAVORABLE RATINGS

AUTHORS: B. Kadry,^{1,2} D. Gammas,⁴ B. Kadry,³ L. Chul,²
A. Macario¹²

AFFILIATION: ¹Stanford University Medical Center, Stanford, CA; ²Lucile Packard Children's Hospital, Stanford, CA; ³Wayne State University-Eugene Applebaum College of Pharmacy, Detroit, MI; ⁴Creighton University School of Pharmacy, Omaha, NE

INTRODUCTION: According to a Harris Poll published in August 2010, 88% of Americans have used the Internet to search for health related information¹. Patient choice of care will likely become influenced by Internet searches as more content becomes available and more people use the Internet to search for health related issues. The search not only includes information about diseases but also providers. Many online physician review sites provide patients with information about physicians and allow patients to give feedback to share with the public. The goals of this study were to 1) determine the most frequently visited physician review websites; 2) evaluate the content characteristics of these websites and how patients rate their physicians; 3) measure the ratings of 4999 physicians to see a breakdown of how physicians are rated online.

Methods: Using Google Trends on October 1st, 2010 (<http://www.google.com/trends>) the most frequently visited online physician review sites were identified. Each site was then analyzed to determine types of scales (e.g., 1-5, 1-4, 1-100) and dimensions of care rated (e.g., recommend to a friend, waiting room time, etc). It took 85 days (October 1st to December 21st, 2010) to record data on 4999 online physician reviews without identifiers and the data was subsequently analyzed.

RESULTS: The most commonly visited websites were: HealthGrades.com, Vitals.com, Yelp.com, YP.com, RevolutionHealth.com, RateMD.com, Angieslist.com, Checkbook.org, Kudzu.com, ZocDoc.com, and UcompareHealthcare.com. These websites had different methods and content to evaluate physicians (Table1). 63% of online users rated physicians above the 70th percentile. (Figure 1) There was a high correlation (Pearson Correlation 0.73, $P < 0.001$) between the different care dimension ratings and the single overall rating about the physician.

DISCUSSION: The majority of physician review websites depend on subjective data input and offer limited information about quality and cost of care. Despite these limitations, physician review websites provide insight to the “patient experience”. An overall rating of a physician is adequate enough to assess the multiple dimensions of care. However, more development is needed to provide patients with more meaningful information about physicians.

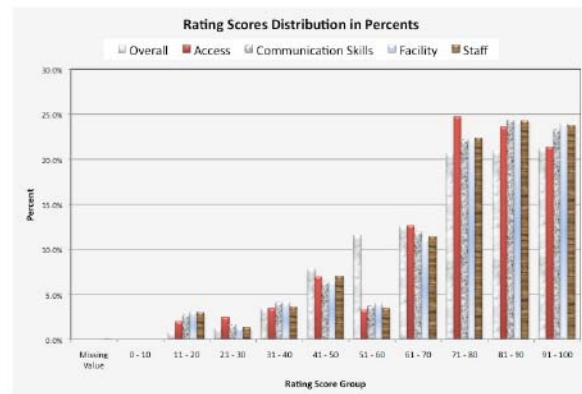
REFERENCES:

1. Taylor, H. "Cyberchondriacs" on the Rise? Those who go online for healthcare information continues to increase. The Harris Poll #95. August 4th, 2010. Harris Interactive.

Table 1: Content Characteristics of 28 Physician Review Websites

[illegible]

Figure 1: Breakdown of Online Physician Ratings



S-104.**FEASIBILITY OF USING A WEB-BASED PATIENT PORTAL TO DIRECTLY ELICIT A COMPREHENSIVE MEDICAL HISTORY FROM VETERANS****AUTHORS:** A. Walia^{1,2}, R. Sierra-Anderson,^{1,2} A. Robertson^{1,2}**AFFILIATION:** ¹Tennessee Valley Healthcare System, VHA, Nashville, TN; ²Vanderbilt University, Nashville, TN**INTRODUCTION:** A comprehensive medical history is required for perioperative risk assessment. Conventional in-person evaluations are labor intensive and inconvenient for patients. A web-based patient portal can facilitate patient triage by remotely eliciting medical information directly from patients. In this study we demonstrated that such a portal can be used by Veterans to accurately communicate relevant information for perioperative risk stratification.**METHODS:** This pilot study was supported by a VHA Greenfield Innovation Grant. The study was designed in accordance with the grant guidelines provided by the funding agency. Using TVHS Veteran volunteers and employees, we evaluated web-based preoperative assessment software, BREEZETM (MedSleuth, Inc.), to assess its accuracy and usability. To establish accuracy a traditional in-person assessment was also completed by a BC anesthesiologist. To account for potential order bias, half the volunteers completed the web-based questionnaire prior to in-person evaluation and vice versa. Both evaluations were then compared to the in-person assessment (gold standard) for accuracy and graded by 2 independent BC anesthesiologists on a 5 point 2-sided scale (5=90-100%, 4=85-90%, 3=80-85%, 2=75-80%, and 1= >75% accuracy). Descriptive statistical analysis and parametric tests (JMP 7.02 SAS Institute) were used when appropriate.**RESULTS:** 30 volunteers (7 f, 23 m) participated in this study (avg age=53±11 years; avg BMI=30±4). 80% of volunteers were able to complete the survey without assistance (n=24, median time to complete=20 min). 75% of volunteers expressed high satisfaction with the web-based assessment tool. Accuracy scores for both reviewing anesthesiologists were identical (Mean± SEM 4.6±0.1; P>0.05). Aggregate evaluation scores of ≥4 were 96.8%. Evaluation scores between reviewers differed in only 30% of volunteers (n=9). Accuracy was not skewed in favor of the in-person interview and missing information was identified in both groups, none of which was considered significant. Assignment of ASA Class I-IV demonstrated excellent concordance between both groups.**DISCUSSION:** This feasibility study has shown that Veterans are capable of independently interacting with a web-based patient portal. This novel method for eliciting a medical history is well accepted, enjoys high usability, delivers an accurate output, and can serve as an effective triage tool for Veterans. Results from this pilot study are similar to data previously reported at a major academic center**REFERENCES:**

1. Abstract 1431, American Society of Anesthesiologists, Annual Meeting, San Diego 2010.

S-105.**DISTRIBUTION OF END-MINUTE DIGITS IN ANESTHESIA BILLING TIMES IN HUMAN VERSUS COMPUTER-BASED RECORD SYSTEMS****AUTHORS:** P. Tighe, L. G. Deal, M. Nyland, N. Gravenstein**AFFILIATION:** University of Florida, Gainesville, FL

INTRODUCTION: Anesthesia time units are segmented at 15-minute intervals, and CMS has explicitly declared that time units are to be rounded to only one decimal place. (1) Suspecting common innocent rounding of times to the nearest 0 or 5, we investigated the distribution of end-minute digits in anesthesia billing times in both human and computer-based anesthesia records.

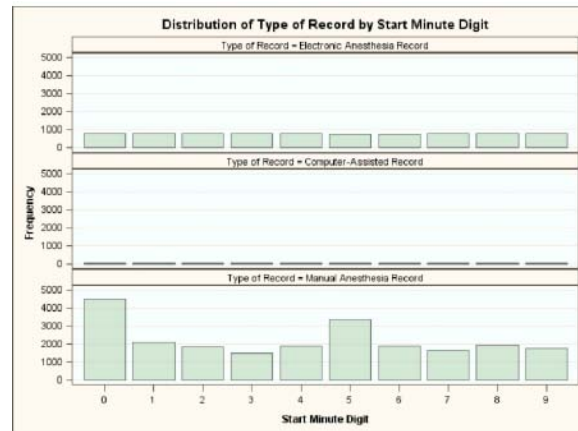
METHODS: This study was a cross-sectional review conducted on billing records from January 2009 through March 2010. The start minute digit (SMD) and end minute digit (EMD) for each time were extracted from each record. We limited the data set to cases beginning after 09:00 and before midnight to avoid artifact from first-start cases. The distributions of SMD and EMD were tested against the null hypothesis of an equivalent distribution pattern using a modified chi square test.

RESULTS: A total of 30,738 cases were included in the analysis. Seventy-three percent of cases were charted using the manual anesthesia record (MAR), 26% with the electronic anesthesia record (EAR), and 2% using computer-assisted anesthesia record (CAR). Differences between recorded and the expected equivalent distribution were noted for MAR ($p < 0.0001$) and CAR ($p < 0.0001$) charting in both SMD and EMD. However, no difference was observed between recorded and expected equivalent SMD ($p < 0.98$) or EMD ($p < 0.55$) distributions in the electronic anesthesia record (EAR) group. (Figure 1 and 2)

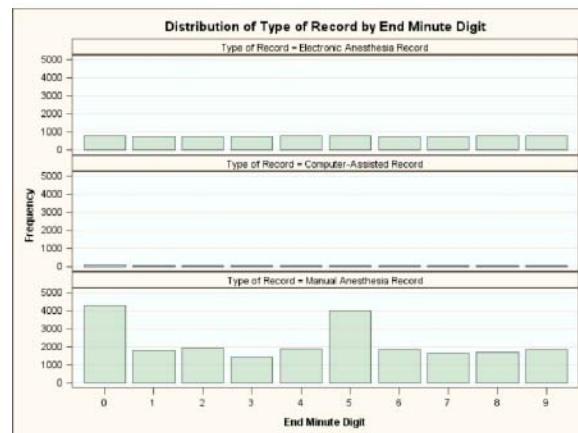
DISCUSSION: Our results suggest that an electronic anesthesia record system, with automated time capture of events verified by the user, produces a more equal distribution of billing times compared with more traditional methods of entering billing times. Computerized anesthetic record systems without automated mechanisms for documenting start and end times are similarly subject to rounding disequilibrium as are manual anesthetic records. Such rounding may occur even in the absence of financial incentives for artificially-inflated anesthesia times.

REFERENCES:

1. Medicare Claims Processing Manual. Chapter 12, Section 50. Centers for Medicare and Medicaid Services. Accessed January 11, 2010.



Distribution of Start Minute Digit by Different Types of Anesthesia Record Systems.



Distribution of End Minute Digit by Different Types of Anesthesia Record Systems.

S-106.**COMPARISON OF ALPHABETICAL VERSUS CATEGORICAL DISPLAY FORMAT FOR MEDICATION ORDER ENTRY IN A SIMULATED ANESTHESIA INFORMATION MANAGEMENT SYSTEM****AUTHORS:** A. Marian, F. Dexter, M. Todd, P. Tucker**AFFILIATION:** University of Iowa Hospitals & Clinics, Iowa City, IA**INTRODUCTION:** Anesthesia information management system (AIMS) records should be designed and configured to facilitate the accurate and prompt recording of multiple drugs administered coincidentally.**METHODS:** We proposed two display formats for use with our department's new EPIC AIMS, alphabetical versus categorical. Both were modeled on iPad® screens. Anesthesia residents, anesthesiologists, and Certified Registered Nurse Anesthetists selected and entered lists of different medications into mock anesthesia records in six experiments each lasting two minutes. Data were analyzed from the third trials with each template to represent learning.**RESULTS:** The categorical templates had mean 5.6 more drugs entered than the alphabetical (95% confidence interval [CI] 4.5 to 6.8, $P < 0.0001$). The finding held for the group first having trials with the alphabetical template ($N = 30$), averaging 6.0 more drugs entered by category (95% CI 4.2 to 7.7, $P < 0.0001$), as well as the group using the categorical template first, averaging 5.3 more drugs entered by category (95% CI 3.8 to 6.8, $P < 0.0001$). More drugs were entered with the categorical template regardless of years of clinical experience: < 1 year mean 6.1 more ($N = 20$, $P < 0.0001$), 1-3 years mean 5.8 more ($N = 20$, $P < 0.0001$), and 4+ yr mean 5.0 more ($N = 20$, $P < 0.0001$). Most anesthesia providers made no (0) errors for most trials ($N=96/120$ trials, lower 95% limit 73%, $P < 0.0001$). There was no difference in error rates between alphabetical and categorical templates ($P = 0.53$), including at the first trial with each format ($P = 0.54$).**Discussion:** Arrangement of drugs in a categorical display format in the medication order-entry screen of an AIMS can result in faster data entry compared to an alphabetical arrangement of drugs. Results of this quality improvement project were used in our department's design of our EPIC Intraoperative Anesthesia Record.**REFERENCES:**

1. Magrabi F, Li SY, Day RO, Colera E. Errors and electronic prescribing: a controlled laboratory study to examine task complexity and interruption effects. *J Am Med Inform Assoc* 2010;17:575-83

| Trial | | | |
|-----------|------------------|-------------------------|------------|
| A - C | D - H | I - O | P - Z |
| Midazolam | Penicillin GK | Ropivacaine 0.5% | Vecuronium |
| Fentanyl | Phentolamine | Ropivacaine 0.75% | Verapamil |
| Lidocaine | Phenylephrine | Sodium Bicarbonate 4.2% | |
| | Procainamide | Sodium Bicarbonate 7.5% | |
| | Propofol | Succinylcholine | |
| | Protamine | Tetracaine | |
| | Remifentanyl | Thiopental | |
| | Rocuronium | Tranexamic Acid | |
| | Ropivacaine 0.2% | Vancomycin | |

Alphabetical Template

| Trial | | | |
|------------------|-----------------------|--------------------|-----------------|
| Common | Fluids & Electrolytes | Cardiovascular | Coagulation |
| Fentanyl | Lidocaine | Alfentanil | Succinylcholine |
| Phenylephrine | Midazolam | Fentanyl | Coarctacurium |
| Lactated Ringers | Midazolam PO | Hydromorphone | Rocuronium |
| | Propofol | Morphine | Vecuronium |
| | Etomidate | Meprobamate | Neostigmine |
| | Ketamine | Remifentanyl | Atropine |
| | Thiopental | Naloxone | Diprimary |
| | Phenylephrine | Acetaminophen - PR | Dexamethasone |
| | Ephedrine | Ketorolac | Ondansetron |

Categorical Template

S-107.**A NEW ARMS RACE? COMPETITION AND QUALITY IN CONTEMPORARY HEALTHCARE MARKETS****AUTHORS:** J. Woo, B. Dauber, A. Tung, D. Glick**AFFILIATION:** University of Chicago, Chicago, IL

INTRODUCTION: The growing cost of healthcare has focused attention on how pricing is determined in hospital markets. Previous studies suggested that hospitals compete on qualitative (not cost) grounds, this “medical arms race” theory suggests that costs are driven up to pay for increasing quality in competing hospitals [1]. This study examined the correlation between quantitative metrics for quality and the price of medical and surgical diagnoses.

METHODS: Two surgical (heart valve replacement and cholecystectomy) and two medical (heart failure and acute MI) diagnoses were studied. Medicare reimbursement data, mortality rate, and complication rate were obtained from the Medicare database (www.medicare.gov/download/downloaddb.asp). Quality data specific to each procedure were obtained from Blue Cross Blue Shield (BCBS, www.bcbsil.com). The quality metrics for AMI were: mortality, complications, ACE inhibitor for LVSD, smoking cessation advice, aspirin at arrival and discharge, beta blocker at discharge, PTCA within 90 minutes of arrival, and fibrinolytic therapy within 30 minutes of arrival. Metrics for heart failure were: mortality, complications, ACE inhibitor for LVSD, smoking cessation advice, assessment of LV function, and discharge instructions. Metrics for cholecystectomy were: complications, appropriate antibiotics (three metrics), DVT prophylaxis (two metrics), and safe hair removal. Metrics for heart valve replacement were: mortality, complications, appropriate antibiotics (three metrics), DVT prophylaxis (two metrics), and blood sugar control.

Hospitals that had 10 or more admissions a year for a given diagnosis were assigned a score of +1 (top 25% in performance), 0 (middle 50%) or -1 (bottom 25%) for each quality metric. Statistical analysis was completed in Microsoft Excel 2007.

RESULTS: The numbers of hospitals for each diagnosis were: heart valve replacement (653), gallbladder removal (1914), treatment for heart failure (651), and treatment for AMI (1898). Correlations were deemed statistically significant if $p < 0.001$. Heart valve replacement demonstrated the strongest correlation between quality and price with seven metrics correlating positively with Medicare reimbursement. The remaining three procedures demonstrated little or no correlation. AMI treatment showed negative correlations between three quality metrics and reimbursement, indicating increasing price with decreasing quality [Table 1].

DISCUSSION: While the arms race theory suggests that price increases to fund an increase in quality, data from this study show that quantitative quality metrics display little correlation with cost especially for procedures that are not elective.

REFERENCES:

1. Health Serv Res. 2001; 36: 191.

S-108.**COMPETITION AND REIMBURSEMENT RATES FOR MEDICAL AND SURGICAL DIAGNOSES****AUTHORS:** J. Woo, B. Dauber, A. Tung, D. Glick**AFFILIATION:** University of Chicago, Chicago, IL

INTRODUCTION: We have shown elsewhere that Medicare reimbursement (a proxy for cost) varies with competition. The purpose of this study was to determine if the relationship is linear or if there are variations in the degree to which competition and price are related.

METHODS: Two medical (heart failure and acute MI) and two surgical (heart valve replacement and cholecystectomy) diagnoses were chosen for study. Medicare reimbursement and hospital provider numbers were obtained from the Medicare database (www.medicare.gov/download/downloaddb.asp), while the degree of competition was derived from Blue Cross Blue Shield (www.bcbsil.com). The degree of competition was defined as the number of other hospitals treating the diagnosis within a 20-mile radius of the index hospital. Only hospitals which had 10 or more admissions for a given diagnosis were considered. Hospitals were separated into quartiles. All statistical data were calculated using Microsoft Excel 2007.

RESULTS: The numbers of hospitals studied for each diagnosis were: heart valve replacement (653), gallbladder removal (1914), heart failure (651), and AMI (1898). Medicare reimbursement increased with each quartile [Table 1]. The cost increment between the third and fourth quartiles (the quartiles with the greatest level of competition) showed the greatest increase. This was true for all four diagnoses.

DISCUSSION: Data from this study suggest that although competition plays a role in hospital costs, the larger cost increment between the third and fourth quartiles suggests that hospitals in the fourth quartile are more expensive for additional reasons. This effect was greatest for emergent diagnoses such as AMI. It is likely that competition had less effect on cost for this diagnosis since patients are simply sent to the nearest hospital for treatment. Other factors, such as hospital reputation, might play a greater role in pricing decisions in this situation. Along these lines, the fourth quartile had the greatest number of US News and World Report Top 50 hospitals for all four procedures.

REFERENCES: None

S-109.**THEATRE EFFICIENCY: USING MEAN DURATION AND VARIATION OF PROCEDURE TIMES TO PLAN A LIST OF SURGICAL OPERATIONS TO FIT INTO THE SCHEDULED LIST TIME****AUTHORS:** A. N. Tavare, J. J. Pandit**AFFILIATION:** Nuffield Department of Anaesthesia, John Radcliffe Hospital, University of Oxford, Oxford, United Kingdom**INTRODUCTION:** Operating theatres represent both one of the largest costs faced by hospitals and also one of the largest potential sources of income. It is important that a surgical list is planned to utilise as much of the scheduled time as possible, whilst not over-running (since this can lead to case cancellation). We wished to assess if, theoretically, the known duration of individual operations could be used quantitatively to predict the likely duration of the list.**METHODS:** In a large university tertiary referral centre within the UK's National Health Service (NHS) we first assessed the extent to which a current, ad hoc method of list planning was able to match the scheduled list times for 153 consecutive historic elective lists. Then using receiver operating curve analysis, we assessed the ability of an alternative method to predict list duration for these same lists. This method uses a simple formula (ie, the sum of individual operation times plus a pooled standard deviation of these times). We used the list duration estimated from this formula to generate a probability that the list would finish within its scheduled time. Finally, we applied the simple formula prospectively to 150 lists, 'shadowing' the current ad hoc method, to confirm the formula's predictive ability.**RESULTS:** The current ad hoc method was very poor at planning: 50% of historical lists were under-booked and 37% over-booked. By contrast the simple formula predicted the correct outcome (under- or over-run) for 76% of these lists according to receiver-operator curve analysis. The calculated probability that a planned series of cases will over- or under-run was found useful in developing an algorithm to adjust the planned cases optimally. In the prospective series of cases, 65% were over-booked and 10% of lists were under-booked; the formula similarly predicted the correct outcome for 84% of lists.**DISCUSSION:** A simple quantitative method of estimating list duration for a series of cases leads to an algorithm (readily creatable on an Excel spreadsheet) that can potentially improve list planning and prevent both over- and under-booking.**REFERENCES:** n/a**S-110.****PREFERENCES OF HIGH AND LOW ANXIETY PATIENTS IN AVOIDING COMMON ANESTHETIC OUTCOMES****AUTHORS:** H. Bennett, M. Gajewski, G. Shah, P. Byrnes, D. Kramer, T. Sebaoun**AFFILIATION:** St. Luke's Roosevelt Hospitals, New York, NY**INTRODUCTION:** Common adverse effects of anesthesia may be a source of anxiety to patients. Patient concerns in avoiding common adverse anesthetic outcomes were previously reported from 101 patients at a community hospital.¹ Replicating and extending the method, the current survey was conducted with over 500 patients from two urban teaching hospitals, adding an anxiety assessment, the State-Trait Anxiety Inventory (STAI).²**METHODS:** Patients awaiting elective surgery provided IRB approved informed consent. We collected demographic data then patients completed the STAI, a well-validated anxiety questionnaire. Ten common anesthetic outcomes were ranked from 1 = "Most want to avoid" through 10, per Macario, 1999.¹ These included post-anesthetic nausea, excessive somnolence, residual weakness, gagging on the ETT, pain, recall, shivering, and sore throat. On POD 2, patients were contacted and reminded to complete an online survey of outcomes from their anesthetic (e.g., 3 ratings of pain and nausea from the first memory after anesthesia, then at 24 and 48 hrs. The online survey on POD 2 included repeating ranking the 10 common anesthetic outcomes to avoid.**RESULTS:** 511 patients were studied. Pre-anesthetic state anxiety scores (avg 39, s.d. 12) were separated for quartile analysis. LOW (< 29, n= 139) and HIGH (> 47, n=139) anxiety quartiles were compared for rank order of preferred outcomes (see Figure 1). Avoidance of nausea was slightly more important for LOW anxiety patients (p=0.01). Other outcomes did not differ in rankings between HIGH and LOW anxiety groups. POD 2 changes in ranking outcomes after anesthesia were similar in LOW and HIGH anxiety quartiles.**DISCUSSION:** Low anxiety patients place a slightly higher value on avoiding nausea than do high anxiety patients. Anxiety generally does not mediate ranking of preferences to avoid common anesthetic outcomes.**REFERENCES:**

1. AnesthAnal, 1999, 89:652-8.
2. State Trait Anxiety Index, www.mindgarden.com/products/staisad.htm

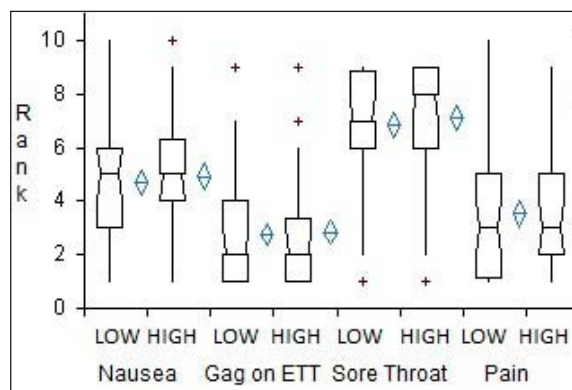


Figure 1. LOW and HIGH anxiety quartiles (each n=137) and rankings of 5 selected outcomes to be avoided. "Most Want to Avoid" is ranked 1.

S-111.**PREOPERATIVE PRACTICE OF FEMORAL NERVE BLOCK SHORTENS ANESTHESIA TIME IN TOTAL KNEE ARTHROPLASTY (TKA), COMPARED WITH POSTOPERATIVE PRACTICE****AUTHORS:** S. Fujii^{1,2}, Y. Iketani,² Y. Fujii,¹ S. Nitta²**AFFILIATION:** ¹Kanazawa Univrsity Hospital, Kanazawa, Japan; ²Ishikawa Prefectural Central Hospital, Kanazawa, Japan

INTRODUCTION: Continuous femoral nerve block (CFNB) has been widely performed in place of epidural analgesia (EA) due to its advantages of less systemic complications and early initiation of anticoagulant therapy. Although its analgesic effect in TKA has been well researched, the timing of the procedure has not been evaluated. The purpose of the present study is to evaluate the timing of CFNB.

METHODS: We retrospectively reviewed anesthetic records of 32 female patients, aged 61-86 years, who underwent TKA from January 2008 to August 2010. Baseline characteristics across groups were comparable. Preoperative CFNB group (Pre-CB, n=22):CFNB performed immediately after the induction of anesthesia. Postoperative CFNB group (Post-CB, n=10):CFNB performed immediately after the dressing is finished. Anesthesia was induced with propofol, fentanyl, and remifentanyl. CFNB was performed under ultrasound guidance(S-nerve,[®] SonoSite) with the nerve stimulator (Stimuplex,[®] HN12 B.Braun). After 20ml ropivacaine 0.75% in Pre-CB or 20ml mepivacaine 1.5% in Post-CB was administered, the polyamide catheter is inserted through the needle and continuous infusion of ropivacaine 0.2% 4ml/hr was started. Postoperatively, blinded nurses recorded pain scores and the incidence of postoperative nausea and vomiting (PONV) from postoperative day 0 to 3.

Anesthesia time was defined as the time starting when the patient is brought to the operating room and ending when the patient leaves the operating room. Anesthesia time was analyzed with Student's t-test.

RESULTS: Anesthesia time was significantly shorter in the Pre-CB than in the Post-CB (298.4±31.2 vs. 326.7±48.9 minutes, p=0.02). The duration of surgery (225.7±36 vs. 205.6±30 minutes), postoperative pain scores and the incidence of PONV didn't show any significant difference in either group.

DISCUSSION: This study clearly shows that preoperative practice of CFNB is associated with significantly shorter anesthesia time. The probable causes are likely to be multifactorial. Firstly, in Pre-CB, we were able to perform the procedure in the absence of surgical drapes and bandages on the patient, which often slows down postoperative procedures. Secondly, in many facilities in Japan, surgeons discuss their surgical plans after induction of anesthesia, adding a few more minutes to anesthesia time. We successfully reduced anesthesia time by performing the procedure while surgeons discuss their plans. This study suggests the preoperative practice of CFNB is more advantageous than the postoperative practice, regarding cost effectiveness and reduction.

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J Clin Anesth. 2009 Jun;21(4):253-7.

J Med Assoc Thai. 2009 Mar;92(3):328-34.

Anesth Analg December 2005 101:1824-1829.

S-112.**COMPETITION AND COST ARE POSITIVELY CORRELATED IN HEALTHCARE MARKETS IN THE U.S.****AUTHORS:** B. Dauber, J. Woo, A. Tung, D. Glick**AFFILIATION:** University of Chicago, Chicago, IL

INTRODUCTION: Healthcare expenditures in the U.S. total over \$2.3 trillion.¹ Competition has been proposed as one potential tool for controlling health care costs. However, market-oriented strategies for regulating healthcare costs may not succeed if market forces are distorted or inoperative. The purpose of this study was to examine the relationship between degree of competition and Medicare reimbursement (a surrogate for cost).

METHODS: We used the Medicare database (www.medicare.gov/download/downloaddb.asp) and the Hospital Compare database (a publicly available listing of hospitals in 24 states) to examine competitive atmosphere and Medicare reimbursement levels for two medical conditions (heart failure and acute MI) and two surgical procedures (heart valve replacement and cholecystectomy). The medical conditions were chosen to represent urgent vs. emergent care, and the surgical procedures were chosen to study specialized vs. non-specialized procedures. All hospitals in the database that had 10 or more admissions for each of these diagnoses per year were identified and their geographical location determined. The degree of competition facing the index hospital was defined as the number of other hospitals admitting patients with these diagnoses within a 20-mile radius. All statistical data were computed using Microsoft Excel 2007 with statistical significance taken at p<0.05.

RESULTS: Statistically significant positive correlations were found for all four diagnoses (figure 1). Heart valve replacement demonstrated the weakest correlation (r= 0.34, 95% CI= 0.27-0.41, p<0.001). Cholecystectomy (r= 0.46, 95% CI= 0.41-0.49, p<0.001) and heart failure (r= 0.52, 95% CI= 0.46-0.57, p<0.001) followed, respectively. AMI treatment showed the highest correlation (r= 0.54, CI= 0.51-0.57, p<0.001).

DISCUSSION: For each procedure and medical condition increases in competition correlated with increases in Medicare reimbursement. Overall, these data suggest that hospitals do not engage in price competition. Perhaps hospitals compete based on the clinical services, quality, and amenities they provide, and, as a result, competition leads to increased service rivalry - and higher prices to accommodate these services. Our finding that correlations were continuously weaker for more elective procedures suggests that for highly elective, less emergent procedures, such as heart valve replacements, patients may be more likely to consider price in their choice of health care provider. Future studies may clarify the complex relationship between competition and cost.

REFERENCES:

1. Centers for Medicare and Medicaid Services. National Health Statistics Group. www.cms.hhs.gov/NationalHealthExpendData/

The comparison of surgical time and anesthesia time in two groups

| | Pre-CB | Post-CB |
|-------------------------------------|-------------|------------|
| Surgical Time (min) | 205.6±29.8 | 225.7±36.5 |
| Anesthesia Time (min) | 298.4±31.2* | 326.7±43.8 |
| Anesthesia Time-Surgical Time (min) | 92.8±21.5* | 101±25.3 |

Data are expressed as mean±SD *p<0.05

S-113.**THE RELATIONSHIP BETWEEN REPUTATION AND COSTS IN HEALTHCARE MARKETS****AUTHORS:** B. Dauber, J. Woo, A. Tung, D. Glick**AFFILIATION:** University of Chicago, Chicago, IL

INTRODUCTION: Expenditures on healthcare in the U.S. total over \$2.3 trillion.¹ Mitigating this growth has become a policy priority as the government and consumers struggle to control health care costs. To execute market-oriented strategies for healthcare, it is important to determine how reputation for quality affects price. The U.S. News and World Report (USNWR) has long been regarded as a reliable gauge of hospital quality based upon reputation.² The goal of this study was to see how this qualitative ranking system as well as the degree of “electiveness” of medical admissions affect hospital pricing.

METHODS: We used the Hospital Compare database to obtain data for two medical conditions (heart failure and acute myocardial infarction (AMI)) and two surgical procedures (heart valve replacement and cholecystectomy). These admissions were chosen because they represented a range of levels of urgency/electiveness and technical difficulty. All hospitals in the publically available Hospital Compare (HC) database (listing of hospitals in 24 states) that had 10 or more admissions for each of the diagnoses/procedures per year were identified. For each of the four procedures cost (as determined by the average Medicare payment for each Diagnosis Related Group) was obtained from the Medicare database (www.medicare.gov/download/downloaddb.asp). The USNWR “Top 50” hospitals for each procedure were identified (health.usnews.com/best-hospitals). Mean costs for USNWR “Top 50” hospitals and unranked hospitals were calculated.

RESULTS: “Top 50” hospitals had a higher mean reimbursement value for all four diagnoses [table 1]. Additionally, the highest percent difference in cost between ranked and unranked hospitals was demonstrated for AMI treatment at 38%, while the lowest percent difference was for heart valve replacement at 24%.

DISCUSSION: Our study had two main findings. First, we found that hospitals with a greater reputation for quality can command higher reimbursements overall for medical and surgical care. Secondly, we found that price differentials for elective, highly specialized procedures, such as heart valve replacements are smaller than those for acute, urgent care. This finding suggests that patients and third-party payers can incorporate price into their decision making calculus, forcing hospitals to lower their costs, for admissions for elective diagnoses. Further research is needed to identify factors allowing market forces to regulate cost.

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2. Ann Intern Med. 2010 Apr 20;152(8):521-5.

S-114.**APPLYING LEAN TO THE PREANESTHESIA TESTING CLINIC****AUTHOR:** M. W. Lew**AFFILIATION:** City of Hope, Duarte, CA

INTRODUCTION: Hospitals strive to provide the safest patient care in an efficient manner. City of Hope initiated a five day Preanesthesia Testing Clinic (PATC) Rapid Improvement Event (RIE) utilizing lean techniques with the goal to eliminate cancellations and delays on the day of surgery. The five step lean principles are to: 1) identify value, 2) map the value stream by eliminating waste, 3) create flow, 4) establish pull by the customer, and 5) seek perfection. Fifteen percent of first case cancellations and delays on the day of surgery were caused by missing or incomplete: 1) consents, 2) labs, and 3) history and physicals. This was largely attributed to the inefficiencies of the PATC.

METHODS: The entire PATC process was reviewed beginning from the arrival of the patient at the front door through the entire PATC process. Forty five percent of surgical patients were not seen at the PATC, the patients traveled 1290 steps (1/3 of a mile), and the entire PATC process took 162 minutes.

The patients were not referred for two main reasons: 1) inadequate number of appointments, and 2) the perception thof the lack of value to referring physician. The PATC process required the patient to visit the various services (registration, EKG, x-ray, labs) located throughout the hospital because the organization traditionally was function focused rather than patient flow/experience focused.

RESULTS: The solution addressed the patient and surgeon needs by: 1) increasing the availability of the PATC by increasing staffing, extending hours, and streamlining work, 2) establishing an educational program to the surgeons highlighting the benefits, and 3) providing all of the services except x-ray at the PATC.

Our six month follow-up demonstrated that the patients seen in the PATC increased from 55% to over 92% of all surgical patients. Despite the increase in volume the percentage of incomplete labs, history and physical, consents missing were markedly decreased, thus essentially eliminating the cancellation/delay on the day of surgery. In addition, by developing a “one stop shop” the new distance travelled (315 steps) dramatically decreased by 76%, and the duration of the PATC visit was slashed by 64% (162 minutes to 58 minutes).

DISCUSSION: With the commitment of the organization and its leaders, the investment of the PATC RIE established value and eliminated waste. This led to improved patient and staff satisfaction as demonstrated by the change in the Press Ganey Patient Satisfaction score from a baseline of 84.5 to 96.3 which was the highest mean score amongst all of the outpatient clinics in the hospital.

REFERENCES:

1. Womack, James P.; Daniel T. Jones, and Daniel Roos (1990). The Machine That Changed the World.

Education & Patient Safety

S-115.**SIMULATION, KNOWLEDGE RETENTION, AND LEARNING PREFERENCES IN MEDICAL STUDENTS**

AUTHORS: J. D. Mitchell, P. Clardy, D. S. Pinto, L. J. Fisher, B. Subramaniam, D. H. Roberts

AFFILIATION: Beth Israel Deaconess Medical Center, Boston, MA

INTRODUCTION: Controversy remains over whether simulation represents a significant improvement over lecture.^{1,2} Our hypothesis is that students would achieve improved and sustained understanding after simulation sessions when compared to lecture experiences.

METHODS: 52 3rd year students were divided into 2 groups. Topics taught were hypotension and acute chest pain. Group 1 received simulation instruction on hypotension while 2 received a lecture. Subsequently, the groups received the alternate intervention for the chest pain topic. Three months later, the groups were taught the same topics using the opposite method. Pre- and post-tests were administered at each session and a final post-test was administered at the 6-month mark without additional teaching.

Challenging Case Report (only complete if your submission falls into the "Challenging Case Report" category. If you select the "Challenging Case Report" category on the next step, this section must be completed.): N/A

RESULTS: Chest Pain: Overall, the group receiving lecture first (Group 1) had a significant decrease in knowledge over time ($p = 0.021$), whereas the group receiving simulation first (Group 2) had no significant change in knowledge. Final scores showed no differences between groups. Analysis of 9 Group 2 students whose individual data could be tracked demonstrated a significant improvement in their average test scores from 74.1% to 90.7% over the three sessions ($p = 0.022$).

Hypotension: Overall, both groups demonstrated a non-significant trend toward improvement in their test scores, independent of the order of teaching. Final scores in the group receiving simulation first (Group 1) were significantly higher than those in the group receiving lecture first (Group 2) (96.3% versus 88.4%, $p = 0.002$).

Perceptions: Self-reported recall of topics was similar between groups. In both groups, over 85% of students felt that revisiting topics and varying approaches were useful. Students preferred learning via simulation, or both over lecture alone. Regardless of topic, order of presentation, or time point queried, over 70% of students reported a preference for receiving lecture prior to simulation.

DISCUSSION: Simulation-first resulted in higher final scores in the hypotension didactics and improved scores in a subset of the chest pain students, but not in the chest pain group overall. Independent of group or topic, students had similar preferences for repetition of topics, varied approaches to teaching, and receiving lecture prior to simulation.

REFERENCES:

1. Grant T, Mc Neil M, Luo X, Absolute and Relative Value of Patient Simulator Features as Perceived by Medical Undergraduates. *Simulation in Healthcare*. 3(3): 133-137, Fall 2008.
2. Wenk M, Waurick R, et al. Simulation-based medical education is no better than problem-based discussions and induces misjudgment in self-assessment. *Advances in Health Science Education* (2009) 14:159-171.

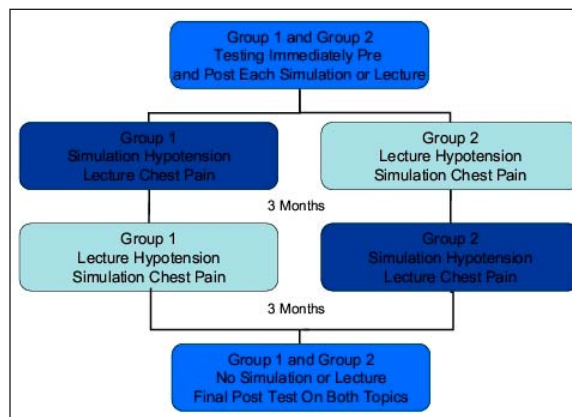


Figure 1: Study Design

Figure 2a

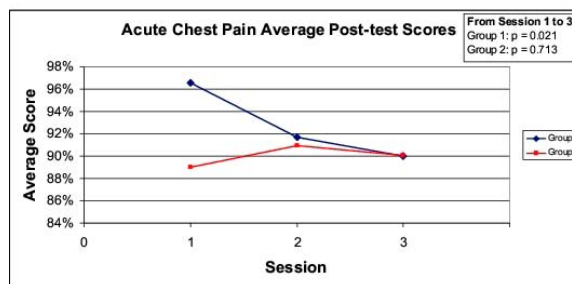
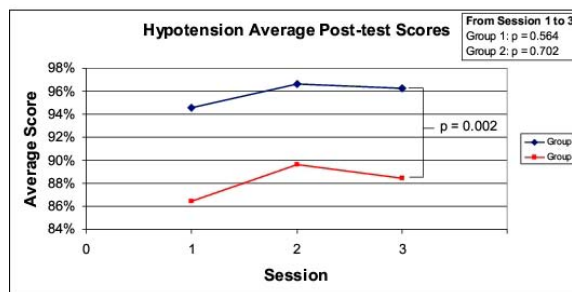


Figure 2b



S-116.**PROGRAM IN QUALITY, PATIENT SAFETY, AND RISK MANAGEMENT: A PRACTICE-BASED LEARNING MODEL THAT EMBRACES THE ACGME CORE COMPETENCIES**

AUTHORS: Y. J. Xie,^{2,1} K. Herzer,¹ M. Mirrer,^{2,1} R. Cover,¹ D. Trabilsy,^{1,2} L. J. Mark¹

AFFILIATION: ¹Johns Hopkins School of Medicine, Baltimore, MD; ²Johns Hopkins University, Baltimore, MD

INTRODUCTION: The Department of Anesthesiology and Critical Care Medicine (ACCM) created the program in Quality, Patient Safety, and Risk Management (QPSRM) to provide a dynamic opportunity for undergraduate students to explore how safety, risk, and quality of medical practices impact patient care. The educational objectives are for students to develop proficiency in safety research and to contribute their acquired methodological skills to institutional initiatives on improving patient safety.

METHODS: Students are introduced to Lean Six Sigma methodology for analyzing research data, such as Root Cause Analysis and Patient Safety Net reporting. Students work closely with surgeons, anesthesiologists, risk managers, and human factors engineers to participate in clinical activities at a surgical suite. A Clinical Perioperative Services Team (CPST) provides oversight for the program. An online project database allows for easy multimedia operations, storage of education materials, and provides students with continuous monitoring of progress. The scope of QPSRM projects includes: patient safety-related incidents, operating room (OR) efficiency, OR support, education, information technology, and perioperative teamwork/communication.

RESULTS: 60 undergraduate students applied for the QPSRM program. 12 were accepted from 2005 to 2010. Students worked on over 27 quality improvement initiatives. Highlights include an FDA national recall of improperly labeled drugs that resulted in look-alike medication errors, development of three surgical programs using in-situ simulations, new robotics programs involving four surgical specialties, and implementation of the Good Catch Award to incentive adverse events reporting. Students in this program have submitted 14 abstracts and 8 poster presentations at various conferences, and have won awards for their work.

DISCUSSION: The QPSRM program represents an innovative model for educating future physicians on patient safety, beginning at the undergraduate level. All QPSRM projects have targeted and embraced the six ACGME core competencies. Furthermore, the methodological skills that these students contributed have significantly increased capacity and support to the CPST. Success of this program is marked by its recent incorporation into the ACCM residency systems-based practice curriculum and elective anesthesia rotations for medical students. This program is ongoing in its effort to educate, identify defects, and formulate solutions to sustain a positive patient safety culture.

REFERENCES:

Designing and implementing a comprehensive quality and patient safety management model: a paradigm for perioperative improvement. J Patient Safety. 2008; 4:84-92.

| | QPSRM Projects | Proficiencies | Academic Achievements |
|---------------------------------|--|---|---|
| Sept 2007-Aug 2008 Freshman | STIX sharps hazard Latex exposure reduction SBAR format PSN Introduction | Introduction to the OR Introduction to Lean Six Sigma (L6S) RCA | WPCT web module and practitioner education on latex safe practices |
| Sept 2008-Aug 2009 Sophomore | 13 Good Catch Awards, Program Pilot i.e. Heliox therapy Insulin administration Modified surgical stapler In-situ simulations IORT HIPEC Interventional pulmonology DART | Abstract writing Story board presentation L6S on efficiency maximization | 5 th Annual Maryland Patient Safety Conference |
| Sept 2009-Aug 2010 Junior | 14 more Good Catch Awards, Program Expansion and Sustainability i.e. Vecuronium and drug look-alike errors King LT-D airway In-situ simulations IORT Robotic transaxillary thyroidectomy DART Weinberg Practices Bone Marrow Harvest IORT Interventional pulmonology Transfusion medicine blood dispensing ACCM CODE bag standardization | Manuscript and scientific paper writing Literature searches for academic writing Academic poster presentations Course background in health policy, biostatistics, and epidemiology | 11 th Annual ACCM Research Day - Silver Medal 6 th Annual Maryland Patient Safety Conference 1 st Annual JHU Public Health Studies Undergraduate Research Day FDA national vecuronium recall QPSRM incorporated into ACCM practice-based learning curriculum for residents |
| Sept 2010-present Senior | ACCM CODE bag standardization and operationalization DART year 1 and 2 analysis MedicAlert Foundation National Difficult Airway/Intubation Registry | L6S methodology on capacity building and efficiency improvement Design for Lean | Society of Airway Management University Health Consortium (UHC) Patient Safety Fall Forum QPSRM incorporated into elective anesthesia rotations for medical students |

QPSRM Project Timeline

S-117.**ANESTHESIA RESIDENTS DO NOT AGREE WITH THEIR TRAINING PROGRAMS ON THE DEGREE TO WHICH THE 2007 ACC/AHA GUIDELINES ARE EMPHASIZED**

AUTHORS: M. Vigoda,¹ V. Behrens,¹ N. Miljkovic,¹ K. Arheart,¹ B. Sweitzer²

AFFILIATION: ¹University of Miami Leonard M. Miller School of Medicine, Miami, FL; ²University of Chicago, Chicago, IL

INTRODUCTION: Clinical practice guidelines have been increasingly accepted as the standard of care. However, few studies have evaluated the degree to which they are emphasized by anesthesiology training programs. We hypothesized that there is a discrepancy between residents' perceptions and those of their training programs on the emphasis placed on the 2007 ACC/AHA Guidelines on Perioperative Cardiovascular Evaluation for Non-cardiac Surgery.¹

METHODS: We designed a web-based survey instrument to evaluate how anesthesiology residents apply the 2007 ACC/AHA Guidelines on Perioperative Cardiovascular Evaluation for Non-cardiac Surgery. Twenty-four anesthesiology-training programs (386 residents) participated. As part of a web-based survey that determined residents' ability to apply the guidelines, we included a question that related to the emphasis of the guidelines in their training. In addition, each site coordinator was asked to quantify the degree to which the guidelines were emphasized. We determined agreement between residents and their program calculating Cohen's kappa statistic with 95% confidence intervals. Cohen's kappa statistic measures the amount of agreement after adjusting for the expected association due to chance.²

RESULTS: The 386 trainees included 44 PGY-1s (preliminary year before anesthesia training), 127 CA-1s, 104 CA-2s and 98 CA-3s. There were 13 participants with incomplete questionnaires. Of the 24 anesthesia training programs, 66% of site coordinators indicated that their training programs emphasize the guidelines. However, regardless of resident's training level, there was no statistically significant agreement between the residents and training program coordinators on the degree that the guidelines are emphasized, as shown by the Cohen's kappa statistic (Table 1).

DISCUSSION: Our study suggests that residents and site coordinators do not always agree on the level to which the 2007 ACC/AHA Guidelines are emphasized. This may be a factor in residents' inability to correctly apply the guidelines in common clinical scenarios.³ Adjustments in educational programs may be required to increase awareness on the importance of applying evidence-based guidelines.

REFERENCES:

1. Anesth Analg 2008;106(3):685-712.
2. Altman DG. Practical statistics for medical research. Chapman and Hall; 1991.
3. Vigoda MM et al. Do Anesthesiology Residents Correctly Apply the 2007 American College of Cardiology/American Heart Association (ACC/AHA) Guidelines on Perioperative Cardiac Evaluation when Evaluating Simulated Patients? Anesth Analg (in press)

S-118.**CAN WE FACILITATE THE SCHOLARLY ACTIVITY OF ANESTHESIOLOGY RESIDENTS?****AUTHORS:** T. Sakai, D. G. Metro, R. M. Patel, Y. Xu**AFFILIATION:** Department of Anesthesiology, University of Pittsburgh School of Medicine, Pittsburgh, PA

INTRODUCTION: Research is indispensable to the future growth of our specialty. Promoting the importance of research to anesthesiology residents and teaching them research methodologies are essential. ACGME residency program requirements allow for a research rotation of up to six months. Definitions of success and methods to achieve it in the area of resident scholarly activity have not been fully established. Since Academic Year (AY) 2006, we have implemented structured processes to promote resident research and scholarly activity. The aim of this study is to assess the impact of these initiatives.

NEW EDUCATION PROGRAMS: (A) For Resident Research Rotation (RRR), 1) researchers were introduced to the residents in a CA2 lecture, 2) Director of RRR was appointed, 3) application procedures were refined, 4) letter of commitment from the research mentors was required, 5) attendance was mandated at a weekly RRR meeting, 6) submission of abstracts/manuscripts/seed grants were encouraged. (B) For all residents, a Research Symposium and a Research PBLD were provided. Topics included research integrity using web based modules, IRB application process, grantsmanship, manuscript preparation, and the art of scientific presentations. (C) For faculty, monetary incentive system was established for providing mentorship in resident research.

METHODS: The following measurements were compared between Pre-Initiative residents (Class2003-Class2006) and Post-Initiative residents (Class2007-Class2010): 1) the percentage of residents who entered RRR, 2) the number of faculty mentors for any research projects, and 3) overall residents' research productivity, which was evaluated using Scholarly Activity Points (SAPs),¹ which were calculated based on a merit matrix system developed within the department as part of a faculty incentive plan (Table 1). SAPs were presented as median with range (minimum, maximum).

RESULTS: The percentage of residents who elected RRR increased from 7.4% (4 residents in 54) in Pre-Initiatives to 28.8% (15 in 52) in Post-Initiatives ($p=0.005$). The number of faculty mentors increased from 9.2% (55 faculty members in 595) in Pre-Initiatives to 23.9% (161 in 673) in Post-Initiatives ($p<0.001$). Residents' research productivity increased from SAPs of 25 (0, 1071.6) in Pre-Initiatives to SAPs of 145 (0, 822.4) in Post-Initiatives ($p<0.001$) (Figure 1).

DISCUSSION: Resident research interest and scholarly productivity can be increased with the implementation of educational programs.

REFERENCES:

1. Emerick et al, Society for Education in Anesthesia, June, 2011 (abstract).

This study was supported in part by the NIGMS, grant T32GM075770 (YX)

Scholarly Activity Points by Merit Matrix System

| ABSTRACT | |
|--|---|
| Abstracts accepted to national & international peer review meeting, 1st & senior authors | 50 points |
| Abstracts accepted to national & international peer review meeting, other authors | 25 points |
| MANUSCRIPT | |
| Manuscripts in peer reviewed journals, 1st & senior authors | 150 points if IF <1 and/or 100xIF for IF >1.0 (IF = Impact Factor) |
| Manuscripts in peer reviewed journals, other authors | 50xIF |
| Case Report, 1st and senior authors | 75 points |
| Case Report, other authors | 25 points |
| Book reviews, letters to editor | 30 points |
| BOOK CHAPTER | |
| ≥ 10 pages at the time of publication, 1st & senior authors | 150 points |
| ≥ 10 pages at the time of publication, other authors | 75 points |
| < 10 pages at the time of publication, 1st and senior authors | 75 points |
| < 10 pages at the time of publication, other authors | 38 points |
| REVIEW ARTICLE | |
| Review Article published in a peer reviewed journal, 1st & senior authors | 100 points + 50xIF |
| Review Article published in a peer reviewed journal, other authors | 50+15xIF |
| Review Article published in a non peer-reviewed journal, 1st & senior authors | 75 points |
| Review Article published in a non peer-reviewed journal, other authors | 25 points |
| GRANT | |
| Application for Seed Grants | 50 points for principal & senior investigators (25 at the time of submission and 25 at the time of reward) |
| Application for Foundation Grant (FAER, IAR) | 100 points for principal investigator & mentor |
| Application for Federal Grant (NIH, VA, etc.) | 200** points for principal investigator & mentor (100 at the time of submission + 100 at the time of the reward) plus 200 points every year for the life of the grant |
| IRB | |
| Approved basic research protocol or IRB Approved clinical study | 30 points for principal & senior investigators |

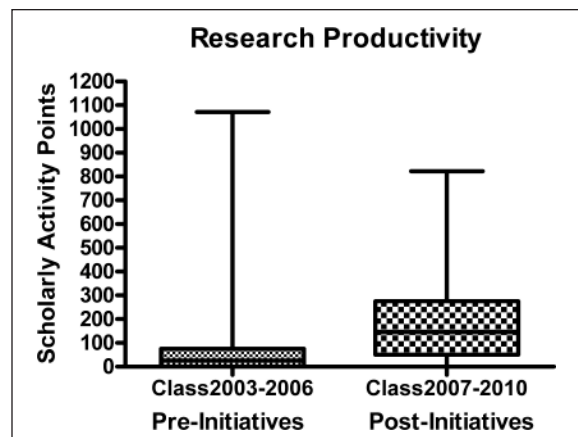


Figure 1

S-119.**EFFECTS OF THE INTRODUCTION OF THE WHO 'SURGICAL SAFETY CHECKLIST' ON IN-HOSPITAL MORTALITY. A COHORT STUDY.**

AUTHORS: W. A. Van Klei, R. G. Hoff, T. H. Kappen, C. J. Kalkman, W. F. Buhr, L. M. Peelen

AFFILIATION: University Medical Center Utrecht, Utrecht, Netherlands

INTRODUCTION: Both public opinion and health authorities increasingly demand that professionals use perioperative checklists to minimize avoidable errors and complications, including mortality.^{1,2} However, compliance to such checklists was reported to be incomplete.² Therefore, it remains unclear whether the reported benefits obtained were through actual completion of a checklist or from an increase in overall awareness of patient safety issues. We aimed to evaluate the effect of implementation of the WHO Surgical Safety Checklist on mortality and to determine to what extent the effect was related to compliance.

METHODS: This retrospective cohort study included 25,513 adult patients undergoing non-day case surgery in a university hospital in the period between January 2007 and September 2010. The WHO checklist was introduced into our hospital on April 1, 2009.

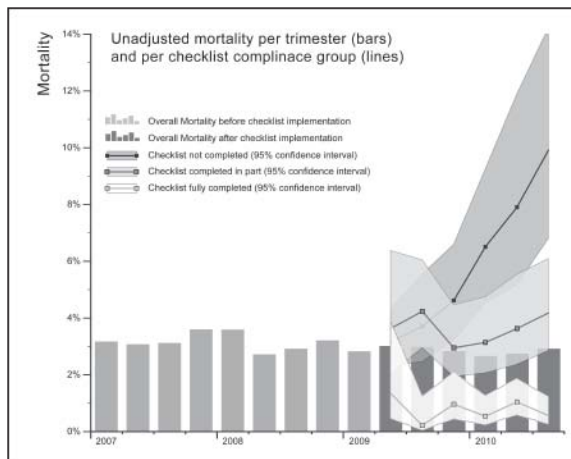
Hospital administrative data and electronic patient records were used for data collection. Operating room circulating nurses documented compliance with each individual checklist item. At the time of documentation, these nurses were unaware of the study. Checklist compliance was defined as 'not completed', 'partially completed' and 'fully completed'. Main outcome was in-hospital mortality within 30 days following surgery. Effect estimates were adjusted for patient characteristics, surgical specialty and comorbidity. To exclude any remaining selection bias due to emergency patients with a lower level of preparation, the analysis was repeated in patients for whom an outpatient preanaesthesia evaluation record was available.

RESULTS: After checklist implementation, mortality decreased from 3.1% to 2.9% ($p=0.2$, Figure). After adjustment for baseline differences, mortality was significantly decreased after checklist implementation (OR 0.85; 95% CI: 0.73-0.98). This effect was strongly related to checklist compliance: the odds ratio for the association between full checklist completion and outcome was 0.44 (95% CI: 0.28-0.70), compared to 1.09 (95% CI: 0.78-1.52) and 1.16 (95% CI: 0.86-1.56) for partial or non-compliance, respectively (Table). In the patients with a completed preanaesthesia evaluation record, the odds ratio for the period after checklist implementation compared to the pre-implementation period was 0.82 (95% CI: 0.59-1.14). The other odds ratios were also comparable.

DISCUSSION: Implementation of the WHO Checklist reduced in-hospital 30-day mortality. Although the impact on outcome was smaller than previously reported, the effect depended crucially upon checklist compliance. If compliance to a simple checklist can reduce surgical mortality, compliance should be targeted to 100%.

REFERENCES:

1. NEJM 2009;360:491-9
2. NEJM 2010;363:1928-37



Over time the checklist was completed in an increasing number of patients (data not shown), but it was less often completed in sicker and urgent patients. The Figure shows an increase in mortality over time in patients with non-completed checklists. This suggests that the checklist was increasingly being completed in patients with a lower urgency and a lower chance of dying, while the checklist was still non-completed in highly urgent patients with a greater chance of dying.

S-120.**THE GOOD CATCH AWARD: CREATING INCENTIVES FOR PATIENT SAFETY REPORTING AND SUSTAINING SYSTEMS CHANGES IN THE PERIOPERATIVE ENVIRONMENT**

AUTHORS: J. Hamrick,¹ J. Fuller,¹ M. Vana,¹ Y. J. Xie,² M. Mirrer,² L. J. Mark¹

AFFILIATION: ¹Johns Hopkins Medicine, Baltimore, MD; ²Johns Hopkins University, Baltimore, MD

INTRODUCTION: Reporting medical errors is important and necessary for improving patient safety. Unfortunately, many patient safety incidents are unreported due to fear of reprisal, litigation, and stigma. To address these barriers, the Good Catch Award program was designed to provide positive incentives for reporting unsafe conditions and events that compromise patient safety.

METHODS: The Good Catch Award program was piloted in 16 ORs and associated PACU at one of our Surgical Suites. There are 5 steps to award a Good Catch: 1) Identify a safety threat, 2) Report the threat to Patient Safety Net (PSN) with SBAR formatting (Situation, Background, Assessment, Recommendation), 3) Review reports with a multidisciplinary team, 4) Mitigate the threat and educate providers, and 5) Recognize individuals for their efforts.

RESULTS: 27 Good Catch Awards were distributed to nurses, physicians, and staff members in the Weinberg Surgical Suite over 24 months. PSN harm scores associated with these reported events ranged from "A" (unsafe conditions) to "H" (critical harm to patient). Highlights of program success include: modification of a pharmacy order sheet to include insulin infusion, FDA national recall of improperly labeled drugs that resulted in look-alike medication errors, and significant steps towards a latex-free environment.

DISCUSSION: The Good Catch Award encourages proactive event reporting through institutional recognition, effective, real-time feedback on reports, and intervention to mitigate safety threats with unit-based ownership and oversight. In addition, this program enhances transparency and increases accountability by rewarding providers for reporting their concerns. Leaders of the program currently study sustainability strategies to maintain implemented systems changes. Practices to enhance sustainability include ongoing PSN monitoring and incorporation of the Good Catch Award into the residency education systems-based learning program. The Good Catch Award program embraces the ACGME competencies and reflects the collaborative effort between anesthesia, surgery, nursing, and risk management, as well as institutional effort to promote a safer perioperative environment.

REFERENCES:

- Herzer K, Mark L, Michelson J, Saletnik L, Lundquist C. Designing and Implementing a Comprehensive Quality and Patient Safety Management Model: A Paradigm for Perioperative Improvement. *J Patient Safety*. 2008;4(2):84-92.
- PSN: www.uhc.edu
- Hospira Urgent Market Withdrawal Notice, Recall # 2009-020, Feb 5, 2009.

Table 1

27 Good Catch Awards, 2008-2010. ACGME Competencies: a. Patient care, b. Medical knowledge, c. Practice-based learning and improvement, d. Interpersonal and communication skills, e. Professionalism, f. Systems-based practice

| Good Catch Award Given | Harm Score | System Changes Implemented | ACGME Competency Addressed | Sustained? |
|---|------------|---|----------------------------|------------|
| 1. Insulin | B2 | Pharmacy order sheet modification | b, f | Yes |
| 2. Heliox | C | On-site OR Heliox | a, b, c, d, f | Yes |
| 3. Liposuction | B2 | New staff in-service | a, b, c, d, f | Yes |
| 4. Modified Surgical Stapler | B2 | Modified surgical informed consent | a, c, f | Yes |
| 5. Jet Ventilation | E | Daily equipment check | a, b, d, f | Yes |
| 6. Latex | B1 | Latex-free environment | a, b, d, f | No |
| 7. CO ₂ Laser | A | Manufacturer representatives on-site | a, d, e, f | Yes |
| 8. Hysteroscopy | A | Specialty nursing & physician in-service | a, b, d, e, f | Yes |
| 9. Methemoglobinemia | E | Limited pharmacy distribution | a, b, d, e, f | Yes |
| 10. Heparin | B1 | Removal of Heparin 10,000 units/ml from institution | b, c, d, f | Yes |
| 11. 180 Table Turn | E | Safety check initiated by surgeon | a, c, f | No |
| 12. Vecuronium | E | FDA recall of improperly labeled medication | a, d, e, f | Yes |
| 13. Informed Consent | B2 | Individual consent for surgical service | d, e | Yes |
| 14. Belmont Infuser | D | MedSun and FDA report with equipment change | a, c, d, f | No |
| 15. King LTD | C | MIEMSS updates; MedSun recommendations with manufacturer input | a, b, c, d, e, f | Yes |
| 16. Double Lumen Tube | D | Updated policy change: invasive Pulmonology incorporated into Difficult Airway Response Team | a, b, c, d, e, f | Yes |
| 17. Transaxillary Robotic Thyroidectomy | A | Patient position modified; neuro monitoring recommended with modified surgical informed consent | a, b, c, d, f | Yes |
| 18. Vecuronium II | A | FDA notified of non-compliant labels | a, d, e, f | Yes |
| 19. Bristojet Look-Alikes | C | Additional color-coding for look-alike drugs | a, c, d, f | Yes |
| 20. Mallinckrodt labels on ETTs | A | Recommended consistent labels; MedSun recommendation to manufacturer (pending) | a, c, d, f | No |
| 21. Malfunctioning Bed | H | MedSun report submitted | a, c, f | Yes |
| 22. EJ Infiltrate | D | Risk management review of peripheral versus central vascular access | a, b, c, d, f | No |
| 23. Trauma Surgery 911 | A | Trauma surgery consulted for OR catastrophes | a, b, c, d, e, f | Yes |
| 24. Cell Saver for Massive Transfusion Hyperkalemia | A | Perfusionists wash RBCs for massive transfusion, hyperK+ | a, b, c, d, e, f | Yes |
| 25. Shattered Bristojets | A | Appropriate use of emergency drugs | a, b, c, f | Yes |
| 26. IV Tubing Backflow Device | G | Backcheck valve tubing standard | a, c, d, f | Yes |
| 27. Access Jackson Table | D | Risk Management Device Sub-Committee formed | a, b, c, d, e, f | Yes |

No Actual Event

☐ A. Unsafe Conditions

Event, No Harm

☐ B1. The event did not reach the individual because of chance alone. ("Near-miss")

☐ B2. The event did not reach the individual because of active recovery efforts by caregivers. ("Near-miss")

☐ C. The event reached the individual but did not cause harm (an error of omission such as a missed medication dose does reach the patient.)

☐ D. The event reached the individual and required additional monitoring or treatment to prevent harm.

Event, Harm

☐ E. The individual experienced temporary harm and required treatment or intervention.

☐ F. The individual experienced temporary harm and required initial or prolonged hospitalization.

☐ G. The individual experienced permanent harm.

☐ H. The individual experienced harm and required intervention necessary to sustain life (e.g. transfer to ICU).

Event, death

☐ I. The individual died.

Figure 2. PSN harm scores, levels A through I

S-121.**MAKING SENSE OF MEDICATION LISTS IN MEDICATION RECONCILIATION**

AUTHORS: M. E. Nunnally,¹ G. Vashitz,² Y. Bitan,¹ Y. Parmet,² R. I. Cook¹

AFFILIATION: ¹Cognitive Technologies Laboratory University of Chicago, Chicago, IL; ²Ben-Gurion University of the Negev, Beer Sheva, Israel

INTRODUCTION: Medication reconciliation (MR) can be broadly defined as the task of bridging an awareness gap in a patient's medical history as care location or context changes. MR is identified by many organizations as a sensitive area of patient care. The Joint Commission has identified MR as an area for safety improvement.¹ To date, however, there are few studies exploring what activities comprise and promote safe medication reconciliation.

METHODS: Using a card-sorting simulation, our goal was to explore how medical condition ordering patterns influenced the arrangements of medications. We produced a simulation to probe the nature of cognition in MR using a card-sorting task. Participants were clinicians practicing in a department of anesthesiology and critical care, whose work involves MR. The simulation was based on patient data from the Anesthesia Preoperative Medicine Clinic at the University of Chicago Medical Center. Abstracted patient records were used to produce a fictional case for preoperative assessment by an anesthesia provider. Patient medical diagnoses and medications were printed on paper cards. The participants were asked to arrange the cards in a way that made sense to them in the clinical context of pending pre-surgical evaluation. To track arrangement along a straight line, we used the Levene's test for equality of variance to compare the variances on X and Y-axis projections. We used the Friedman test for ranking to compare the adjusted distances and explore for specific ordering.

RESULTS: Levene's test for equality of variance showed that 58% of the 24 participants arranged the medications along a straight line ($p < 0.001$). With only few exceptions, the medications were arranged along the line in a fixed order, from cardiac conditions to depression (Friedman's $\chi^2(54) = 289.7$, $p < 0.001$). The table illustrates the closest and farthest drug pairs. The five closest drug pairs all came from the same organ systems: cardiovascular (2 pairs), pulmonary (2 pairs) and psychiatric medications (1 pair). The most distant card pairs were from separate organ systems.

DISCUSSION: Understanding how clinicians think about diseases and medication helps uncover the cognitive processes behind MR. These processes ultimately influence points of resilience and weakness in the continuity of care as a patient transitions from one care location to another. These findings are a starting point for the creation of tools that enhance, rather than distract from, the cognitive MR process.

REFERENCES:

1. JCAHO (2005) Hospital national patient safety goals. www.jointcommission.org/PatientSafetyNationalPatientSafetyGoals/05_hap_npsgs.htm. Accessed April, 12, 2010.

Table 1

Proximity pairing of cards, highest and lowest.
Ranks are from Friedman's rank test.

| Pair | Mean Rank |
|---------------------------------|-----------|
| 5 Closest Pairs | |
| Fluticasone - Albuterol | 8.50 |
| Alprazolam - Paroxetine | 10.89 |
| Atorvastatin - Diltiazem | 13.86 |
| Digoxin - Diltiazem | 15.59 |
| Home Oxygen - Albuterol | 16.89 |
| 5 Most Distant Pairs | |
| Aspirin - Paroxetine | 38.11 |
| Atorvastatin - Paroxetine | 38.18 |
| Alprazolam - Digoxin | 38.30 |
| Paroxetine - Digoxin | 38.86 |
| Potassium Chloride - Paroxetine | 39.68 |

S-122.**MOST ANESTHESIOLOGISTS DON'T CORRECTLY APPLY 2007 ACC/AHA GUIDELINES ON PERIOPERATIVE CARDIAC EVALUATION****AUTHORS:** M. Vigoda,¹ V. Behrens,¹ N. Miljkovic,¹ K. Arheart,¹ R. P. Dutton²**AFFILIATION:** ¹University of Miami, Miami, FL; ²Anesthesia Quality Institute, Chicago, IL**INTRODUCTION:** The 2007 American College of Cardiology/American Heart Association (ACC/AHA) Guidelines on Perioperative Cardiac Evaluation and Care for Noncardiac Surgery is an evidence-based standard for perioperative cardiac evaluation. We surveyed practitioners to determine how they apply suggested testing algorithms from the ACC/AHA guidelines when evaluating simulated patients. We then estimated the percentage of anesthesiologists nationwide that correctly apply the guidelines.**METHODS:** American Society of Anesthesiologists (ASA) members were solicited by e-mail to participate in a survey. Participants were presented with 6 clinical scenarios characterized by surgical procedure and the patient's clinical condition (i.e., clinical risk factors and functional capacity). Scenarios and possible recommendations were presented in a randomized order. Anesthesiologists selected the recommendation (from a list of 5 possible choices) that they considered to be most consistent with the guidelines.**RESULTS:** A total of 1595 practicing anesthesiologists participated in the survey. Recommendations for scenario #1 (active cardiac condition) were consistent with the guidelines approximately 80% (95% CI: 78-82) of the time. However, for the remaining 5 scenarios, this occurred only 18%-38% of the time (See Table).**DISCUSSION:** The 2007 preoperative cardiac testing guidelines, although well supported by scientific evidence, are not correctly applied by anesthesiologists evaluating simulated patients. The number of years in practice was inversely related to percentage of anesthesiologists providing the correct recommendation, suggesting that current methods for dissemination of the guidelines may need reevaluation. Nonetheless, the generally poor performance indicates that other factors (i.e., guideline clarity, logistical considerations, etc.) may also be relevant. Increased efforts by regulatory and societal agencies are needed to encourage evidence-based improvements in care. Further study is needed to determine if decision support tools may increase correct application by practicing anesthesiologists.**REFERENCES:**

Anesth Analg 2008;106(3):685-712

Percent of Practicing Anesthesiologists with Correct Recommendation

| Scenarios | % Correct with 95% Confidence Intervals |
|--|---|
| Active cardiac condition | 80 [78,82] |
| No active cardiac condition, low-risk surgery | 38 [35,40] |
| No active cardiac conditions, intermediate-risk surgery, good functional capacity, 1 clinical risk factor | 29 [27,31] |
| No active cardiac conditions, intermediate-risk surgery, poor/unknown functional capacity, 2 clinical risk factors | 18 [16,20] |
| No active cardiac conditions, vascular surgery (1 or 2 risk factors) | 26 [24,28] |
| No active cardiac conditions, intermediate risk surgery and no clinical risk factors | 30 [28,32] |

S-123.**CARD SORTING ORDER SUGGESTS MEDICATION RECONCILIATION STRATEGIES****AUTHORS:** M. E. Nunnally,¹ G. Vashitz,² Y. Bitan,¹ Y. Parmet,² R. I. Cook¹**AFFILIATION:** ¹Cognitive Technologies Laboratory University of Chicago, Chicago, IL; ²Ben-Gurion University of the Negev, Beer Sheva, Israel**INTRODUCTION:** Medication reconciliation (MR) is an area of vulnerability in patient care. Understanding how clinicians reconcile medications and medical conditions might help with the development of tools to make the process safer. Our goal was to study the order of reconciliation, comparing medication sorting to condition sorting.**METHODS:** We have uncovered certain cognitive tendencies in clinicians performing simulated MR in our laboratory using a card-sorting task. Clinicians practicing in a department of anesthesiology and critical care, whose work involves MR were asked to arrange the cards in a way that made sense to them in the clinical context of pending surgery and pre-anesthetic evaluation. A video camera recorded hand movements and conversation. Each time a card was sorted, we recorded whether it was a condition or medication. Final arrangement had up to 18 steps. Using the final placement of each card as a discreet time point, we used the Generalized Wilcoxon test to illustrate the evolution of arrangements in terms of diseases and medications in a modified survival analysis.**RESULTS:** Medical conditions were routinely sorted before medications. Figure 1 demonstrates each subject's ordering sequence. By Kaplan Meyer analysis, 14 out of 24 subjects (58%) showed a statistically earlier ordering of conditions over medications ($p < 0.05$). The figure demonstrates the comparative sorting order of medications and conditions.**DISCUSSION:** Our previous analyses have suggested an arrangement both conditions and medications that is reproducible across subjects. These data suggest that conditions are ordered before medications, reinforcing the argument that clinicians approach MR using an organization strategy based on disease, rather than drug. Drug lists that take this into account may better suit users' cognition and enhance the MR process.**REFERENCES:**

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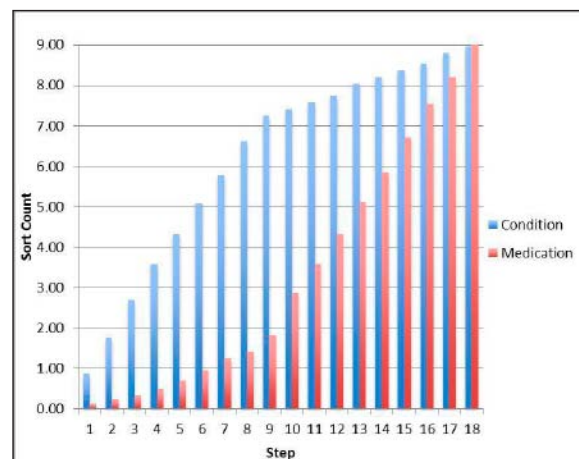


Figure 1. Progression of sorting: conditions versus medications over time. Conditions sort earlier than medications.

S-124.**CONVERSION TO PRE-FILLED MEDICATION SYRINGES REDUCES MEDICATION WASTE AND COSTS**

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INTRODUCTION: It is estimated that 1 significant medication error occurs in every 133 anesthetics and 1 out of every 250 of these errors is thought to be fatal. The Anesthesia Patient Safety Foundation (APSF) recommends a new paradigm for reduction of medication errors which includes pre-filled medication syringes (PFS).¹ We tested the hypothesis that pre-filled medication syringes reduce drug waste and costs.

METHODS: After obtaining IRB approval, we collected drug waste during two ten day time periods, baseline (Phase I) and after the implementation of 9 different PharMEDium PFS (Phase II). Drug waste, classified as any unused drug drawn up into a syringe or a used drug that remained in its original, opened container at the conclusion of a case, was collected by OR pharmacy staff following each case. Drug waste costs were determined by linking the 2009 average wholesale price to the medications national drug code number. A cost per milliliter (mL) was calculated for each product and the quantity of waste reported was multiplied by the cost per mL to calculate the cost of the drug waste. Statistical analysis was performed using a student t-test for continuous variables and a Fisher's exact test for nominal variables.

RESULTS: The total number of cases for Phase I and Phase II were 154 and 171, respectively. One hundred and ten cases (71%) had waste during Phase I versus 66 cases (38%) in Phase II. Total drug waste by volume decreased 61% from 3,284.2 mL in Phase I to 1,266.3 mL in Phase II. Overall, the reduction in lidocaine waste was the greatest at 90%, followed by succinylcholine (74%), and glycopyrrolate (60%). This reduction in waste quantity also resulted in a reduction of drug waste costs from \$3,106.95 in Phase I to \$1,849.88 in Phase II. This drug waste cost decrease resulted in a savings of \$126.51 per day or \$32,683.82 in annual savings. The overall drug cost savings was \$187.50 for Phase II or \$4,875.00 annually.

DISCUSSION: The conversion to PFS led to a significant reduction in drug waste and drug waste cost savings. PFS have a direct cost that is higher than the vial counterpart. However, when drug waste is considered, we have shown the hospital system saved \$4,800 after the implementation of the 9 PFS. PFS are thought to improve patient safety because of their extended use dating, enhanced labeling, and consistent dilutions. Additionally, in another report by our group, we have shown that the majority of OR practitioners endorse the use of PFS.² We conclude that costs savings accrue to the use of PFS.

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S-125.**THE PERIOPERATIVE HANDOFF PROTOCOL: IMPACT ON HANDOFF DEFECTS AND PROVIDER SATISFACTION**

AUTHORS: M. Petrovic, Y. J. Xie, R. S. Gill, Z. Jurdi, E. A. Martinez, H. Aboumatar

AFFILIATION: Johns Hopkins Medicine, Baltimore, MD

INTRODUCTION: Patient handoffs represent high-risk encounters ripe for breakdowns in communication and teamwork. Perioperative handoffs are particularly challenging given patients' evolving post-procedural physiology, their physical transport through the hospital, and the triad transfer of personnel, information, and medical technology. We developed a new perioperative handoff protocol and pilot-tested it at our cardiac surgical ICU in 2007. The protocol was then refined and implemented in the adult Perianesthesia Care Units (PACU), starting in January 2010. We present here our findings from the PACU intervention.

METHODS: The perioperative handoff protocol introduced a standardized, step-wise process that mandated the presence of a core team consisting of anesthesia and surgical providers, receiving PACU nurse, and, whenever possible, the OR nurse at bedside for the transfer of patient care using discipline-specific checklists to guide information exchange. 103 handoffs were observed (53 pre- and 50 post-intervention) to evaluate the impact of the new protocol. Key measures of the study were average number of defects (includes both missed information and technical transfer issues) per handoff, handoff personnel satisfaction scores, and the total handoff time. Defects were determined through direct real-time observation of handoffs, and satisfaction scores were assessed via post-handoff personnel surveys.

RESULTS: The mean number of defects per handoff was reduced from 9.68 to 2.24 ($p < 0.01$) after protocol implementation. The mean number of missed information items from surgery report was reduced from 7.57 to 1.2 items per handoff and that from anesthesia report from 2.02 to 0.94 ($p < 0.01$). Technical defects reported by unit nurses were also reduced from 0.34 to 0.10 ($p = 0.04$). Delivery of a verbal report by surgeons increased from 20% to 100%. While the total duration of handoff increased by an average of 2 minutes ($p = 0.01$), the average time from patient arrival at PACU to handoff start was reduced by 1.5 minutes ($p = 0.01$). At baseline, PACU nurses (receiving team members) were less satisfied than anesthesiologists (sending team members). Post-implementation satisfaction ratings were comparable among all the disciplines.

DISCUSSION: The perioperative handoff protocol implementation has been associated with improved information sharing, reduced handoff defects, and improved satisfaction among handoff receivers and shows promise as a national model for conducting these patient transfers.

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S-126.**SUCCESSFUL USE OF A TEST SYSTEM (EPIC POC) FOR ACHIEVING TRAINING AND COMPETENCE OF END USERS BEFORE GOING LIVE WITH ELECTRONIC ANESTHESIA RECORDS**

AUTHORS: A. Marian, M. Todd, F. Scamman, M. Anderson, E. S. Herzig

AFFILIATION: University of Iowa Hospitals & Clinics, Iowa City, IA

INTRODUCTION: The University of Iowa recently adopted EPIC Electronic Anesthesia Records. Transitioning from paper anesthesia records to electronic records required adequate preparation and thorough training of all clinical providers. Classroom training is valuable in the early stages, but has limitations including poor acceptance by clinicians, inability to cover all topics, different from real-time OR situation and limited time for hands on experience.

METHODS: We explored the possibility of the anesthesia providers using the electronic record in parallel with the paper record for several weeks before going live. Use of actual record, EPIC PROD for this would result in inaccurate or incomplete data entry into actual patients' medical records. EPIC POC (Proof of Concept) is a program that was designed for testing the system as well as to provide an arena to trial new changes. With the help of the hospital IT team, EPIC POC was transformed into a trial environment for clinicians to practice and ultimately achieve competence prior to initiating EPIC PROD.

Each clinician took part in a 2-hour classroom training session where they were given an introduction to the system. After this EPIC POC was made available for the clinicians in every OR. During the course of the day, they were instructed to make use of this system and encouraged to use the practice environment as though it was live, using fictitious patients. They had the ability to start an anesthesia record, see how the data is collected, and work through various events, staffing, attestations etc as they had time. After initial hesitation, the providers started using the system everyday. With this hands-on experience they became acclimated to the system and learned more than could have been possible in a classroom environment. This training period also provided the clinicians with the ability to provide feedback, which helped us tweak the system and make it even better. At the end of the 4-week period, all of our clinicians were proficient with the system.

RESULTS: The result of this was an unbelievably smooth go-live. Even though extensive floor support was planned and provided, most providers required little help to make the overnight transition from paper to the electronic record. Ambulatory Surgical Center was support free by the third day and the main OR did not require any extra support by the end of the first week. This allowed us to successfully go-live with satellite locations the following week.

DISCUSSION: We demonstrate the successful use of test system for training clinicians in electronic anesthesia records. Other institutions could benefit from similar training methods while implementing electronic records.

REFERENCES: N/A

S-127.**IMPLEMENTING A COMPREHENSIVE QUALITY AND PATIENT SAFETY MANAGEMENT MODEL TO MAXIMIZE CLINICAL EFFECTIVENESS IN THE PERIOPERATIVE ENVIRONMENT**

AUTHORS: L. J. Mark, K. S. Mon, J. Steppan, K. Herzer, L. Saletnik, R. Cover

AFFILIATION: Johns Hopkins Medicine, Baltimore, MD

INTRODUCTION: A comprehensive patient safety management model was developed to address the complexity of perioperative care at a large academic medical center. This model used a systems-approach to integrate 1) multiple data sources of defects, 2) a multidisciplinary team, 3) quality improvement methodology, 4) analyses of defects, and 5) proactive feedback to staff members. We report on our experience from 2005 to 2010.

METHODS: 2 primary incident-reporting systems were used: the Department of Anesthesiology and Critical Care Medicine (ACCM) Assurance Encounter Reporting and the University HealthSystem Consortium Patient Safety Net. A multidisciplinary team of physicians, nurses, administrators, nurse educators, risk managers, and human factors engineers was formed to review new incidents and events weekly on-site. A simple taxonomy was used to categorize defects, and the Lean Six Sigma (L6S) methodology was used to analyze the data. A priority score was calculated for each reported incident, and quality improvement initiatives were developed for those with the highest priorities. An online SharePoint database facilitated multimedia operations and continuous monitoring of progress.

RESULTS: Highlights of the model includes: development of 4 surgical programs using in-situ simulation (intraoperative radiation therapy, hyperthermic intraperitoneal chemotherapy, interventional pulmonary, transaxillary robotic thyroidectomy), an on-site transfusion medicine blood dispensing program, and 4 new robotics programs involving Urology, Surgery, Gynecology/Oncology and Otolaryngology-Head and Neck Surgery. We also developed: 1) the Good Catch Awards to incentivize incident reporting 2) Program in Quality, Patient Safety, and Risk Management to engage pre-medical undergraduates in patient safety research, and 3) ACCM CA3 Resident Assistant Surgical Suite Coordinator Rotation to involve residents in quality improvement initiatives.

DISCUSSION: This model used a systems approach to successfully integrate data from incident-reporting systems, empowered stakeholders from a multidisciplinary team, and utilized L6S methodologies to develop sustainable quality improvement projects to positively impact perioperative care processes.

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S-128.**RESIDENT CAREER EXPECTATIONS: A SURVEY****AUTHORS:** S. N. Johnson, M. Kameyama, J. Wasnick**AFFILIATION:** St. Luke's - Roosevelt Hospital, New York, NY

INTRODUCTION: Workforce challenges for graduating residents may change. Current opinions of future challenges were sought, with IRB approval, from resident physicians throughout the United States to determine what motivated them in choosing their medical specialty, what they expect out of their lifestyle in terms of work hours, and whether they are still optimistic about their career choice. The survey results of anesthesiology residents were particularly evaluated to determine if the opinions of anesthesiology residents differed from those of other specialties.

METHODS: With IRB approval, a 10 multiple-choice question survey was generated and distributed electronically via www.surveymonkey.com to residency programs of all specialties within the USA. The residency contact emails were obtained from the American Medical Association FRIEDA online website.

RESULTS: 516 survey responses were received. The geographic distribution of survey participants were: Northeast 29%, West 24%, Southwest 17%, Midwest 16%, and Southeast 14%. The specialty of survey participants represented were: Anesthesiology 22%, Radiology 22%, Pediatrics 17%, Emergency Medicine 10%, Orthopedic Surgery 8%, Psychiatry 8%, Internal Medicine 7%, and General Surgery 6%. In terms of the most important factor in choosing a specialty, 80% replied interest in the specialty was the most important factor. In regards to work hours and lifestyle, 64% of survey participants are planning on working part-time, with the reasons being pursuing research or a career outside of healthcare or the desire to travel. Most survey participants planned on working 50-60 hours per week (39%), followed by 27% planning on working 40-50 hours per week. In terms of practice settings, 40% would choose private practice; 39%, private practice with teaching responsibilities; and 21%, academics. 81% of survey participants were optimistic about choosing a medical career. Of the anesthesia resident responses, 81% were also optimistic about their career. Of the participants, 81% of anesthesiology residents also responded. For those not optimistic, the top 3 reasons were because of changes in reimbursement, loss of autonomy, and loan debt. In terms of their specialty choice, 85% of survey participants would choose the same specialty. The large majority that would not choose their specialty again would not choose medicine at all as a career.

DISCUSSION: Despite the ongoing changes in healthcare, most residents in all parts of the country and across different specialties are optimistic about their choice of having a medical career and their specialty. The responses of anesthesiology residents did not differ from their peers in other specialties.

REFERENCES: N/A

S-129.**IMPLEMENTATION OF A NOVEL CA3 ASSISTANT COORDINATOR ROTATION THAT EMBRACES ACGME CORE COMPETENCIES WITH FOCUS ON PRACTICE-BASED LEARNING & IMPROVEMENT AND SYSTEMS-BASED PRACTICE****AUTHORS:** V. O. Busso, K. S. Mon, M. Mirrer, Y. J. Xie, D. Schwengel, L. J. Mark**AFFILIATION:** Johns Hopkins Medicine, Baltimore, MD

INTRODUCTION: The CA3 Assistant Coordinator Rotation is a one month elective that targets ACGME core competencies with focus on practice-based learning & improvement and systems-based learning. CA3 anesthesia residents at our institution learned to manage a busy, academic surgical suite and perioperative services.

Methods: The program goals and objectives were created based on ACGME core competencies. Residents spent 3 days a week with administrative and supervisory clinical responsibilities and 2 days a week with academic time. Residents received didactic orientation to managing the surgical suite, case scheduling system and anesthesia manpower scheduling system, and finalized daily surgical schedules with anesthesia team assignments. With direct supervision, residents were empowered to coordinate the surgical suite with nursing colleagues and supervised CRNA and junior resident colleagues. Residents also participated in the weekly perioperative clinical services team meeting and were in-serviced to patient safety event reporting systems (University HealthSystem Patient Safety Net and Department of Anesthesiology and Critical Care Medicine Assurance Event Report).

RESULTS: 12 CA3 residents completed the rotation from August 2009 through June 2010. 9/12 residents completed evaluations with an average evaluation score of 5/5. 11/12 residents completed academic projects and 16 abstracts were presented at local and national meetings. 3 residents were inspired to pursue additional research time which has led to the creation of a comprehensive clinical practices compendium and the incorporation of some of their projects into the Residency Program Systems-Based Learning Course. These projects are ongoing with current classes of residents.

DISCUSSION: This novel rotation has been well received by CA3 residents and has been academically productive. Residents commented that participation facilitated their transition to an attending, and that they valued the clinical application of practice-based learning & improvement and systems-based practices they were learning.

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S-130.**THE DEVELOPMENT OF AN AIMS-BASED ALGORITHM FOR THE DETECTION OF FENTANYL DIVERSION BY ANESTHESIA PROVIDERS**

AUTHORS: I. Hofer, E. Bryson, M. Krol, C. Bodian, J. Silverstein, D. Reich

AFFILIATION: Mount Sinai School of Medicine, New York, NY

INTRODUCTION: Addiction remains a major issue in the anesthesia workplace. In addition to developing tighter controls over opioids and other drugs with abuse potential, systems must be designed to detect diversion of controlled substances as early as possible. We describe the development of a semi-automated surveillance system designed to detect fentanyl administration patterns suspicious for diversion.

METHODS: Fentanyl administration data from an AIMS recorded between July 2004 and June 2009 were analyzed. All cases were ranked based upon fentanyl dose per kg per min of anesthesia time and by primary CPT code. For each provider (attending, resident, or CRNA), the case was compared with other cases with the same primary CPT code and type of provider to assign a percentile rank. For cases with more than one provider, each provider's percentile rank was assigned separately. Using intraclass correlation coefficients, an initial analysis was conducted to determine whether providers have a consistent percentile rank regardless of CPT code. Each provider's set of fentanyl percentile ranks was then analyzed using the CUSUM procedure to detect deviations from steady state. A secondary criterion of concomitantly high median percentile rank was subsequently applied to reduce the false positive rate.

RESULTS: Our study looked at 282 providers, including three known to have diverted fentanyl. The CUSUM technique was able to "flag" all three known cases of fentanyl diversion in the study group. In addition to the three known diverting providers the algorithm identified 14 false positives and 265 true negatives. The cases of diversion were detected 0, 3, and 17 months prior to their removal from clinical practice.

DISCUSSION: The reported fentanyl diversion detection algorithm was derived so as to detect all known cases of fentanyl diversion in our study sample. There were, however, false positives in the analysis that would require approximately five investigations for every true case of diversion. Considering the consequences of undetected diversion this additional investigative effort may be justifiable, however it must be balanced with the possible consequences of investigating non-diverting providers. The CUSUM and percentile rank techniques are potentially widely applicable for screening of anesthesia practitioners for patterns of narcotic use consistent with diversion.

S-131.**DO RESIDENTS GAIN SIGNIFICANT KNOWLEDGE FROM A DIDACTIC COURSE IN TEE TAUGHT DURING RESIDENCY?**

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AFFILIATION: ¹UMDNJ-New Jersey Medical School, Newark, NJ; ²Maimonides Medical Center, Brooklyn, NY

Introduction: TEE can improve the care of patients undergoing non-cardiac surgery.¹⁻⁴ Whether to teach TEE to residents has been debated.^{5,6} A didactic TEE course was provided at 2 anesthesia departments. The study determined whether the didactic program increased residents' knowledge of TEE.

Methods: 75 residents consented for this IRB-approved study. A 40 hour curriculum for year 1 (2008-2009) included: assigned weekly reading and key points, a 5 question on-line quiz with instant grading, a DVD shown weekly corresponding to topics read, and a brief review of the DVD session with an attending experienced in TEE. Due to changes in the residency didactic program, the TEE curriculum for year 2 (2009 - 2010) was decreased to 20 hours. For some sessions, material was doubled up, but a fair amount of material from year 1 was not part of the year 2 curriculum. A 2 hour 10 minute exam was administered at the beginning of the program, after the first year, and after the second year. Alternating versions of the same exam were used. The exam was created by 3 experienced cardiac anesthesiologists, and consisted of 20 video clips (worth 1.5 points each) and 70 written questions (worth 1 point each). All questions were checked for accuracy, and "one best answer" by an expert in TEE.

RESULTS: Exam scores of CA-I, II and III's increased significantly after the 40 hour curriculum ($p = 0.0017$, 0.007 and 0.03 respectively). In contrast, after the 20 hour curriculum, CA-II scores were unchanged ($p=0.82$), and CA-III scores decreased ($p=0.004$). Scores of all residents combined increased 23.7% after the 40 hour curriculum ($p < 0.0001$), but decreased - 0.6% after the 20 hour curriculum ($p=0.15$). CA level ($p = 0.003$) and didactic hours ($p = 0.004$) both affected exam scores.

DISCUSSION: The 40 hour curriculum resulted in significantly increased exam scores, while the 20 hour curriculum did not. Low scores on the exams were expected, as the exam was designed to assess the full spectrum of TEE knowledge. We will administer the exam to individuals completing a cardiac anesthesia fellowship to determine the curve among people who experience one year of regular TEE use and education. The debate whether TEE should be taught during residency continues. Educators should consider that 40 TEE didactic hours plus assigned reading annually may be required to provide an effective didactic experience. If educators decide that residents should be taught TEE during residency, the need for time dedicated to clinical exposure to TEE must be considered as well.

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Exam Scores After 40 Hour and 20 Hour Curricula

| CA Level | 6-7/08 Baseline | 6-7/09 After 40 Hours | 6-7/10 After 20 Hours |
|----------------------|-------------------|-----------------------|-----------------------|
| Group A CA-I 08/09 | 37.7 +/- 5.5 n=16 | 47.1 +/- 11.2 n=15 | 47.2 +/- 12.7 n=14 |
| Group B CA-II 08/09 | 41.2 +/- 8.1 n=19 | 53.2 +/- 15.6 n=19 | 43.4 +/- 9.6 n=17 |
| Group C CA-III 08/09 | 45.9 +/- 4 n=17 | 56 +/- 11.7 n=10 | p=0.03 |

S-132.**EXPERIENCE IN FOUR-WEEK ANESTHESIOLOGY TRAINING WAS NOT SUCCESSFUL IN REDUCING MENTAL STRESS RELATED TO INTUBATION**

AUTHORS: M. Tomita,¹ M. Fukumoto,² T. Azami,¹ Y. Mizuochi,¹ H. Kohmura¹

AFFILIATION: ¹Department of Anesthesiology and Medical Crisis Management, Nagoya City University Graduate School of Medical Sciences, Nagoya, Japan; ²Okazaki City Hospital, Okazaki, Japan

INTRODUCTION: Tracheal intubation is an essential procedure for medical interns. In Japan, a four-week anesthesiology rotation is required of medical interns in the first year. We investigated whether four-week anesthesiology training increased intubation success rate and reduced mental stress related to intubation.

METHODS: The subjects were fifteen first-year interns and nine second-year interns. First, we conducted a questionnaire survey on intubation success rate and the stress of intubation before anesthesiology training. Second, we investigated rate of success rate with intubation and mental stress related to intubation during anesthesiology training. Intubation cases were allocated randomly, and intubation success rate and Cormack grade were examined. In order to evaluate the psychological state of interns objectively, we measured salivary α -amylase (α AMY), which reflects mental stress. We confirmed an increase in α AMY with stress by comparing values of α AMY in various situations: not only before intubation, but also prior to, during, and after their anesthesia training as a non-stressful situation. We examined the relationship between increase in α AMY and the status of interns' acquisition of intubation technique.

RESULTS: The questionnaire survey before training showed that first-year interns had experienced tracheal intubation only five times on average, that their intubation success rate was around 50%, that tooth and lip injury were common when they performed this procedure, and that they all felt anxious about intubation technique. In addition, during anesthesiology training, intubation success rates were 76.6% for first-year interns and 86.2% for second-year interns ($P=0.021$). Furthermore, there was a significantly higher number of cases judged Cormack grade I for second-year interns than for first-year interns ($P=0.031$). On the other hand, no significant change was noted α AMY due to experience ($P=0.499$), and there was no correlation between α AMY and intubation success rate.

DISCUSSION: We expected that our four-week anesthesiology training would improve intubation success rates and relieve anxiety related to intubation technique in association with increase in intubation success rate. However, although intubation success rate was obviously improved, mental stress related to intubation was not reduced. The reason for this appeared to be that four-week training was insufficient to gain confidence with intubation. Longer anesthesia training may thus be needed in internship. Experience in four-week anesthesiology training improved intubation success rates, but was not successful in reducing mental stress related to intubation.

REFERENCES: N/A

S-133.

WITHDRAWN.

S-134.**WATCHING A MOVIE UNDER REGIONAL ANESTHESIA REDUCES DRAMATICALLY PROPOFOL CONSUMPTION****AUTHORS:** W. Tom, A. Rosenbaum**AFFILIATION:** University of California Irvine Medical Center, Orange, CA

INTRODUCTION: Multiple studies showed the benefits of music in reducing anxiety during surgery under regional anesthesia.¹ We hypothesized that watching a movie compared to music may have a superior anxiety reduction effect. To quantify the anxiety level during the surgery we used propofol patient controlled sedation (PCS),² similar in principle to patient controlled analgesia (PCA). In addition to the primary hypothesis, we examined the possibility that there is a correlation between preoperative anxiety and the propofol consumption. We were hoping that answering these two questions will assist us with improving patient perioperative experience.

METHODS: After an IRB approval, we studied 17 patients under regional anesthesia, assigned randomly to 3 groups: first group listened to music during the surgery; second group watched a movie using video goggles and the third group had neither. The movies and the music were pre-selected as to patient preferences. At least 30 minutes prior to the surgery each patient was asked to answer the Amsterdam Preoperative Anxiety and Information Scale (APAIS) questionnaire. All patients were instructed to use the self administered propofol pump as needed. The pump was programmed to a demand dose of 100 mcg/kg and lock-up interval of 5 minutes without basal infusion.

RESULTS: Average propofol consumption was 9.0 ± 4.6 mcg/kg/min, 1.5 ± 2.2 mcg/kg/min and 4.7 ± 0.6 mcg/kg/min for the music, movie and control group respectively. Median consumption was 0.0 mcg/kg/min, 5.98 mcg/kg/min and 4.22 mcg/kg/min respectively. Using Kruskal-Wallis one way analysis of variance showed a statistically significant difference between the groups ($P=0.013$). The median APAIS score was 12 (maximum allowable score was 30). No correlation was found between the APAIS score and the propofol consumption.

DISCUSSION: This study shows that watching a movie has a beneficial effect in reducing patient anxiety. This can be attributed to higher level of attention distraction during the surgery. Surprisingly, the propofol consumption was higher in the music group compared to the control group. This finding can be attributed to the small sample size. In addition to the primary conclusion, we observed the benefits of using propofol PCS; it may have the advantage of reduced propofol consumption compared to continuous infusion, resulting in higher safety margin, shorter recovery time and increased patient satisfaction. Further studies are required to assess this observation.

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S-135.**THE EFFECTS OF PRE-OPERATIVE, VIDEO-ASSISTED ANESTHESIA EDUCATION IN SPANISH ON SPANISH-SPEAKING PATIENTS' ANXIETY, KNOWLEDGE AND SATISFACTION-PILOT STUDY****AUTHORS:** A. M. West,¹ E. Bittner,² V. E. Ortiz²**AFFILIATION:** ¹Harvard Medical School, Boston, MA; ²Massachusetts General Hospital, Boston, MA

INTRODUCTION: The time preceding an operation is marked by uncertainty and angst, particularly when communication barriers exist between the patient and the healthcare professional. Language barriers can lead to miscommunication, mistrust, avoidance of medical care and heightened anxiety about the unknown. As medical interpreter services are scarce, patients who opt to use family members as interpreters may not receive the exact message that is intended from the medical team. Video instruction has proven to be effective in many aspects of health care.¹ In studies where language barrier does not exist, it has been shown that the addition of video instruction to a pre-anesthesia interview increases patient knowledge about procedures and lowers pre-operative anxiety.^{2,3} We studied the effect of an instructional video in Spanish on self-reported anxiety, knowledge about general anesthesia procedures and satisfaction with the preoperative anesthesia process in patients requiring a Spanish interpreter.

METHODS: Twenty consecutive, Spanish-speaking patients scheduled to undergo surgery under general anesthesia were randomized to group V (video) or group NV (no video). Using a 1-10 scale, all patients were asked in Spanish to describe their anxiety associated with general anesthesia, knowledge about anesthetic procedures, and satisfaction with the information about general anesthesia they had received in the preoperative clinic. On the day of surgery, all patients had the routine pre-anesthesia interview involving use of a medical interpreter or family member. Prior to this interview, group V saw a three-minute educational video explaining in Spanish the procedures, risks and benefits accompanying a general anesthetic. Both groups were then asked the same questions about anxiety, knowledge, and satisfaction. Pre and Post- interview changes in anxiety, knowledge and satisfaction scores were compared between the V and NV groups using the Wilcoxon Rank Sum test. The level of significance was set at $p < 0.05$.

RESULTS: The study included 20 patients; Median age 53.9 ± 16.8 ; 65% female; 80% literate. There was a significant reduction in anxiety score in patients who viewed the video compared to those who did not (median reduction 2 vs 0, $p=0.020$). There was an increase in satisfaction score in the video group (median increase 2 vs 0, $p=0.046$). There was no difference in reported knowledge improvement score between the 2 groups (3.5 vs 4, $p=0.908$).

DISCUSSION: In Spanish speaking patients, the addition of an instructional video in Spanish to a pre-anesthesia interview decreases anxiety and increases satisfaction.

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S-136.**MATCHING DISEASES AND MEDICATIONS USING CLUSTER ANALYSIS**

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INTRODUCTION: Using a card-sorting simulation, we have discovered that clinicians order diseases and medications in reproducible patterns, and that these patterns appeared to be based on disease pathophysiology. We explored the spatial relationships between conditions and medications, and how these help define what MR might be in the context of medical care. Our hypothesis was that, by using cluster analysis, we could uncover strong and weak spacial relationships between condition and medication cards that would support this hypothesis.

METHODS: Clinicians practicing in a department of anesthesiology and critical care, whose work involves MR were asked to arrange the cards in a way that made sense to them in the clinical context of pending surgery and pre-anesthetic evaluation. Each participant had 10 disease cards and 11 medication cards, forming 110 disease-medication pairs. We calculated the Mean of the Adjusted Distances across all participants (MAD), a number from 0 to 1 representing relative distance. We then did a cluster analysis on the MAD of each pair, across all subjects, clustering into 4 clusters (to represent an ordinal scale of near to far).

RESULTS: The cluster analysis revealed 4 clusters based on MADs of 0.30, 0.44, 0.59 and 0.73. Table 1 illustrates the relationships. We found a match between the cards allocation into clusters and their clinical meaning. Diseases and drugs associated with the same organ system frequently allocated to the same cluster. Clusters were found for cardiovascular, psychiatric and pulmonary systems.

DISCUSSION: Our results suggest that medications and conditions share complex group relationships that are likely used by clinicians to build cognitive strategies, using their own opinions and conceptual understanding of disease physiology, for approaching medical care. These common strategies are a starting point for defining MR. These analyses corroborate and enhance our previous results and strongly suggest that clinicians think about medications in the context of diseases. Diseases have a socio-technical hierarchy, mostly in terms of organ systems. This model may be a useful one for testing interventions to improve the process' reliability.

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| | Aspirin | Atorvastatin (Lipitor) | Clidogrel (Plavix)* | Digoxin (Lanoxin) | Diltiazem | Potassium Chloride |
|---------------------------|---------|------------------------|---------------------|-------------------|-----------|--------------------|
| Atrial Fibrillation | 0.590 | 0.440 | 0.440 | 0.300 | 0.300 | 0.440 |
| Coronary Artery Disease | 0.440 | 0.440 | 0.440 | 0.300 | 0.300 | 0.590 |
| Hypertension | 0.440 | 0.440 | 0.300 | 0.300 | 0.300 | 0.440 |
| Myocardial Infarction (1) | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.440 |
| Myocardial Infarction (2) | 0.300 | 0.300 | 0.300 | 0.300 | 0.300 | 0.440 |

Cluster analysis subset-cardiovascular conditions and medications. All but 2 pairings sort in the top 2 clusters. 6 pairs are in the highest cluster.

S-137.**A TEAM-ORIENTED MULTIDISCIPLINARY APPROACH TO EMERGENCY AIRWAY TRAINING USING HIGH-FIDELITY SIMULATION**

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INTRODUCTION: There is established evidence that effective teamwork, communication, and coordination among health care providers play a pivotal role in improving patient outcomes, reducing medical error, and preventing adverse patient care events. In 2001, the Joint Commission published patient safety standards calling for the promotion of a collaborative multidisciplinary approach to patient care through formal teamwork training.

Methods: In response to a series of airway-related sentinel events within our institution, we developed a multidisciplinary emergency airway management course for anesthesiology, emergency medicine, general surgery, and otolaryngology resident physicians. The full-day course is conducted by faculty members representing each specialty, and comprises lectures, simulation, and skills training. Small groups comprised of participants from each specialty interact in high fidelity simulations designed to reinforce technical and communication skills.

RESULTS: Over 100 residents have participated in the multidisciplinary course to date, and participation has been extended to fellows. Over 80% of participants rated the course as "very good" or "excellent".

DISCUSSION: Emergency airway is a life-threatening clinical situation that requires effective communication and coordination between medical professionals with various areas of expertise. Berkow et al recently proposed that an airway educational program include all members of the health care team and incorporate crisis management skills and team-building. Our institution created a multidisciplinary course to foster the development of teamwork, coordination and communication strategies necessary to manage the complex airway situations. This training program addresses the Joint Commission recommendations for formal teamwork training via a collaborative multidisciplinary approach.

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Table 1: Contents of Multidisciplinary Airway Course

| Lecture Topics | Simulation | Skills Training |
|-----------------------------|------------------|------------------------------------|
| Airway Assessment | Difficult Airway | Bag Mask Ventilation |
| Airway Techniques | Trauma Airway | Direct Laryngoscopy |
| Trauma Airway Management | Pediatric Airway | Tracheal Tube Introducers |
| Pediatric Airway Management | | Supraglottic Airways |
| Team Training | | Fiberoptic Intubation |
| Decision Making | | Holinger Scope Intubation |
| | | Glidescope Intubation |
| | | Cricothyrotomy (Pig Trachea Model) |

S-138.**A STANDARDIZED PATIENT SAFETY MODEL FOR INTRODUCING NOVEL TECHNOLOGY INTO THE OPERATING ROOMS AT AN ACADEMIC TERTIARY CARE MEDICAL CENTER**

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INTRODUCTION: Transaxillary robotic assisted thyroid surgery (TART) provides a novel approach for performing thyroidectomy. Potential advantages of TART include: less postoperative dysphagia and a more favorable cosmetic result due to lack of an anterior neck scar. As novel technology moves from the stages of early innovation to clinical practice, several questions must be addressed regarding the associated risks, improvement in clinical care, and cost effectiveness. A standardized model for managing patient safety is essential for navigating the hidden risks found in any new technology. Our institution developed a multidisciplinary model that prospectively identifies and mitigates potential hazards for patients and caregivers when introducing new technology into the perioperative setting.

METHODS: Surgery, anesthesia, and nursing staff performed in situ simulation using a low-fidelity, full-scale mannequin to identify potential patient safety risks and implement process improvement for TART (Figure 1).

Results: Several defects were identified using in situ simulation: positioning of the patient's arm to optimize surgical exposure and minimize risk for brachial injury (swimmer's arm position), recommended equipment for arm positioning, and credentialing processes for surgical staff.

DISCUSSION: TART offers potential advantages over other well-described techniques. However, before applying this approach, in situ simulation identify areas that must be addressed by a multidisciplinary team of surgeons, anesthesiologists, nurses, risk management, hospital credentialing board members, and a consulting national expert. This standardized patient safety model using in situ simulation led to the implementation of TART procedural standards at our institution, including: modified arm position, application of brachial plexus sensory evoked potential monitoring during the initial cases (Figure 2), altered patient selection criteria, and new training/credentialing standards for surgical staff. These modifications were employed prior to the first live procedure and are examples of how a standardized systems approach with in situ simulation can optimize the implementation of novel technology in the OR setting.

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Figure 1. In-situ Simulation of Robotic Transaxillary Thyroidectomy



Figure 2. Intraoperative arm positioning and neuromonitoring of brachial plexus

S-139.**USE OF AN IPAD BASED CURRICULUM TO IMPROVE HOUSESTAFF EVALUATIONS OF EDUCATION DURING A ROTATION IN ANESTHESIA FOR ORTHOPEDICS****AUTHORS:** P. P. Tanaka, K. Hawrylyshyn, A. Macario**AFFILIATION:** Stanford University, Stanford, CA

INTRODUCTION: Many current residents learn and interact with the world in a fundamentally different way than previous generations and express a preference for the use of technology while learning. The goal of this study was to compare scores on housestaff evaluations of “overall teaching quality” during a two-week rotation in anesthesia for orthopedics before and after implementation of an iPad (Apple, Inc, Cupertino, Ca) based curriculum.

METHODS: At the beginning of the rotation, the resident was given an iPad containing the rotation syllabus, reading assignments, articles of interest, and problem based case discussions. Prior to the study these materials were handed in a printed binder. The iPad served as a roadmap for self-directed learning, provided a virtual forum for stimulating discussion, and guided the discussion in the OR with the attending of each day’s assigned reading. At rotation’s end, the resident performed a literature search pertaining to an anesthesia related question encountered during the rotation and submitted this summary to the collection of resources available in the iPad. Quantitative course evaluations completed anonymously via the institution’s residency online software (<http://www.medhub.com/>) as well as qualitative feedback were compared pre and post introduction of the iPad curriculum.

RESULTS: On a scale from 1 (unsatisfactory) to 5 (outstanding), the global rating of the rotation as assessed by “overall teaching quality of this rotation” increased from 4.18 (SD 0.8) (N=11 before intervention) to 5.0 (SD 0) (N=4 after intervention) $p=0.045$. Scores for sub dimensions such as “Goals of the rotation were defined” increased from 3.91(0.9) to 4.75(0.4), “Goals of the rotation were achieved” increased from 3.91(1.0) to 4.5(0.5), “Quality of the syllabus increased from 4.09(0.7) to 4.75(.4), and “Teaching not directly involved with case management” increased from 4.00(0.9) to 5.0(0). The main benefits cited of the intervention were: portability of large amounts of information into the OR, more dynamic interaction with attendings in the OR, and stimulation of self-directed learning.

DISCUSSION: Residents responded favorably to the introduction of an innovative iPad based curriculum and active learning in the orthopedic anesthesia rotation. Medical educators today have new tools that could transform modes of traditional medical education. More studies are needed to show how mobile computing such as tablets can enhance learning, especially since residents work at multiple locations, have duty hour limits, and the need to document resident learning in six ACGME core competencies.

REFERENCES: this abstract is the first reference about this innovative use of the iPad.

S-140.**VALIDITY OF A COMPUTER MODEL OF PHYSIOLOGY AS A TOOL FOR CLINICAL STUDIES****AUTHORS:** E. D. Curley, C. R. Sims, R. L. Hester, T. A. Allingham, L. Delima**AFFILIATION:** University of Mississippi Medical Center, Jackson, MS

INTRODUCTION: Computer models of human physiology allow human studies to be conducted at reduced costs and decreased harm to humans. HumMod is a Windows-based mathematical model of integrative human physiology.¹ This study aims to validate HumMod by determining if the cardiovascular and metabolic responses to isovolemic hemodilution in human subjects are consistent with a published study by Weiskopf et al., 1998.²

METHODS: We subjected our “patient” to a series of isovolemic hemodilutions as described by Weiskopf. After each 10 g/L reduction in hemoglobin the same cardiovascular parameters as presented in the paper were recorded.

RESULTS: Isovolemic hemodilution resulted in a decreased systemic vascular resistance and oxygen transport with an increased heart rate, stroke volume and cardiac output, similar to that observed in the clinical study. Oxygen consumption and lactate remained stable (see chart).

DISCUSSION: The results obtained using HumMod correlate with those from human subjects. Any differences between our computer model and the human subjects are likely due to variation in population dynamics in the clinical study. Integrative simulation advances our understanding of testable physiologic scenarios and allows us to perform studies which would not be ethical to perform in human subjects.

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S-142.**APPLICATION OF 2007 ACC/AHA GUIDELINES ON PERIOPERATIVE CARDIOVASCULAR EVALUATION AND CARE FOR NON-CARDIAC SURGERY USING DECISION SUPPORT TOOLS**

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INTRODUCTION: We previously demonstrated that anesthesiology residents, as well as practicing anesthesiologists, do not correctly apply the 2007 ACC/AHA Guidelines on Perioperative Cardiac Evaluation and Care for Noncardiac Surgery¹ when evaluating simulated patients in common clinical scenarios.² To determine the impact of decision support aids on residents' application of the American College of Cardiology/American Heart Association (ACC/AHA) guidelines, we conducted a multi-program, multi-arm study. We then estimated the percentage change in anesthesiology residents that correctly apply the testing algorithms based on their use of decision support aids.

METHODS: In this multi-center study (24 anesthesiology training programs), we assessed the use of a web-based decision support tool to determine how well anesthesiology residents could apply the ACC/AHA guidelines. We randomly assigned consenting residents to 1 of the 3 study groups: Control, User-Initiated Decision Support (UIDS) or Computer-Assisted Decision Support (CADS). Residents evaluated 6 clinical scenarios with 5 possible recommendations per scenario.

RESULTS: The 386 resident participants included PGY-1s (preliminary year before anesthesia training), CA-1s (first year of anesthesia residency), CA-2s (second year) and CA-3s (third year). Level of training was not associated with likelihood of selecting the correct recommendation. Residents in both decision support arms were significantly more likely than residents in the control group to apply the correct recommendation regarding appropriate care as defined by the ACC/AHA guidelines (i.e., User-initiated vs. Control: 66% [95% CI 55-75] vs. 47% [95% CI: 36-59]; $p < 0.001$) and Computer-assisted vs. Control: 73% [95% CI 62-81] vs. 47% [95% CI: 36-59]; $p < 0.001$). See Tables.

DISCUSSION: Our findings demonstrate that decision support tools increase residents' application of national standard of care guidelines for cardiac evaluation of patients anticipating noncardiac surgery, irrespective of training level. Integrating decision-support aids into clinical practice is a logical next step to facilitate appropriate preoperative care of patients.

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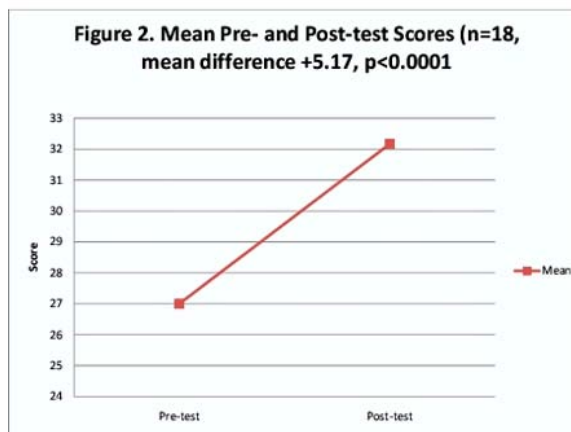
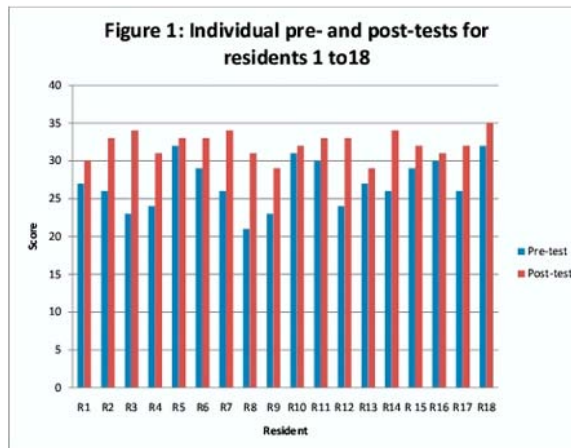
S-143.**ONLINE TEACHING MODULES ON MANAGEMENT OF PEDIATRIC TRAUMA IMPROVE KNOWLEDGE IN SENIOR ANESTHESIOLOGY RESIDENTS****AUTHORS:** S. M. Bhananker, A. Zeng, R. Ghazvinian, S. Sharar**AFFILIATION:** University of Washington School of Medicine, Seattle, WA

INTRODUCTION: Teaching pediatric trauma management to anesthesia residents can be challenging given their sporadic clinical exposure and limited textbook discussions in this area. Pediatric trauma anesthesia faculty from Harborview Medical Center (Seattle, WA), designated Level I Pediatric Trauma Center for Washington state and the surrounding multi-state WWAMI region, developed a 7-module, online curriculum in the acute assessment and management of pediatric trauma patients (<http://depts.washington.edu/pedtraum/>) to meet the Pediatric Education Requirement (PER) required of all health care providers in adult- and pediatric-trauma centers who may participate in the early care of injured children in Washington state. The curriculum is free of charge and may be effective in improving medical knowledge of busy anesthesiology residents in pediatric trauma management

METHODS: Twenty CA-2 (Clinical Anesthesiology-2) and CA-3 residents who have completed their standard pediatric anesthesiology (non-trauma) rotations volunteered for the study. They first took a pre-test consisting of 35 multiple choice questions on pediatric trauma management. Then they were given up to 20 weeks of time to study the online curriculum at their own pace before taking a post-test consisting of the same questions in a different order. The pre/post-tests were administered either electronically or on paper. Residents were blinded to their test scores. The mean pre- and post-test scores were compared using paired t-tests to assess change in medical knowledge of pediatric trauma with the educational intervention.

RESULTS: To date, 18 CA-2 and CA-3 residents have completed the online curriculum and pre/post-tests. Post-tests for the remaining 2 residents are pending. Preliminary data for individual and mean pre- and post-test scores are shown in Figure 1 and Figure 2, respectively. The difference in mean pre-test score (27.00) and post-test score (32.17) is +5.17 [95% confidence interval 2.56 to 6.78], $p < 0.0001$.

DISCUSSION: Overall our data show a significant improvement in the didactic knowledge of pediatric trauma in senior anesthesiology residents after completing a focused online curriculum. The curriculum is especially helpful in narrowing knowledge gaps that still remain after routine pediatric anesthesia and adult trauma care rotations. Additionally, the curriculum was completed by residents in a non-time-sensitive way at no monetary cost. The curriculum may have similar educational value for other health care providers who have limited experience in caring for acutely injured children.

REFERENCES: None

S-144.**IMPROVING PERIOPERATIVE EXPERIENCE AND PATIENT EDUCATION FOR PATIENTS UNDERGOING BONE MARROW HARVEST PROCEDURES**

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AFFILIATION: ¹Johns Hopkins Medicine, Baltimore, MD; ²Johns Hopkins University, Baltimore, MD

INTRODUCTION: Annually, about 100 outpatient bone marrow harvests (BMH) are performed at our institution. Within the framework of system-based improvement efforts, we analyzed the impact of spinal vs general anesthesia on process efficiency in patients undergoing BMH. This initiative was triggered by a patient complaint that the oncology patient education brochure did not reflect current institutional or national anesthesia practices.

METHODS: A multidisciplinary team of BMH providers, anesthesiologists, and nurses reviewed the patient education brochure. It stated that most BMH procedures were performed with local anesthesia. Anesthesia records of BMH patients before the complaint were reviewed (8/2007 to 7/2009). Our spinal anesthesia rate (14%) was below the national average of 20%. System-based improvements included: 1) Revise the patient brochure to reflect institutional and national practices, and 2) Encourage BMH and anesthesia providers to offer patients the choice of spinal versus general anesthesia. After the system-based initiative, we reviewed all anesthesia records of patients undergoing BMH from 1/2010 to 12/2010.

RESULTS: 294 patients underwent BMH during the periods studied: 187 from 8/2007 to 7/2009 (mean age 46±1.2 yrs) and 104 during 2010 (mean age 40±1.7 yrs). After the intervention in 9/2009, spinal anesthesia increased from 13.90% to 33.65% without significantly changing the patient length of stay (LOS) in the postanesthesia care unit (PACU, 352±10 min vs. 382±14 min). The amount of harvested bone marrow was not significantly different (1027±27 ml vs 960±40 ml). Of note, patients received significantly more crystalloids intraoperatively (2539±108ml vs 3397±400ml). While there was no change in the administration of banked donor packed red blood cells (units per year: 13.5 vs 13.0), there is an increase in autologous blood transfusions (44% vs 62%).

DISCUSSION: Concordance of patient educational brochure and anesthetic choices offered by the anesthesiologist led to an increased selection of spinal anesthesia, without increasing LOS in PACU. Future systems-based initiatives will target perioperative fluid resuscitation, postoperative nausea and pain scores to further streamline recovery and early ambulation, decrease PACU LOS, and increase patient satisfaction.

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S-145.**EQUIPMENT AVAILABILITY AND PATIENT SAFETY STUDY**

AUTHORS: J. Kraidin, S. H. Ginsberg, A. Amponsah, A. Solina

AFFILIATION: UMDNJ-Robert Wood Johnson Medical School, New Brunswick, NJ

INTRODUCTION: Recent advances in patient safety have been facilitated by availability of functional medical equipment; the lack thereof has led to incidents of patient morbidity or mortality. A statement issued by ASA recommends that standards and protocols should be instituted in order to ensure the inter-operability of medical devices.¹ The aim of the study is to provide a basis of comparison for practice patterns and institutional support.

METHODS: Hospital IRB approval was obtained. Surveys were e-mailed to academic chairs of 133 US medical schools, to inquire about infrastructural support afforded to peri-operative sites. Data was collected anonymously and analyzed.

RESULTS: Of 133 surveys mailed, 62 were returned. This was a 50% response rate. The median, quartiles and range of data were calculated. We found between 2 and 20 ultrasound (US) devices were available at institutions. A wide range of number of cases per US device (3.29- 62.82) was noted. There was a median of 8 main ORs/dedicated glidescope; 3 sites reportedly had no glidescopes. Over 25% of Chairs reported safety issues due to lack of immediate access to a glidescope. Over 70% of sites stated that their main ORs were better stocked than their offsites.

DISCUSSION: Ultrasound devices are commonly used to assist with accuracy and safety of performing peripheral nerve blocks. They are also used during various vascular procedures, eg. central line placement. Research shows that US is efficacious to adding safety by decreasing complications and shortening time of insertion of central lines.² Glidescopes have conventionally been employed to manage difficult airways. One could argue that they should be readily available as part of an airway algorithm; yet they are not available at all institutions. Over 25% of Chairs reported that lack of immediate access to Glidescopes has led to safety issues. This study also found a wide range of availability of other airway devices such as fiberoptic scopes. The survey reports that majority of the chairs believe their main ORs were better stocked than "offsite" locations. This is unfortunate because the "off sites" often manage difficult cases with limited equipment. This data should help toward comparing your institution with those throughout the country. It might enable you to change the way you practice and help in negotiating for essential equipment.

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S-146.**SIMULATION-BASED INTERVIEWS FOR SELECTION OF ANESTHESIOLOGY RESIDENCY CANDIDATES**

AUTHORS: S. L. Lin, D. R. Raphael, C. Canales, S. L. Strom, Z. Kain

AFFILIATION: University of California, Irvine, Orange, CA

INTRODUCTION: Selection of anesthesiology residency candidates in the United States is currently based on traditional personal interviews. However, the use of traditional interviews to evaluate non-cognitive domains has poor predictive validity, while high predictive validity has been demonstrated using multiple mini-interviews. Patient simulation reliably distinguishes the performance of anesthesiology resident trainees based on years of clinical experience. As simulation may reveal further insight into communication skills, ability to learn, and critical thinking skills, we implemented simulation-based interviews for anesthesiology residency candidates to determine the acceptability of this format and correlation with traditional interviews.

METHODS: Anesthesiology residency candidates at University of California, Irvine were consented for this IRB-approved study. Students were informed that simulation interview performance would not be disclosed to the residency selection committee. Each student received individual teaching by CA-3 anesthesiology residents and staff during an ultrasound-guided central line simulation using a simulator and standardized patient, a transesophageal echocardiography (TEE) simulation, and a fiberoptic simulation. Students were evaluated on the 6 ACGME core competencies using a 7-point scale (1=lowest score; 7=highest score).

RESULTS: Fifty-five out of 62 medical students (89%) interviewing for anesthesiology residency at University of California, Irvine were enrolled in this study to date. Of the possible 42 points, the average candidate score was 32 for the central line simulation, 34 for the TEE simulation, and 32 for the fiberoptic simulation. Resident scores in all 3 simulation interviews demonstrated a strong correlation with scores from traditional interviews ($r = 0.62$, $p < 0.02$). On follow-up survey, 93% of interviewees reported that the simulation-based interview was an enjoyable part of the interview day, 78% of interviewees reported being able to accurately portray their abilities, and 71% of applicants reported that the simulation-based interview provided a positive impression of the teaching resources in the residency program. Data collection is ongoing.

DISCUSSION: Our study demonstrates that simulation-based interview scores correlate with standard interview scores and may evaluate additional candidate qualities. Simulation-based interviews are an acceptable format for evaluation for anesthesiology residency candidates. Residency programs will benefit from future studies on whether simulation performance is predictive of clinical performance during residency.

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S-147.**EVALUATION OF ANESTHESIOLOGY RESIDENT PERFORMANCE BASED ON BEHAVIORAL CHARACTERISTICS**

AUTHORS: C. Canales,¹ J. Rinehart,¹ N. Kudrick,¹ M. A. Fortier,¹ S. Edelstein,² Z. Kain¹

AFFILIATION: ¹University of California-Irvine, UCI Medical Center, Orange, CA; ²Loyola University Medical Center, Maywood, IL

INTRODUCTION: Predicting which residency applicants will be successful during their training is difficult to determine based on cognitive evaluations (board scores, medical school grades, and etc.).¹ Interview scores and cognitive measures have shown to correlate poorly with overall performance in residency.^{1,2} The aim of our study was to correlate specific, observable resident behaviors with overall resident performance and evaluate whether behavioral characteristics have better predictive value.

METHODS: After IRB approval, the study was conducted in two academic institutions. First, faculty who evaluate residents in their own program were recruited to complete a survey where they were asked to rank the senior class of residents from "best" to "worst" in terms of how closely they approach "the ideal anesthesia resident." Faculty were then asked to complete a 27 item survey of specific behavioral characteristics on each senior resident. The items were categorized into 6 general categories: interpersonal skills, data monitoring, response to teaching, preparedness, technical skills, and emergency situations. The ratings were done on a 5 point Likert scale (1 least likely to possess a characteristic and 5 most likely) for each behavioral characteristic. Bivariate correlations between ranking of an ideal candidate and specific characteristics were analyzed.

RESULTS: Twenty residents were ranked at their respective institutions (12 and 8) by a total 21 faculty (10 and 11). Faculty ranked the top quartile and bottom quartile residents almost universally. Middle of the road residents were difficult to differentiate. Residents ranked in the first quartile of their class were more likely to be prepared, and have good interpersonal skills. Although still ranked high in the top quartile residents, data monitoring and technical skills were less important. Specifically, being self reliant was least important while having positive interactions with patients and other healthcare providers was most important. Residents in the bottom quartile were less likely to be prepared, had poor interpersonal skills, and have poor demeanors during emergencies.

DISCUSSION: Residents ranked at the top of their program by the displayed similar characteristics in terms of preparation and interpersonal skills. Residents ranked at the bottom on their program were more likely to lack those behavioral characteristics. Further study on the predictive value of the characteristics is necessary.

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S-148.**BURNOUT AND COPING STRATEGIES AMONGST ANESTHESIOLOGISTS IN A US METROPOLITAN AREA: A PILOT STUDY****AUTHORS:** R. L. Downey, R. Schumann, T. Farhat**AFFILIATION:** Tufts Medical Center, Boston, MA

INTRODUCTION: Anesthesiology has evolved into a complex specialty, often caring for medically complicated older patients, in an environment characterized by growing production pressures. The importance of wellbeing and a balanced lifestyle to prevent clinician burnout and to improve patient safety and outcomes has been increasingly recognized. We conducted this study to assess burnout and coping strategies in anesthesiologists in a metropolitan area of the Northeastern US.

METHODS: Following IRB approval, an anonymous online questionnaire including the validated Maslach Burnout Inventory and a coping strategy assessment was distributed via email to Boston area anesthesiologists. Univariate and multivariate analyses were used to examine correlations between burnout, demographic variables, and coping strategies (SAS version 9.2, Cary, NC). A *p* value of < 0.05 was significant.

RESULTS: Of 57 respondents to the survey, burnout in the 3 dimensions of emotional exhaustion, low personal achievement and depersonalization were found in 61%, 65% and 32% of anesthesiologists respectively. High work load perception (*p*=0.0001), younger age (*p*=0.002), number of years in practice (*p*=0.0009) and academic practice (compared to private) correlated with a high degree of burnout. Coping behaviors among burned out respondents were more avoidant and emotion-focused (Table 1).

DISCUSSION: Burnout of anesthesiologists in this study was characterized by emotional exhaustion, linked to workload, and low personal achievement, experienced more frequently by married physicians with children and those in academic practice. Associations existed between burnout and perceived severe workload, younger age, and moderate number of years in practice (5-15 years). Active coping strategies involving planning and reassessment of stressors as a source of personal growth were used by older, more experienced and less burned out anesthesiologists. Boston anesthesiologists had a greater sense of personal achievement than prior national and international studies, a characteristic that was also linked to positive coping mechanisms. Depersonalization was linked to moderate number of years in practice and negative coping strategies. Systematic approaches to prevent, identify and treat burnout, as well as studies examining possible correlations between burnout and patient outcomes are needed.

References: N/A

Table 1. Mean responses to coping questions

| Question | Mean (SD) | N |
|--|-------------|----|
| I make a plan and follow it. | 4.92 ± 1.48 | 52 |
| I wish the situation or problem would go away and would not happen. | 2.81 ± 1.89 | 52 |
| I try to forget the situation. | 2.10 ± 1.95 | 51 |
| I talk to someone about how I feel. | 3.74 ± 1.79 | 54 |
| I am growing as a professional and as a person. | 4.83 ± 1.49 | 52 |
| I criticize and lecture myself. | 3.51 ± 1.70 | 51 |
| I avoid people and avoid talking about it. | 1.29 ± 1.52 | 52 |
| I exercise. | 4.11 ± 1.76 | 52 |
| I make myself feel better by engaging in activities that I later regret. | 0.47 ± 0.88 | 51 |

Response options: 0 = never, 1 = a few times a year, 2 = once a month or less, 3 = a few times a month, 4 = once a week, 5 = a few times a week, 6 = every day SD: standard deviation, N: number of participants

S-149.**PROSPECTIVE VALIDATION OF THE SURGICAL APGAR SCORE****AUTHORS:** K. Gorman,¹ D. Ong¹**AFFILIATION:** ¹Department of Anesthesia, University of Saskatchewan, Saskatoon, SK, Canada; ²Clinical Research Support Unit, University Of Saskatchewan, Saskatoon, SK, Canada

INTRODUCTION: Perioperative healthcare teams continue to lack an accurate, objective tool predictive of postoperative complications. A 10-point Surgical Apgar Score (SAS), developed to identify patients at high risk of postoperative complications¹, has been retrospectively validated in multiple surgical populations.^{2,3} We sought to prospectively evaluate the ability of this score to predict postoperative complications. Additionally, we wished to assess whether incorporating the American Society of Anesthesiologists classification into the SAS, coalesced to form a 15-point Postoperative Morbidity Score (PMS), improved the accuracy of this prognostic tool.

METHODS: This study was approved by the local research ethics board. In a prospective observational study over a 13-month period, a convenience sample of 121 patients undergoing major surgery was preoperatively recruited. The intraoperative variables used to calculate the SAS and PMS were collected during surgery, allowing immediate postoperative calculation of these scores, which were then evaluated against the incidence of major postoperative complications.

RESULTS: Twenty-two patients (19%) experienced a major complication within 30 days of surgery. Patients with a lower PMS or SAS had a higher risk of postoperative complications. Among the 14 patients with a low PMS (1-7 points), 11 patients (79%) had a major postoperative complication, whereas only 1 of the 60 patients (1.7%) with a high PMS (11-15 points) suffered a major complication. Patients with a high versus a low SAS were less likely to experience complications (95% CI 0.002-0.062, OR=0.010, *p*<.0001), as were patients with a high versus a low PMS (95% CI 0.001-0.049, OR=0.005, *p*<.0001). The PMS did not show an improved ability to predict postoperative outcomes over the SAS.

DISCUSSION: In patients undergoing major surgery, both the PMS and SAS prospectively predicted major postoperative complications. These prognostic tools provide an objective form of communication to all members of the postoperative health care team regarding the patient's immediate postoperative status. The success of these scoring systems encourages the development of postoperative management strategies to properly assess these scores' ability to decrease the number of patients suffering these potentially preventable morbidities. Recognizing the increasing importance of proper resource allocation, the PMS and SAS have the potential to be used as tools to efficiently distribute our ever-declining healthcare reserve.

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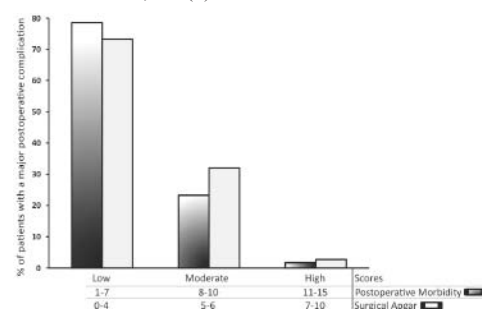


Figure 1 Postoperative Morbidity and Surgical Apgar Scores versus major postoperative complications. Both a high PMS and SAS predicted fewer major complications when compared to a low PMS (95% CI 0.001-0.049, OR=0.005, *p*<.0001) and SAS (95% CI 0.002-0.062, OR=0.010, *p*<.0001), respectively.

S-150.**AUTOMATED ANALYSIS OF FREE TEXT ELECTRONIC MEDICAL RECORDS TO IDENTIFY PATIENTS WITH SPECIFIC MEDICAL DIAGNOSES**

AUTHORS: A. Rao,¹ J. M. Ehrenfeld,² R. Peterfreund,¹ M. Zalis,¹ M. Harris¹

AFFILIATION: ¹Massachusetts General Hospital, Boston, MA; ²Vanderbilt University Medical Center, Nashville, TN

INTRODUCTION: Identifying patients with Diabetes mellitus (DM) amongst those scheduled for surgery is important because they are at a higher risk of morbidity and mortality. Differences in the outcomes of diabetic patients have been attributed to intraoperative hypoglycemia, poor healing rates and higher rates of infection, postoperative hyperglycemia, electrolyte abnormalities and ketoacidosis. It is therefore critical to identify patients with DM during the perioperative period in order to optimize outcomes and minimize adverse events.

METHODS: Over a 9-week period we used a free text search tool called Queriable Patient Inference Dossier (QPID) to prospectively identify surgical patients who are most likely have DM. QPID is a catalog of modifiable search functions, structured queries and associated natural language processing operators. Indexed EMR records were searched using the following parameters:

- 1) ICD-9 code for DM I or II.
- 2) Included strings/phrases: permutations of diabetes, dm, type, (I, II, 1, 2), 'diabetic', 'ketoacidosis', 'diet controlled DM', and several other strings.
- 3) Excluded strings/phrases: 'diabetes screening', 'pre-diabetes', 'borderline diabetes' and 'non-diabetic'.

QPID-derived results were verified by the anesthesiologist of record during each surgery. Following this 9 week period, a refined version of the QPID algorithm was then subsequently validated using a set of 600 surgical patients.

Challenging Case Report (only complete if your submission falls into the "Challenging Case Report" category. If you select the "Challenging Case Report" category on the next step, this section must be completed.): NA

RESULTS: In our initial analysis, 9,401 patients were enrolled and we determined QPID's sensitivity (98.6%) specificity (99.4%) accuracy (98.8%), positive predictive value (PPV, 97.4%) and negative predictive value (NPV, 99.7%). A separate validation study of 600 patients revealed similar results: sensitivity (96.7%) specificity (91.07%) accuracy (92.2%), PPV (55.1%) and NPV (99.4%).

DISCUSSION: DM patients who undergo surgery need better perioperative care. Using QPID we have identified DM patients and leveraged the architecture of EMRs to integrate it with perioperative monitoring systems. Our results illustrate the ability to process cases scheduled for surgery on a real-time basis and relay the results to the anesthesiologists and directly impact medical care. We have created and validated a methodology to automatically identify patients with a diagnosis of DM from free text notes contained within an enterprise wide EMR. In the future, the ability to extract patient specific diagnoses from unstructured EMR data will allow the refinement of clinical decision support tools which can leverage this information.

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S-151.**IMPACT OF SHADOWING ON MEDICAL STUDENT PRECONCEPTIONS OF THE FIELD OF ANESTHESIOLOGY**

AUTHORS: K. Price,^{1,2} G. Natt,² M. Brzezinski,^{1,2} B. O'Brien,¹ M. Bogetz¹

AFFILIATION: ¹University of California, San Francisco, San Francisco, CA; ²San Francisco VA Medical Center, San Francisco, CA

INTRODUCTION: Little is known about the factors influencing student preconceptions about the field of anesthesiology.¹ Early exposure to a specialty, through shadowing or preceptorship, has been shown to influence attitudes and beliefs of participants.²⁻⁴ To examine the influence of early shadowing, we explored themes and tones that emerged in student descriptions of preconceptions about anesthesiology. We compared students who did or did not shadow prior to their clinical clerkship.

METHODS: Annually, first and second year medical students are invited to shadow an anesthesiologist assigned through the department for a half day. Participants complete a survey before and after shadowing. Students describe preconceptions and evaluate their experience. Third and fourth year medical students must complete a 2-week anesthesia rotation. All students record one preconception about anesthesia during the clerkship orientation. A grounded theory approach was used to analyze students' written preconceptions. Student comments were systematically evaluated for recurring themes and tone by two researchers individually. Key words associated with each theme were identified and used to code for themes and tone in each written description. Discrepancies in theme or tone assignment were reconciled prior to analysis. Frequencies between shadowing and non-shadowing groups were compared using chi-square analysis.

RESULTS: We analyzed preconceptions from 1,009 students at our institution from 2003-2009. Fourteen percent shadowed previously. Five main themes emerged: Patient Interaction(PI), Task Responsibilities(TR), Reputation(Re), Lifestyle(Lf), & Future of the Field. TR was most prevalent, followed by PI and Re for both shadowing and non-shadowing groups. Regardless of theme, tone was negative for over half of all responses from both groups. Shadowing was unrelated to differences in theme or tone detected within preconceptions. Theme and tone were associated-preconceptions containing PI & TR themes were typically negative, while Lf & Re were positive(p<.0001).

DISCUSSION: Preconceptions about medical specialties develop from a variety of sources. Shadowing experiences can impact student attitudes about a specialty.²⁻⁴ Amount, timing, & content of exposure play important roles in shadowing quality.¹⁻³ In our study, early shadowing did not impact the tone or thematic content of anesthesia preconceptions. Most prevalent themes were overwhelmingly negative across all students. Suggestions on how to re-evaluate and restructure the shadowing experience will be offered to enhance future impact.

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S-152.**BURNOUT IN ANESTHESIOLOGY RESIDENCY DIRECTORS: A NATIONAL SURVEY****AUTHORS:** G. S. De Oliveira, S. Ahmad, P. Fitzgerald, R. McCarthy**AFFILIATION:** Northwestern University, Chicago, IL

INTRODUCTION: Burnout is a psychological syndrome related to work. It can decrease job performance and it involves professions that have a substantial portion of their time devoted to personal relations. Our aim was to evaluate work related stress as well as personal factors associated with professional burnout in program directors of anesthesiology.

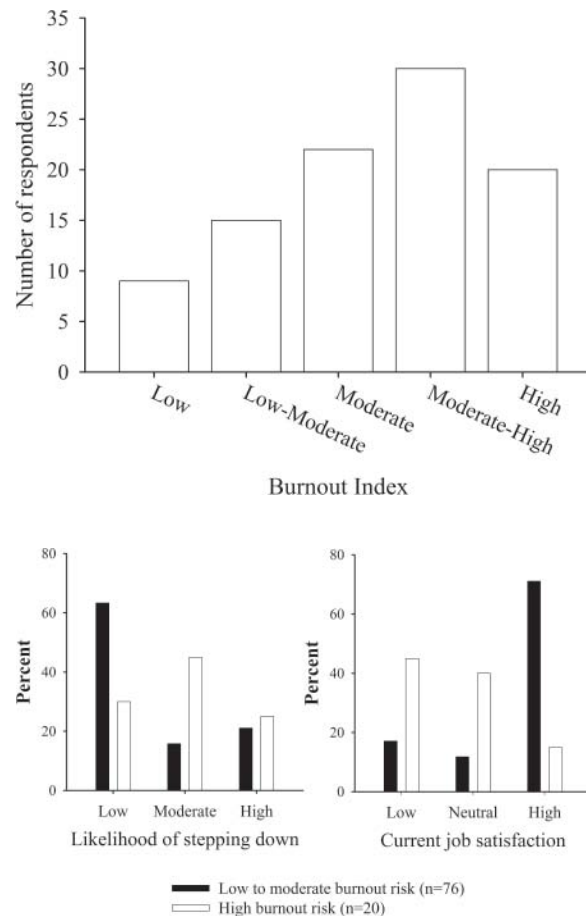
METHODS: the study was a Web-based cross-sectional survey. The survey was sent to Academic Anesthesiology Departments in the United States (n=132). The survey consisted of a five part questionnaire evaluating program and respondents demographic information, work related stressors, an assessment of control of respondent's personal life using the modified efficiency scale, the Maslach Burnout Inventory - Human Services survey (MBI-HSS), and an assessment of spousal/significant relationship support.

RESULTS: One hundred program directors (76%) responded to the survey. Twenty respondents met the criteria for high burnout and 30 additional scored in high risk to develop burnout category. Twenty-two reported a high likelihood that they would step down in 1-2 years. Forty-three percent reporting a high likelihood of stepping down stated they were significantly affected by job related stressors compared with 18% that reported a lower likelihood of stepping down ($P=0.03$). Program directors that scored in the high burnout risk category were more likely to report lower current job satisfaction ($P<0.005$) and an increased likelihood of stepping down in the next two years ($P=0.009$). Logistic regression analysis identified compliance issues, self assessment of effectiveness, family/significant other support, perceived impact of stressful factors and current job satisfaction as predictors of high burnout. The model had sensitivity (95% CI) of 0.55 (0.34 to 0.74) and specificity of 0.99 (0.92 to 1.0) for predicting high burnout risk.

DISCUSSION: We found that 52% of anesthesiology program directors are at high risk for developing burnout syndrome. Job related stress especially with administrative duties regarding compliance was predictive of burnout among program directors. Because of the high impact these individuals have in training the future generation of anesthesiologists, strategies to reduce job stress in residency directors are needed.

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S-153.**STATE OF EDUCATIONAL ENVIRONMENT IN
ANESTHESIOLOGY TRAINING PROGRAM**

AUTHORS: J. Rinehart, I. Hadaya, C. Canales, S. L. Strom, E. Sanchez, Z. Kain

AFFILIATION: University of California-Irvine, UCI Medical Center, Orange, CA

INTRODUCTION: Advances in technology are changing the practice of anesthesiology, which presents significant challenges to resident training programs. At the forefront are new medical devices and monitors requiring specialized training, increased demand for robotic and other minimally invasive procedures. Additionally, programs must keep up with institutional and ACGME changes while preparing residents for practice in a healthcare system that is in flux. Our goal was to assess variables that may affect the state of education amongst residency programs in the continental United States. We hypothesized that programs with newer program directors would be more likely to adopt new practices and regulations.

METHODS: Following IRB approval, 129 ACGME approved programs were surveyed. The survey consisted of 155 questions organized into 10 categories: general program and hospital characteristics, program director (PD), clinical base year, clinical rotations, didactics, resident well being, simulation, special topics, and technology. We used unpaired sample t-test and one-way analyses of variance to analyze data. Significance level was determined at $p < .05$

RESULTS: Forty seven surveys were completed and analyzed (36%). There was a significant inverse relationship between the PD's length of practice and Residency Review Committee (RRC) accreditation ($p < .05$), but not the number of years as PD. Private hospitals were more likely to have longer accreditation lengths than purely state-funded hospitals ($p < .01$). Several other features not required by the RRC are becoming more common including acute pain service, ultrasound guided procedures, professionalism series, and resident well being series. Only 10% programs surveyed reported having a geriatric rotation.

DISCUSSION: Not surprisingly for our field, adoption of new technologies by most programs has been rapid. The inverse relationship between the PD's years in practice and the RRC accreditation status is interesting, though it is difficult to say much beyond the correlation. It's possible that programs with shorter accreditation seek more experienced PDs. Additionally, it is possible that younger faculty are more likely to adopt and incorporate newer RRC requirement and thus obtain longer review cycles. Lack of a geriatric rotation is presumably because programs assume geriatrics will be learned as part of other rotations. However, elderly patients comprise a large part of our day to day practice and residents should have training in the nuances of anesthesia for the aged.

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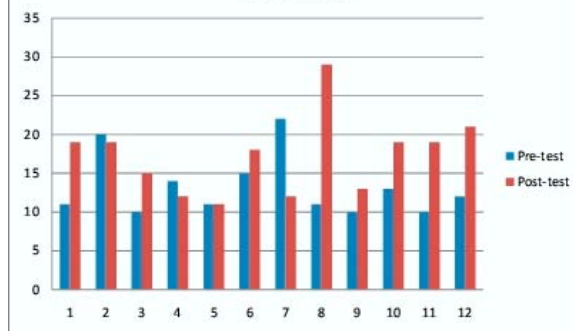
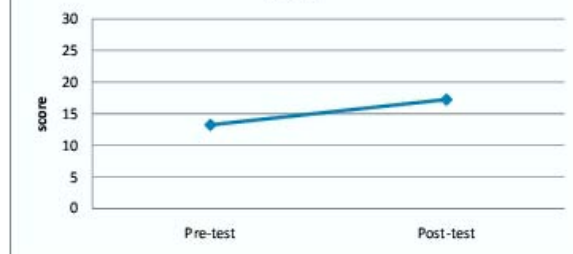
S-154.**WEB BASED TEACHING BLOCKS TOGETHER WITH OPERATING ROOM TEACHING DISCUSSION COULD IMPROVE MEDICAL KNOWLEDGE IN FIRST YEAR (CA-1) ANESTHESIOLOGY RESIDENTS****AUTHORS:** S. M. Bhananker, A. Zeng, R. Ramaiah, L. Lollo**AFFILIATION:** University of Washington School of Medicine, Seattle, WA

INTRODUCTION: Teaching medicine to anesthesiology residents is challenging due to the lack of adequate time for didactic teaching and independent reading. Clinical workloads, resident work hours regulations, and rapid adaptation to a unfamiliar specialty compound the difficulty. We assessed the impact of web based teaching modules and accompanying operating room teaching in specific clinical areas, on the performance of year 1 clinical anesthesiology (CA-1) residents in tests of anesthesiology knowledge.

METHODS: CA-1 residents rotating through “general anesthesiology rotations” of 4-5 weeks duration each are assigned to a teaching block. Each teaching block focuses on one clinical area such as regional anesthesia, pulmonary and airway physiology, neuromuscular physiology, pathology and pharmacology etc. Educational materials including book chapters, problem based learning discussions, review articles, refresher course lectures (powerpoint presentations and handouts), links to relevant web sites are made available to the residents and educators via the website for each teaching block. Residents are expected to discuss one or more topics with the attending physician in the operating room (OR) each day and maintain a log of the topics discussed in a “dance card”. Sample dance card is attached. Pre-test and post-test scores using 30 multiple choice questions on regional anesthesia, from previous board examinations of the American Board of Anesthesiology are used to test the improvement (or lack) of medical knowledge during each rotation. The teaching block on regional anesthesia can be accessed at <http://faculty.washington.edu/sbhanank/>.

RESULTS: All residents are expected to complete these teaching blocks in their first year of clinical anesthesia. Compliance with this requirement is variable thus far. Our preliminary experience from 12 residents completing the teaching block on regional anesthesia reveals a NONsignificant improvement in post-test scores as compared to pre-test scores (mean pre-test scores 13.25 ± 3.98 , mean post-test score 17.25 ± 5.07 , $p=0.074$, 95% CI 0.46 to -8.46 for difference in test scores, using paired t- test)

DISCUSSION: We discuss the previous and new methods employed for OR teaching, why we felt the change in teaching approach was necessary, and plans for additional study and assessment of this new approach. One outlier resident has thus far skewed the results. We do not know if the improvement in test scores will be retained over a longer period or not nor do we know about the student satisfaction with this method of teaching.

REFERENCES: None**Fig 1. Individual residents' pre and post-test scores****Fig. 2. Mean pre- and test scores, n=12**

S-155.**IT'S RIGHT ON THE TIP OF MY TONGUE: LANGUAGE PREFERENCE AT EMERGENCE****AUTHORS:** B. Dauber, R. Bhansali, M. Dauber, D. Glick**AFFILIATION:** University of Chicago, Chicago, IL

INTRODUCTION: The latest U.S. census data indicate that there are approximately 55.1 million people who speak a language other than English at home. More than 24 million of these people speak English less than "very well"¹. During emergence from anesthesia, a language barrier between patient and anesthetist may be magnified and compromise the safety of the patient, since based on a patient's responses to commands, anesthesiologists evaluate extubation criteria, determine neurologic functioning, and ascertain a patient's level of pain. Second languages acquired in adulthood are spatially separated from native languages and thus may be stored in external memory systems.² Furthermore, neural changes associated with pharmacologic alterations of consciousness in humans cause a loss of the ability to use specialized, external memory systems³. The goal of this study was to determine if patients who spoke English as a second language responded more effectively to their native language during the emergence period.

METHODS: After obtaining IRB approval, patients whose self-assessed language skills were better in a foreign language than in English were enrolled. With a laptop computer, we recorded three commands in English and in the native language from a family member of each patient: "open your eyes", "squeeze my fingers", and "wiggle your toes". Additionally, each patient was asked to assess their English and foreign language understanding skills on an ascending scale of 1-10. During emergence from general anesthesia, the English and foreign language commands were played in alternation, pausing to allow for a response.

RESULTS: 68 patients were enrolled. There were a total of 277 responses given for the three commands. 66% (n=183) of the responses came to only the foreign language, 32% (n=88) of the responses came to both English and the foreign language at the same time, and 2% (n=6) of the responses came from English only. The average self-assessed English understanding skills were rated at 6.3 (+ 2.9).

DISCUSSION: These results highlight that although patients may rate themselves as having good English understanding skills, when emerging from anesthesia, they may respond quicker and more effectively to their native tongue. A large percentage of patients responded only in the foreign language, never responding in English. Even patients who responded to both languages responded earlier to commands in the foreign language. This emphasized the importance of considering the special needs of those who speak English as a second language as they emerge from anesthesia.

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S-156.**KEEPING THE AIRWAY OPEN DURING CHEST COMPRESSION-ONLY CPR ON PATIENTS WITH OBSTRUCTIVE SLEEP APNEA AND OBESITY MAY IMPROVE OUTCOME****AUTHORS:** K. T. Kong,¹ C. Parise,² A. K. Kong^{3,4}

AFFILIATION: ¹Granite Bay High School, Granite Bay, CA; ²Sutter Institute for Medical Research, Sacramento, CA; ³CASE Anesthesia, Sutter Roseville Medical Center, Roseville, CA; ⁴Department of Anesthesiology and Pain Medicine, University of California, Davis, Sacramento, CA

INTRODUCTION: Recent studies have reported that chest compression-only CPR(CCOC) is just as or more effective than chest compression with rescue breaths CPR performed by bystanders for sudden cardiac arrest.^{1,2,3} These studies prompted the American Heart Association to amend its recommendation to hands-only CPR for bystanders. Certain subsets of patients, such as those with obstructive sleep apnea and obesity, may benefit from having their airways kept open during CCOC. High intrapleural pressure(IP) resulting from closed airways during CCOC on these patients may impede venous blood return to the heart and therefore lower blood circulation, especially to the heart and brain.⁴ None of the studies that favored CCOC included co-morbid conditions of the patients and offered no reference to opening the patient's airway during CCOC.

The purpose of this study was to demonstrate that CCOC may not be as effective for patients with obesity and the potential to have obstructed airways.

METHODS: Using a lung model,⁵ change in IP(cm H₂O) during chest compressions was independently measured five times with an open airway and five times with a closed airway. To demonstrate airway obstruction during the inspiratory phase, five measurements were also taken before and after 1/2 ml lung expansion with a closed airway. Differences between the two conditions were analyzed with the independent-groups t-test.

RESULTS: There was an 18-fold increase in IP during chest compression with the airway closed versus when open. Mean change in IP in the open airway condition(0.620±0.11) was statistically significantly different (t8=-21.72, P=0.000) from the closed airway (11.40±1.11). When the lung was inflated to demonstrate the inspiratory phase during an obstructed airway, there existed also a corresponding increase in IP, but to a lesser degree. Change in IP was also statistically significantly (t8=6.85, P=0.000) higher (9.40±0.32) before 1/2 ml lung expansion than after expansion (6.78±0.79).

DISCUSSION: We conclude that there exists the potential for high IP resulting from CCOC and closed airway in a subset of sudden cardiac arrest patients with obstructive sleep apnea and obesity. Such high IP may impede venous blood return, and thus decrease the overall blood circulation. We therefore subscribe to the concept that keeping the airway open in this subset of patients during CCOC may improve outcome.

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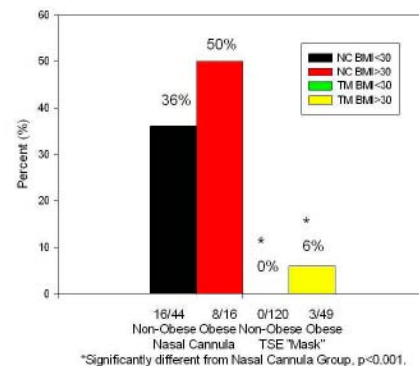
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S-157.**PRE-OXYGENATION WITH NO-COST TSE “MASK” PREVENTS SEVERE DESATURATION AND IMPROVES OXYGENATION IN OBESE PATIENTS UNDER DEEP PROPOFOL SEDATION DURING LENGTHY UPPER GI ENDOSCOPY****AUTHORS:** J. Tse, M. Negron-Gonzalez, B. Razvi, J. T. Denny, S. Mellender, S. Cohen**AFFILIATION:** University of Medicine and Dentistry of New Jersey-Robert Wood Johnson Medical School, New Brunswick, NJ

INTRODUCTION: Patients routinely receive nasal cannula (NC) O₂ and propofol sedation during upper GI endoscopy. Over-sedation and/or airway obstruction may cause severe desaturation (Desat). Obese patients have increased risk of respiratory complications due to airway anatomy, sleep apnea, decreased FRC and high O₂ consumption. A simple plastic sheet improved oxygenation in sedated patients by converting a NC to a face tent (TSE “Mask”) during EGD(1). We examined its effectiveness in improving oxygenation in obese patients during lengthy upper endoscopy.

METHODS: Review of patients who underwent lengthy (>20 min) EGD, EUS, ERCP, EGD/Colonoscopy or PEG identified 2 groups. Group 1 (NC, n=60) received NC O₂. Group 2 (TM, n=169) received NC O₂ and a clean plastic sheet covering patient’s eyes, nose and mouth(1-3). Monitors included ECG, BP cuff, pulse oximetry, capnography and oximetry. Patients received NC O₂ (3-5 l/min or higher as needed) prior to sedation with only iv propofol. Data collected included age, weight, height, ASA physical status, O₂ Sat, mask-bag ventilation, propofol dosage, duration and FiO₂. Student t-test and the Chi Square test were used. A p value < 0.05 was considered as significant. (Mean±S.D.)

RESULTS: Among non-obese patients (BMI <30), there were no differences in age, BMI, ASA status, baseline room air (RA) O₂ Sat, O₂ Sat after 5 min O₂, the highest O₂ flow, duration and the overall propofol dosage(Table). There were significant differences in the lowest O₂ Sat (NC:88±11%; TM:97±3%), severe Desat (O₂ Sat<85%) (NC:16/44; TM:0/120)(Fig) and the need for mask-bag ventilation (NC:5/44; TM:0/120).

Fig. 1 Severe Desaturation (O₂ Sat <85%) during Lengthy Upper GI Endoscopy (>20 min)

Among obese patients (BMI>30), there were no differences in age, BMI, ASA status, RA O₂ Sat, O₂ Sat after 5 min O₂, the highest O₂ flow, duration and the overall propofol dosage. There were significant differences in the lowest O₂ Sat (NC:85±14%; TM:95±6%), severe Desat (O₂ Sat<85%) (NC:8/16; TM:3/49) and the need for mask-bag ventilation (NC:4/16; TM:1/49).

In 20 NC patients, NCs were converted to TSE “Mask” due to severe Desat (O₂ Sat: 83±7%). Their O₂ Sat was rapidly improved to 95±6%, 98±3% and 99±1% at 5 min intervals.

TM group had higher FiO₂(0.5±0.1) than NC group(0.3±0.1).

DISCUSSION: The data show that pre-oxygenation with TSE “Mask” improves oxygenation and prevents severe desaturation in patients under deep propofol sedation especially in obese patients during lengthy upper GI endoscopy. This simple face tent may have great impact on patient safety at no additional cost. Even though it may be used as a rescue device when patient’s oxygenation deteriorates, it should be routinely used prior to sedation.

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Effects of TSE “Mask” on Patients under Deep Propofol Sedation during Lengthy EGD

| | Age (yrs) | BMI | Duration (min) | Propofol Dosage (ug/kg/min) | Highest NC O ₂ Flow (l/min) | Room Air O ₂ Sat | Lowest O ₂ Sat | Severe Desat (O ₂ Sat < 85%) | Mask-Bag Ventilation |
|----------------------------|------------|---------------|----------------|-----------------------------|--|-----------------------------|---------------------------|---|----------------------|
| Non-Obese NC group (n=44) | 63±18 | 25±3 | 36±16 | 195±74 | 5.0±2.1 | 98±2% | 88±11% | 16/44 | 5/44 |
| Non-Obese TM group (n=120) | 61±17 n.s. | 24±4 n.s. | 41±18 n.s. | 188±62 n.s. | 4.5±1.0 n.s. | 98±2% n.s. | 97±3%* p<0.0001 | 0/120* p<0.001 | 0/120* p<0.001 |
| Obese NC group (n=16) | 59±16 | 32.3±2.3 | 32±14 | 192±65 | 5.3±2.0 | 97±2% | 85±14% | 8/16 | 4/16 |
| Obese TM group (n=49) | 60±14 n.s. | 34.9±6.1 n.s. | 36±15 n.s. | 166±63 n.s. | 5.5±1.7 n.s. | 97±2% n.s. | 95±6%* p<0.0005 | 3/49* p<0.001 | 1/49* p<0.001 |

n.s. Not significantly different from Nasal Cannula group; * Significantly different from Nasal Cannula group. Data presented as Mean±S.D.

S-158.**THE DIFFICULT AIRWAY RESPONSE TEAM (DART): A MULTIDISCIPLINARY APPROACH TO DIFFICULT AIRWAY EMERGENCIES**

AUTHORS: K. S. Mon,¹ A. Hillel,¹ K. Herzer,¹ P. Flint,^{2,1} L. berkow,¹ L. J. Mark¹

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INTRODUCTION: A difficult airway, anticipated or not, challenges medical providers. Between 2006 and 2008, five sentinel airway events occurred at our institution, prompting a root cause analysis to compare these events and establish a strategy for improving airway management. Common contributing factors across the five events were an outdated paging system, unreliable access to equipment and difficult airway expertise, and unclear roles within multidisciplinary providers during events. All events occurred outside of the operating rooms and involved four departments: Anesthesiology, Otolaryngology Head and Neck Surgery, Trauma Surgery, and the Emergency Department. DART initiative was created to recruit leaders from these departments into an operational, safety, and educational program. We present the operational results for 2 years.

METHODS: DART Year 1 (2008-2009) focused on: education of providers on existing code teams regarding role and activation of DART and DART cart; replacing the paging system; and web based quality assurance data report review and identification of defects in real time. DART Year 2 focused on practice-based learning and systems-based process improvement. Outcomes including sentinel events and surgical airways were studied.

RESULTS: For DART Year 1, there were 490 code calls, of which 61 were escalated to a DART response. The DART cart fleet was increased from 8 to 11 and re-allocated to high response rate clinical areas. For DART Year 2, there were 668 code calls, of which 57 were escalated to a DART response. Emergency surgical airways decreased from 4 in Year 1 to 2 in Year 2. Airway sentinel events were reduced to 0 for DART Year 1 and 2, compared to 5 in the previous 2 years.

DISCUSSION: At our institution, the multidisciplinary DART initiative has been effective in improving management of airway emergencies to improve hospital safety through practice-based learning and system-based approach.

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S-159.**PROPOSAL OF AN EXTUBATION ALGORITHM FOR MAJOR NECK AND UPPER AIRWAY SURGERY**

AUTHORS: L. F. Cavallone, A. Vannucci

AFFILIATION: Washington University in Saint Louis, Department of Anesthesiology, Saint Louis, MO

INTRODUCTION: A pre-planned strategy for the management of difficult airway (DA) may lead to improved patients outcome.^{1,2} Respiratory adverse events causing death or brain damage at induction of anesthesia have decreased over the past years, while tracheal extubation and recovery are still associated with an unchanged rate of death or brain damage, suggesting that education and guidance in this area are still needed.^{2,3}

In the 2003 ASA "Practice Guidelines for Management of the Difficult Airway" anesthesiologists are encouraged to have "a pre-formulated strategy for extubation of the DA". The rate of failed extubation requiring re-intubation after endoscopic upper airway surgery may approximate 3%.⁴ Maxillofacial and major neck surgery have a high risk for postoperative laryngo-pharyngeal edema and airway obstruction; in this population a failed extubation rate within the first 24 hours close to 11% has been reported.⁵

The decision making process regarding extubation after major neck and upper airway surgery is a critical part of the overall success of these procedures.

We propose an algorithm to guide extubation in this clinical setting.

METHODS: We performed a systematic review of the literature to identify predictors of extubation failure after neck and upper airway surgery. In addition, we looked for published recommendations and criteria pertinent to the goal of improving safe practices with extubation.

RESULTS: (Please, see image for results - "notes" are not included for limited space availability)

DISCUSSION: It is important to distinguish between "extubation failure" defined as "inability to tolerate removal of the translaryngeal tube" and "weaning failure" which is the "inability to tolerate spontaneous breathing without ventilator support".⁶

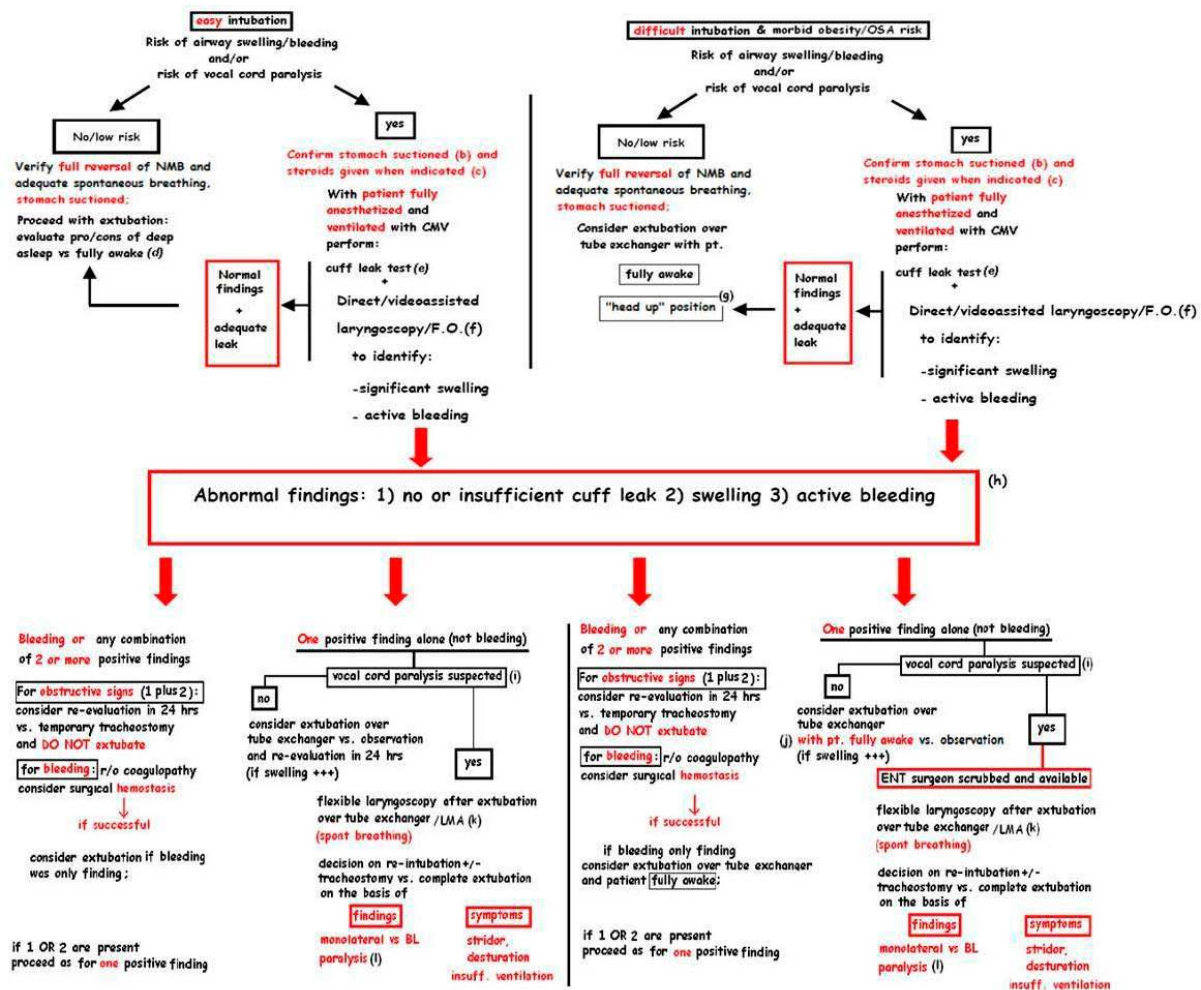
Extubation failure has been related to factors like upper airway obstruction, inadequate cough and excess respiratory secretions.⁶ We propose that in the setting of major neck and upper airway surgery, parameters to assess post-extubation airway patency are valuable predictors of extubation outcome. Also, our search has confirmed that several tools and strategies can be utilized to improve extubation outcomes when high risk of post extubation airway obstruction exists.

We critically incorporated these findings into our algorithm, that is presented with a section of notes that illustrate pros/cons of critical decision steps, together with the evidences supporting the proposed strategies.

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Extubation algorithm for major neck and upper airway surgery (a)



S-160.**EXTUBATION OF THE DIFFICULT AIRWAY: AN ALGORITHMIC APPROACH****AUTHORS:** C. J. Voscopoulos,¹ A. Saxena,² J. Antoine³**AFFILIATION:** ¹Department of Anesthesia, Critical Care, and Pain Medicine, Emory University, Atlanta, GA; ²University of California at San Francisco School of Medicine, San Francisco, CA; ³Department of Anesthesiology, Saint Mary's Hospital, Catholic Health Care West, San Francisco, CA**INTRODUCTION:** Tracheal extubation remains a critical procedure in management of the difficult airway. The patient with a known difficult airway is at greater risk in these settings for reintubation. Because of this, there has been recognition of the need for guidelines in the form of an algorithm to deal with extubation in these patients.**METHODS:** Literature review.**Results:** As the algorithm demonstrates (Figure 1), before extubating a patient with a difficult airway, one must first consider calling for help, obtaining the appropriate equipment for possible reintubation, perform aggressive suctioning of the oropharynx, ensure the patient is sufficiently awake to protect their airway by being able to follow commands, and consider performing a cough test, as well as a cuff leak test.

Either an AEC or GEB should then be placed depending on the equipment available to the practitioner and their level of comfort using each device, prior to awake extubation.

If the patient is oxygenating and ventilating appropriately, the AEC can be removed either in the operating room (OR) or in the PACU.

If the patient has adequate ventilation but inadequate oxygenation, oxygen can be insufflated via the AEC. If this resolves the problem, once it is reaffirmed that the patient can protect and maintain his airway, the AEC can be removed and the patient can continue receiving supplemental oxygen as needed. However, if the patient continues to have inadequate oxygenation, jet ventilation, or positive pressure ventilation, may become necessary as a temporizing procedure. This should immediately be followed by attempted reintubation over the AEC, as the patient has failed extubation. This same scenario will be required if the patient has inadequate ventilation after the removal of the ETT tube. If the reintubation is unsuccessful, one would then proceed to the ASA's difficult airway algorithm.

If an AEC is not available, one can insert a GEB, and remove the ETT tube over it during awake extubation.

DISCUSSION: The Difficult Airway Algorithm prepared by the ASA presents the basic tenets of preparedness and forethought. While this algorithm is likely to have had a beneficial impact of reducing complications to our patients with difficult airways, it also suggests a need for additional recommendations for difficult airway management during emergence and recovery. The algorithm presented here will serve this need by providing a stepwise approach to extubation of the difficult airway.**REFERENCES:**

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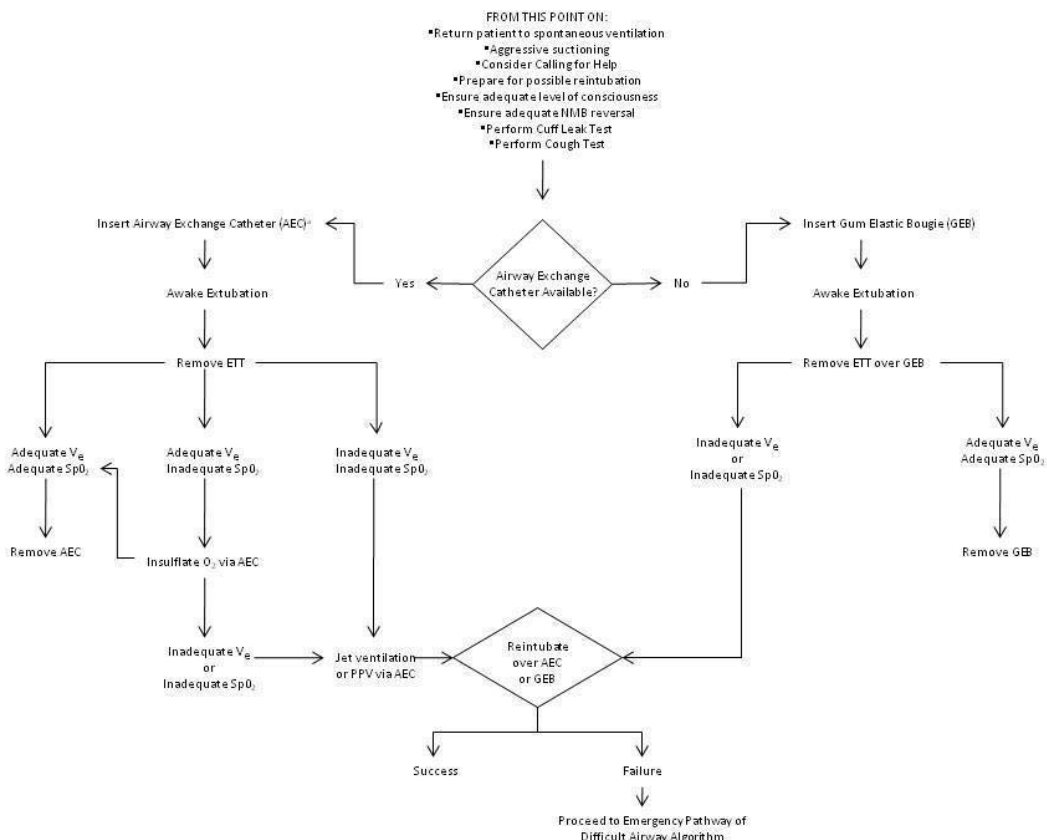


Figure 1. Algorithm for Extubation of the Difficult Airway. This algorithm illustrates a stepwise approach for extubation of the difficult airway, as a complement to the American Society of Anesthesiologist's Difficult Airway Algorithm. Airway exchange catheter (AEC), Gum elastic bougie (GEB), Positive Pressure Ventilation (PPV), Neuromuscular Blockade (NMB).

S-161.**SUPPLEMENTAL OXYGEN: A REDUCTION IN PULSE OXIMETRY SENSITIVITY OR AN INCREASED MARGIN OF SAFETY?****AUTHORS:** M. Rollins,¹ S. Shah,² P. Bickler,¹ J. R. Feiner¹¹University of California, San Francisco, San Francisco, CA;²University of California, San Diego, San Diego, CA

INTRODUCTION: Respiratory depression and hypoxemia are serious events that occur in patients receiving post-operative opioids. Recent publications stress the dangers of supplemental nasal cannula oxygen (NC-O₂) masking respiratory depression by decreasing the specificity and response time of pulse oximetry, yet several studies examining the use of NC-O₂ in patients receiving opioids or sedation show improved safety.

To help determine whether NC-O₂ should be routinely used in these patients, we studied an opioid model of progressive respiratory depression in volunteers. During increasing levels of apnea and hypoxemia we determined 1) length of apneic period, 2) rate of desaturation, 3) carbon dioxide (CO₂) levels, and 4) amount of drug associated with each apneic event at three pulse oximetry threshold values (95%, 90%, and 85%) with and without NC-O₂.

METHODS: Following IRB approval, 11 healthy volunteers were studied on both 3L/min NC room air (RA) and NC-O₂. Standard ASA monitors, respiratory rate, invasive arterial pressure, and transcutaneous CO₂ were measured throughout. After randomizing each to RA or O₂ first, a remifentanyl infusion was started. Escalating remifentanyl boluses were given and the infusion rate increased each 5 minutes. This produced increasing apnea periods and distinct desaturation levels <95%, <90%, and <85%. After a 90-minute recovery each volunteer repeated the study on the other NC gas.

RESULTS: Results are displayed in the table. For each SpO₂ threshold, the associated apnea time, CO₂ level, and opioid bolus dose needed, were greater with NC-O₂ compared to RA. The desaturation rate was significantly greater on RA compared to NC-O₂ when crossing 85% SpO₂, with no difference at the other target thresholds, and no difference in the nadir SpO₂ level associated with crossing a given threshold (p>0.05) (not shown).

DISCUSSION: NC-O₂ administration to volunteers receiving escalating remifentanyl doses to depress respiration resulted in 1) tolerance of longer apnea duration before desaturation to target SpO₂ levels, 2) requirement of greater opiate doses to produce a desaturation target, 3) higher CO₂ levels, and 4) a rate of desaturation and associated nadir similar to RA. This suggests, for a given drug dose, an improved margin of safety with NC-O₂ compared to RA rather than an eventual hypoxemic condition that is more rapid and severe, but with significantly higher CO₂ levels. Given the study limitations (ASA I nonobstructing volunteers), additional clinical studies are needed to evaluate the effects of NC-O₂ and the predictive value of both pulse oximetry and transcutaneous CO₂ monitoring with and without supplemental O₂ in patients given opioids.

REFERENCES: Funded by the APSF

S-162.**SUPPLEMENTING OXYGEN THROUGH AN AIRWAY EXCHANGE CATHETER: WORTH THE RISK?****AUTHORS:** L. Duggan¹, J. Law², M. F. Murphy³**AFFILIATION:** 1University of British Columbia, Vancouver, BC, Canada; 2Dalhousie University, Halifax, NS, Canada; 3University of Alberta, Edmonton, AB, Canada

INTRODUCTION: The recent death due to barotrauma of a young ASA 1 patient while receiving oxygen insufflated through an airway exchange catheter (AEC) prompted the Chief Coroner of Ontario to seek guidelines regarding their use. The AEC serves two roles: as a conduit for endotracheal tube placement and as a means to provide oxygen, either by low-pressure insufflation or high-pressure jet-ventilation.

METHODS: An extensive literature search investigating the efficacy and complications associated with AEC oxygen supplementation was undertaken. Source: MeSH, EMBASE and CINAHL databases were searched using a number of strategies.

Challenging Case Report (only complete if your submission falls into the "Challenging Case Report" category. If you select the "Challenging Case Report" category on the next step, this section must be completed.): N/A

RESULTS: No studies were found comparing either oxygen insufflation or jet-ventilation through an AEC to any standard forms of oxygen therapy. Barotrauma occurs either by direct damage to the tracheobronchial tree¹ or by lack of complete exhalation leading to escalating intrathoracic pressure.² In the only case series found using jet-ventilation through an AEC, 11% of patients sustained pulmonary barotrauma.³ In 13 other case reports, jet-ventilation over a range of driving pressures was associated with pneumothorax,⁴⁻⁹ pneumoperitoneum,⁸⁻¹⁰ cardiovascular collapse,⁸ and death.^{8,9} In four case series totaling 76 adults^{11,12} and 31 children^{13,14} no complications were reported from oxygen insufflation through an AEC. However, in two separate case reports AEC oxygen insufflation resulted in gastric perforation¹⁵ and AEC manual ventilation resulted in pneumothorax.¹⁶

DISCUSSION: Jet-ventilation through an AEC appears to be associated with a significant risk of barotrauma. Oxygen insufflation appears to be associated with a lower risk, but is not risk-free. Failing proven benefit of AEC-administered oxygen over standard oxygen therapies, the authors caution against its routine use. Should a patient with an AEC in situ decompensate, re-intubation is the key management strategy. Supplemental oxygen can be provided using standard techniques prior to intubation or between attempts. Under emergency circumstances, oxygen insufflation or manual ventilation through an AEC may be considered provided vigilance for barotrauma is maintained, and re-intubation not delayed.

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AEC Associated Barotrauma Complications

| Author | Patient/ Series | Intervention | Complications |
|---------------------|--------------------|------------------------------|---|
| Nunn 2007 (4) | 1 patient | Jet ventilation 50 psi | Tension pneumothorax |
| Fetterman 2006 (15) | 1 patient | Insufflation 2 LPM | Gastric perforation |
| Chen 2008 (16) | 1 patient | Manual ventilation | Pneumothorax |
| McDonald 1997 (5) | 1 patient | Jet ventilation 50 psi | Tension pneumothorax |
| Baraka 1997 (6) | 1 patient | Jet ventilation 50 psi | Tension pneumothorax |
| Cooper 1996 (3) | 5/45 patients | Jet ventilation 15-50 psi | Pulmonary emphysema or Pneumothorax |
| Cooper 1994 (7) | 1 patient | Jet ventilation 20 psi | Pneumothorax |
| Egol 1985 (8) | 3 patients | Jet ventilation 20-50 psi | Pneumothorax, Cardiovascular collapse, Pneumoperitoneum |
| Chang 1980 (9) | 3 patients | Jet ventilation 15 psi | Tension pneumothorax |
| Chang 1978 (10) | 1 patient | Jet ventilation 50 psi | Severe gastrointestinal distension, Hypoxia |

psi= pounds per square inch LPM= liters per minute



Both standard 15 millimeter and luer-lock adaptors for oxygen insufflation and jet-ventilation respectively are included with the Cook (Bloomington IN) AEC



An awake patient in the PACU with an 11 Fr 83 cm Cook AEC in situ following anterior cervical spine fusion. Note supplemental oxygen administration via face-mask. In this case, the AEC is routed through the face-mask and taped to both the mask and forehead. The patient is able to phonate and breathe easily.

S-163.

WITHDRAWN.

S-164.**DIRECTING COST EFFECTIVE MEASURES TO REDUCE PERI-OPERATIVE MORBIDITY AND MORTALITY IN UNDIAGNOSED OBSTRUCTIVE SLEEP APNEA PATIENTS IN AN ACADEMIC MEDICAL CENTER****AUTHORS:** T. Straker, A. Scoggin, A. Bastien**AFFILIATION:** Montefiore Medical Center, Bronx, NY

INTRODUCTION: Numerous studies have observed the prevalence of obstructive sleep apnea (OSA) in patients. Estimates of twenty percent of the United States population have been reported to have OSA, of which approximately ninety percent are undiagnosed. In the perioperative setting, this finding is of great importance, and may result in significant unforeseen costs due to increased morbidity and mortality of this high risk population.

METHODS: Using the STOP BANG questionnaire, nurses in our ambulatory surgery unit screened non bariatric surgical patients over the age of twenty one for OSA in a three week period. This screening process was done to determine the prevalence of these high risk patients in our institution. All of the questions were already a part of our routine nursing assessment. In addition, the nurses measured the neck circumference of the patients with a tape measure, and the body mass index (BMI) of each patient was calculated.

Results: 696 patients were screened; 29 patients were excluded due to insufficient data and 4 patients were excluded for being known OSA patients. Out of the 663 patients included, 433 (65.3%) were positive assessments for high risk undiagnosed OSA and 230 (34.7%) were negative.

DISCUSSION: This data indicates a significant prevalence of undiagnosed OSA amongst our non bariatric surgical population - far more significant than what had been postulated. The STOP BANG questionnaire has proven to be a sensitive and cost effective screening tool during the pre operative assessment period.

This data has been presented to our institution to facilitate the inclusion of an OSA "telemetry" unit in our hospital. This unit will consist of OSA beds with monitored and alarmed pulse oximetry, smaller nursing to patient ratios, and prudent post operative pain management.

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S-165.**EVALUATION OF THE OPTIMUM SIZE OF OF THE SYRINGE FOR AN EFFICIENT FLUID RESUSCITATION**

AUTHORS: G. R. Toshniwal¹, Z. Ahmed², J. Tweedie², T. Bialobrzeski², E. Kaminski², R. Thomas²

AFFILIATION: ¹Wayne State University/Detroit Medical Center, Detroit, MI; ²Children's Hospital of Michigan, Detroit, MI

INTRODUCTION: We conducted this study to evaluate the optimum size of the syringe for efficient fluid resuscitation. Our model was to infuse 10ml/kg in a toddler weighing 25kg. Several methods are utilized to perform fluid resuscitation depending upon patient's age, degree of urgency, equipment and personal preference. In adult patients, rapid infusers and pressure bags are used and in infants, a few pushes with a syringe is the routine. In toddlers, fluid administered and pressure generated with rapid infuser/ pressure bags may be difficult to control. Manually pushing fluids via a syringe is often utilized for rapid and brief fluid resuscitation in a controlled fashion. The choice of syringe size depends on personal preference; influenced by the anticipated degree of fatigue, the rapidity of fluid administration desired or the anticipated pressure generated.

METHODS: After IRB approval, 20 anesthesia providers were enrolled in the study. Informed consent was obtained. All the volunteers were asked to push 250ml 0.9NS from a preset IV line setup connected to a 3-way stopcock and a 22G IV cannula in a container. Each observation had at least a one and half hour gap in between. The time needed to push 250ml and time for onset of fatigue was noted. The observer also noted the pressure generated at the end of the IV setup based on the amount of agitation/movement in the 22G IV cannula.

Challenging Case Report (only complete if your submission falls into the "Challenging Case Report" category. If you select the "Challenging Case Report" category on the next step, this section must be completed.): N/A

RESULTS: The mean time to push 250ml of fluid for each syringe (in seconds) were 5ml (273), 10ml (231), 20ml (228) and 60ml (295). Among all the syringes, 5ml syringe were least fatiguing. Among the volunteers, 75% got fatigued with 60ml syringe compared to 15-35% in other syringes (Table 1). Figure 1 shows the results of the questionnaire filled out at the end of the study by the volunteers with regard to most preferred and most inefficient syringe.

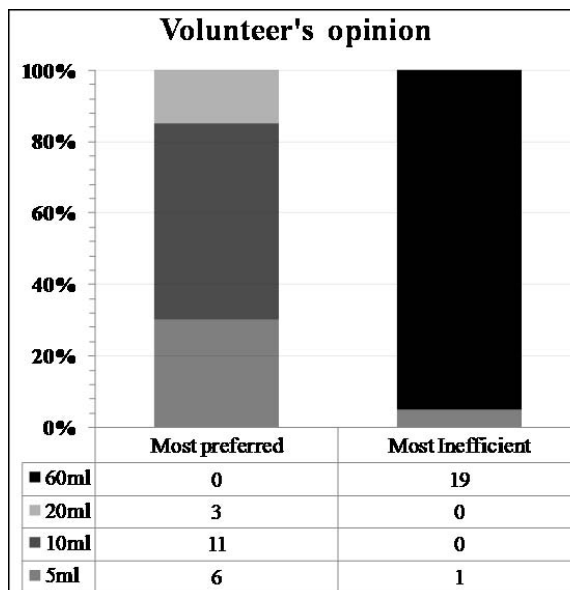
DISCUSSION: Our study showed that the 10ml syringe was most efficient when time taken to push 250ml fluid and onset of fatigue was taken into consideration, even though 5ml syringe was least fatiguing. During acute fluid resuscitation in a trauma or surgery, the push-pull technique for fluid administration can lead to fatigue of the resuscitator. The size and handling of the syringe play an important role. Hence, 10ml syringe is less fatiguing compared to 20ml. However, 20ml syringe can be used with similar efficiency in cases with smaller and fragile veins where the amount of pressure generated at the IV cannula tip is important as the pressure generated is inversely proportional to the size of the syringe.

REFERENCES:

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Table 1: Fatiguability in each syringe group

| Syringe Group | WM (n=10) | CM (n=30) |
|---------------|-----------|------------|
| 5ml | 233 | 15%(3/20) |
| 10ml | 194 | 20%(4/20) |
| 20ml | 188 | 35%(7/20) |
| 60ml | 194 | 70%(15/20) |



S-166.**EFFECTS OF PREOPERATIVE ORAL INTAKE
OF AN AMINO ACID AND NO FAT LIQUID DIET
ON PERIOPERATIVE TEMPERATURE**

AUTHORS: N. Takeuchi, H. Arima, H. Ota, T. Azami, K. Sobue

AFFILIATION: Department of Anesthesiology and Medical Crisis Management, Nagoya City University Graduate School of Medical Sciences, Nagoya, Japan

INTRODUCTION: Perioperative hypothermia increases postoperative complications and is associated with a poor prognosis.¹⁻⁴ It is known that intravenous infusion of amino acids during the pre- and intra-operative periods prevents hypothermia.⁵ Whether oral intake of amino acids has the same effect is unknown. We investigated whether preoperative oral intake of an amino-acid and no-fat liquid diet affects perioperative temperature.

METHODS: Thirty patients who underwent artificial knee replacement under general anesthesia were assigned to two groups: one with preoperative oral intake of 400 ml of water (control group), or another with intake of 400 ml of an amino-acid and no-fat liquid diet (liquid diet group) from two hours to three hours before the start of anesthesia. We measured hunger, thirst, blood glucose level, and salivary amylase level preoperatively, changes in esophageal temperature as a measure of core temperature during anesthesia, and blood glucose level, chills, and shivering postoperatively. For statistical analysis, the t-test and the paired t-test and the Fisher test and the two way repeated measures ANOVA test were used.

RESULTS: None of mean age, gender, and BMI differed significantly between the two groups. The liquid diet group had significantly less hunger ($P<0.001$) and hypothermia than the control group. In addition, the liquid diet group had fewer chills and less shivering than the control group, though not to a significant extent.

DISCUSSION: Our findings suggest that preoperative oral intake of an amino-acid and no-fat liquid diet increases patient satisfaction, and can be expected to prevent decrease in esophageal temperature in general anesthesia.

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S-167.**NO-COST TSE “MASK” PREVENTS SEVERE DESATURATION AND REDUCES RISK OF FIRE HAZARD IN OBESE PATIENTS UNDER MODERATE-DEEP PROPOFOL SEDATION DURING VARIOUS LENGTHY SURGICAL PROCEDURES**

AUTHORS: M. Negron-Gonzalez, S. Cohen, A. Lamba, C. W. Hunter, C. McDonough, J. Tse

AFFILIATION: University of Medicine and Dentistry of New Jersey-Robert Wood Johnson Medical School, New Brunswick, NJ

INTRODUCTION: Desaturation (Desat) is common in obese patients under moderate-deep sedation. Raising nasal cannula (NC) O₂ flow to improve oxygenation may increase the risk of fire hazard by pooling O₂ under the surgical drapes above the recommended safe level (30%).¹ A simple plastic sheet improved oxygenation in sedated patients by converting NC to a face tent (TSE “Mask”) without raising NC O₂ flow.²⁻⁴ We examined its effectiveness in improving oxygenation in obese patients and assessed O₂ level under the surgical drapes.

METHODS: Review of patients who underwent lengthy (>20 min) procedures (breast biopsy, AV fistula, cystoscopy, D & C, hysteroscopy, hernia repair) identified 2 groups. Group 1 received NC O₂ (NC, n=34). Group 2 received NC O₂ and a TSE “Mask” (TM, n=84) using a plastic specimen bag(2-4) or a plastic fluid-shield surgical mask.⁴ Monitors included ECG, BP cuff, pulse oximetry, capnography and oximetry. Patients received NC O₂ (3-5 l/min) prior to sedation with only iv propofol. Data collected included age, weight, height, O₂ Sat, bag-mask ventilation, procedure duration, O₂ and CO₂ levels. Student t-test and Chi Square test were used for statistical analysis. A p value < 0.05 was considered as significant. (Mean±S.D.)

RESULTS: Among non-obese patients (BMI<30), there were no differences in age, BMI, ASA status, O₂ Sat after 5-min O₂ (NC:100±0%;TM:100±1%), duration, overall propofol dose and bag-mask ventilation (Table). There were significant differences in room air (RA) O₂ Sat (NC:99±1%;TM:98±2%), the highest O₂ flow (NC:5.3±1.7 l/min;TM:4.3±0.8), the lowest O₂ Sat (NC:94±5%;TM:97±4%) and severe Desat (O₂ Sat<90%) (NC:8/26;TM:3/51)(Fig).

Among obese patients (BMI>30), there were no differences in age, BMI, ASA status, RA O₂ Sat, O₂ Sat after 5-min O₂

(NC:99±1%;TM:100±0%), duration, the overall propofol dose and need for bag-mask ventilation. There were significant differences in the highest O₂ flow (NC:6.6±1.9 l/min;TM:4.8±1.3), the lowest O₂ Sat (NC:87±14%;TM:97±3%) and severe Desat (O₂ Sat<90%) (NC:3/8;TM:0/33).

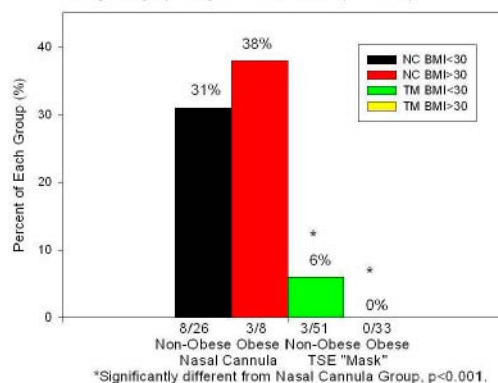
TM group had higher FiO₂ (0.60±0.18) than NC (0.32±0.09) and lower O₂ level under surgical drapes (0.22±0.01) than NC (0.41±0.13). The O₂ level under surgical drapes was higher than FiO₂ in NC group.

DISCUSSION: The data show that a TSE “Mask” improves oxygenation and prevents severe desaturation in propofol-sedated patients, especially in obese patients during lengthy procedures. It increases O₂ delivery without raising O₂ flow. It may improve patient safety at no cost and reduce risk of fire hazard by preventing O₂ pooling under the surgical drapes.

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Fig. 1 Effect of TSE “Mask” on Severe Desaturation (O₂ Saturation <90%) during Lengthy Surgical Procedures (>20 min)

**Effects of TSE “Mask” on Patients under Propofol Sedation during Lengthy Surgical Procedures 1**

| | Age (yrs) | BMI | ASA Status | Duration (min) | Propofol Dosage (ug/kg/min) | Highest NC O2 Flow (l/min) | Room Air O2 Sat | Lowest O2 Sat | Severe Desat (O2 Sat<90%) | Mask-Bag Ventilation |
|---------------------------|------------|---------------|--------------|----------------|-----------------------------|----------------------------|-----------------|----------------|---------------------------|----------------------|
| Non-Obese NC group (n=26) | 53±18 | 24.4±3.5 | 2.2±0.8 | 44±21 | 151±77 | 5.3±1.7 | 99±1% | 94±5% | 8/26 | 0/26 |
| Non-Obese TM group (n=51) | 54±17 n.s. | 24.8±3.3 n.s. | 2.0±0.7 n.s. | 55±27 n.s. | 171±73 n.s. | 4.3±0.8* p<0.001 | 98±2%* p<0.02 | 97±4%* p<0.005 | 3/51* p<0.01 | 0/51 n.s. |
| Obese NC group (n=8) | 56±8 | 33.6±4.0 | 2.4±0.5 | 63±39 | 122±67 | 6.6±1.9 | 96±2% | 87±14% | 3/8 | 1/8 |
| Obese TM group (n=33) | 55±13 n.s. | 35.8±4.6 n.s. | 2.4±0.7 n.s. | 49±26 n.s. | 128±58 n.s. | 4.8±1.3* p<0.01 | 98±2% n.s. | 97±3%* p<0.001 | 0/33* p<0.001 | 1/33 n.s. |

n.s. Not significantly different from Nasal Cannula Group; * Significantly different from Nasal Cannula group. Mean± S.D.

S-168.**DIFFICULT AIRWAY RESPONSE TEAM (DART) YEAR 1: IDENTIFYING SYSTEM DEFECTS THROUGH IN SITU PATIENT SIMULATIONS**

AUTHORS: K. S. Mon, J. Ok, W. Liao, D. Syin, R. Lourens, L. J. Mark

AFFILIATION: Johns Hopkins University, Baltimore, MD

INTRODUCTION: In response to five sentinel airway events that occurred from 2006 to 2008, the DART Initiative was established as a multidisciplinary approach to provide the highest level of comprehensive and specialized care in difficult airway management. The DART Initiative aimed to: 1) improve operational coordination and patient care, 2) identify system defects using in situ patient simulations, and 3) ensure sustainability in practice and knowledge through innovative educational programs.

METHODS: In DART Year 1 (2008-2009), five in situ simulations were conducted at our institution (Table 1). These simulations either proactively addressed issues with complex airway management (WICU, L&D, WBG 5) or were modeled after DART events (PACU, CCU). In situ simulations appropriately use the high/low-fidelity mannequins (SimMan[®], Laerdal) and a phone-activation simulation to achieve realism and are conducted in real time with day-of-care code/DART clinicians.

RESULTS: The five in situ simulations validated and uncovered additional system defects in a reproducible fashion that facilitated the institutional process improvement to decrease the number of airway-related sentinel events from 5 to 0 by the end of DART Year 1.

DISCUSSION: A metric goal for DART Year 2 and 3 is to implement in situ simulations in three clinical areas that are identified as frequent DART response areas during DART Year 1: neurosurgery critical care unit, adult ED, and pediatric trauma ED. Review of the in situ simulations and the DART activation events will lay an important foundation for improving the operations of DART during Years 2 and 3.

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| Unit | Type of Simulation | Goals | Defects Identified | Results and Lessons Learned |
|-------|--|--|---|--|
| PACU | CODE to DART in situ High-Fidelity Human-Patient SimMan [®] , Laerdal | A) To establish a template for packaging in situ simulations in a cost-effective, time-efficient manner in real time. B) To orient incoming DART attendings to the process. | 1. PACU was unable to mobilize DART practitioners and airway cart in < 10 min. 2. Providers identified a non-retractable scalpel in the DART cart, which put practitioners at risk for STIX injury. 3. Fiberoptic (FOB) bronchoscope and rigid laryngoscope (RL) cables were entangled, and practitioners could not readily attach light source. | 1. DART oversight created a DART cart activation and mobilization process and an educational package for all practitioners. 2. Non-retractable scalpels were replaced with safety scalpels on the DART cart; 3. FOB and RL cables and light source were color-coded to facilitate operations. |
| WICU | CODE to DART Phone activation simulation | A) To achieve portability of SimMan [®] , Laerdal and create a financial package for the simulation process. B) To test the universal activation number for code/ DART (410-955-4444). | 1. Identified outdated code/DART pager numbers and a significant time lag between emergency paging and DART response. | 1. A knapsack containing necessary equipments for in situ simulations was created. 2. Members of DART oversight and Safety Officer receive all pages to ensure functionality of the paging system. 3. DART oversight performed on-going investigations with paging system and the investigation of a new emergency response system. |
| CCU | CODE to DART in situ High-Fidelity Human-Patient SimMan [®] , Laerdal | A) To re-enact a significant near-miss. B) To review videos with the CCU team and present as a multidisciplinary DART Initiative at a multidisciplinary DART conference. | 1. Identified that the delay in DART response time was due to a lack of elevator key access. 2. Observed >20 min response time in mobilizing the DART cart from established remote locations (metric <10 min response time). 3. Ambiguity of DART attendings' roles when multiple providers are at bedside and of choice of airway algorithms. 4. Ambiguity for identified providers to set up DART cart during the emergency. | 1. Performed on-going investigations with Security and facilitated elevator keys attached to all DART carts. 2. Funding was allocated for an additional DART cart to be placed at the CCU. 3. Need for a post-event, on-site debriefing by providers with clarification of DART attending roles and of airway algorithms utilized. 4. Respiratory Therapy who already provides 24/7 service will assume responsibility of DART cart set-up. |
| L&D | CODE to DART Phone activation simulation | A) To test the universal activation number for code/DART. B) To determine the ideal location for the DART cart in L&D between OB inpatient units, which are within the AMBER alert security system for infant abduction. | 1. AMBER alert was inadvertently activated during simulation. DART team locked in to OB inpatient unit-Security had difficulty resolving the lockdown because of multiple entrances to the unit. This situation was dramatized by the simultaneous code/DART call to a different location in real time (Note: 2nd code/DART team was mobilized). 2. DART cart (in the L&D suite) was physically locked out of the patient unit during the AMBER alert. | 1. Resolution to the inadvertent AMBER alert was achieved by coordinated efforts between Security and AMBER alert system administrators. 2. OB nurse manager delivers and has access to AMBER alert-protected inpatient units. |
| WBG 5 | CODE to DART Phone activation simulation | A) To test the universal activation number specifically in Weinberg Cancer Center. B) To deploy DART cart to the Weinberg Cancer Center and to assess the ideal location in the Cancer Center for placement of DART cart. | 1. Inability for the paging system to activate entire code/DART teams in time metrics of <10 min response time. 2. Deployment of DART cart to Weinberg 5th floor (WBG 5) limited by lack of specific elevator keys (key system different from main hospital). | 1. Funds were approved for implementing the new LifeLineEmergencyPaging system. The LifeLineEmergencyPaging system includes pager, cell phone, and internet activation with audiotape process improvement review. 2. WBG 5 inpatient unit identified high risk patients for complex airway management and DART cart housed in WBG 5. |

S-169.**QUANTIFYING INTRAOPERATIVE EFFECTS OF β - BLOCKADE IN ELDERLY PATIENTS UNDERGOING VASCULAR SURGERY**

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INTRODUCTION: While prior research on β - blockers and vascular surgery patients has focused on issues such as β - blocker type and dosage,¹ this study is one of the first to examine the adequacy of intra-operative heart rate control for different age groups. As patients age, their cardiovascular system stiffens and there is a diminished β -adrenergic receptor response.² This decreased physiologic reserve may play a role within the intra-operative period prior to surgical incision. The pre-incision period continues to be an interval when maximal stresses such as induction of general or regional anesthesia take place.

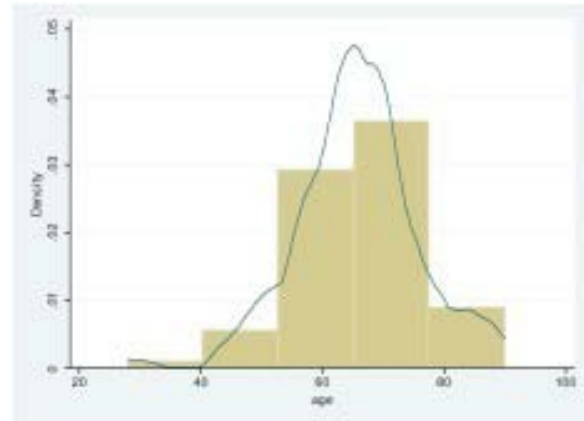
METHODS: Given guideline ranges of 65 to 80 beats per minute(bpm),¹ we characterized control based on the maximal heart rates achieved for the interval between entry to operating room and surgical incision. We reviewed intra-operative physiologic, administrative, and pharmacologic data on 154 patients who presented for vascular surgery from 2008-2009. Age was divided into groups of <50,50-60,60-70,70-80,>80 years. We examined the association of maximal heart rate and β - blocker usage by performing crude and adjusted (for age) linear regressions. All p-values are two-sided and a p-value less than 0.05 is considered to be statistically significant. STATA 11 (STATA Corporation, College Station, TX, USA) was used for the statistical analyses.

RESULTS: Table 1 provides a description of patient and treatment characteristics. We identified 91 patients who were preoperatively prescribed β -blockers and 54 patients not prescribed β -blockers. The two groups were comparable across age (Fig 1,2), body mass index, ASA status, and heart rate on entry to OR. The group taking β -blockers had a significantly lower maximal heart rate achieved (112 ± 49 bpm) compared to the non- β -blocker group (130 ± 58 bpm). Both unadjusted($\text{Beta} = -17.7; p = .04$) and adjusted($\text{Beta} = -17.4; p = .04$) linear regressions showed a significant benefit in all age groups for heart rate protection with the use of β -blockers .

DISCUSSION: Patients undergoing vascular surgery represent a group where there may be substantial benefits of administering β -blockers. The results of this study will document the extent of intra-operative heart rate variability in different age groups. These results may further assist in evaluating existing practice guidelines.

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Histogram and kernel density plot for age for patients taking B-blockers

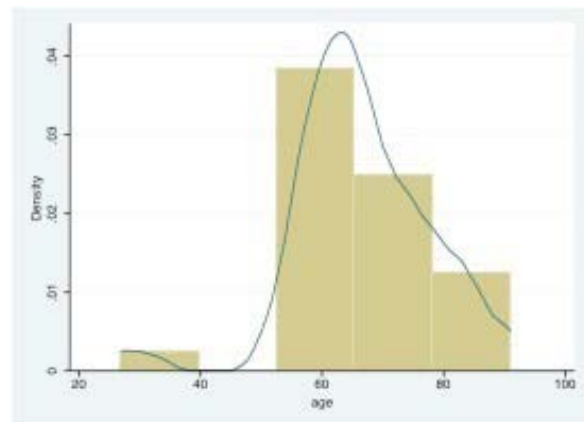


Figure 2: Histogram and kernel density plot for age for patients not taking β -blockers

S-170.**FAMILIES IDENTIFY SAFETY LEARNING OPPORTUNITIES IN HOSPITALIZED CHILDREN**

AUTHORS: J. Daniels, K. Hunc, D. Cochrane, R. Carr, J. Lim, J. Ansermino

AFFILIATION: University of British Columbia, Vancouver, BC, Canada

INTRODUCTION: Identifying adverse events is essential for safety improvement and patients have been shown capable of reliably reporting adverse events.¹ The impact of a patient safety reporting system used by families of pediatric inpatients on the reporting rate from healthcare providers has not been investigated. Knowledge is needed about the types of adverse events and near misses that families self-report, their harm profile, and the overlap between this reporting technique and that from healthcare providers.

METHODS: Following Institutional Review Board approval, between November 2008 and November 2009, 544 families of children discharged from the Neurosciences and Surgery ward of a university-affiliated pediatric hospital provided informed consent and responded to a web-based questionnaire (Table 1) regarding adverse events and near misses that occurred during their hospital stay. Posters were placed on walls of the study ward advertising the family reporting study to begin in November 2008 and were left in place during the entire study. During the study, a research assistant attended weekly safety rounds attended by medical, nursing and staff representatives active on the study ward and provided updates on the family reporting study. Hospital staff were not informed of the study hypothesis. The effect of this intervention on healthcare provider reporting rates compared to the previous year was determined via a quasi-Poisson model with over-dispersion. Family reports were analyzed by two investigators to determine whether the reports represented legitimate safety concerns. Family reports were matched with healthcare provider reports to determine overlap in reported events.

RESULTS: At least one adverse event or near miss was reported in 201 (37%) family provided reports. A total of 321 events were identified. Forty eight percent of these events were evaluated to represent legitimate patient safety concerns. Only 2.5% of the family reports were reproduced in the healthcare provider reporting system. No significant change was seen in monthly healthcare provider reporting rates (Figure 1 ($p=0.73$)).

DISCUSSION: This study shows that the introduction of a family initiated adverse event reporting system administered on discharge from a pediatric inpatient surgical ward did not result in a change in adverse event reporting rate by healthcare providers. Most reports submitted by families were not duplicated in the healthcare provider reporting system and almost half represented legitimate patient safety concerns. Families represent an untapped resource for learning about patient safety problems within pediatric healthcare institutions.

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Table 1: Web-based Questionnaire Definitions and Items

| Question Stem | Safety Problem Definition and Example |
|---|--|
| Do you think a Medication Problem occurred or was stopped before occurring? | Medication Problems: When a medication is not given exactly as it was meant to be. Examples: Medication given in the incorrect amount. An allergic reaction to medication. |
| Do you think a Complication of Care occurred or was stopped before occurring? | Complication of Care: When there is an unwanted result of treatment. Examples: Unexpected bleeding occurred. Transfer to the intensive care unit due to a complication. |
| Do you think an Equipment Problem occurred or was stopped before occurring? | Equipment Problems: When equipment fails or is not used correctly. Examples: Equipment not available when needed. An arterial line leaks or becomes blocked. |
| Do you think Miscommunication between Staff occurred, or was stopped before occurring? | Miscommunications Between Staff: When members of the staff give or receive information from other staff about diagnosis, treatment, or care, that is inadequate (not enough information), conflicting (information that is different than someone else gave), or incorrect. Examples: A test was repeated because the original was lost or destroyed. A test was cancelled by mistake. |
| Do you think a Miscommunication between your Family and Staff occurred or was stopped before occurring? | Miscommunications Between My Family and Staff: When you or your family give or receive information from staff about diagnosis, treatment, or care, that is inadequate (not enough information), conflicting (information that is different than someone else gave), or incorrect. Examples: Medication instructions were not explained to me or my family. Staff did not communicate well. |
| Do you think any Other Problems occurred or were stopped before occurring? | Other: When any action not previously described fails, or was the incorrect action. Examples: A burn occurred. A cut occurred. |

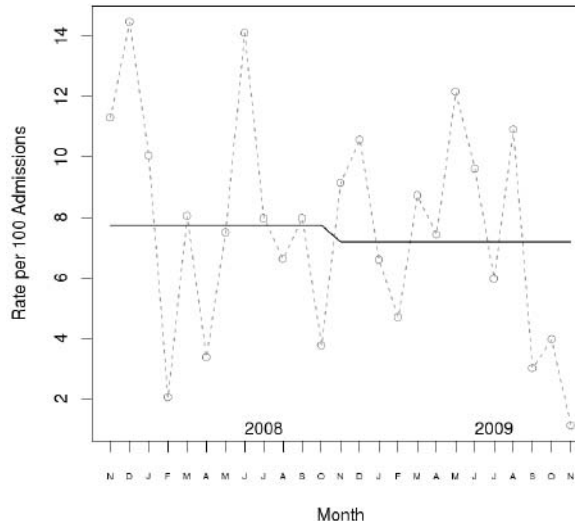


Figure 1 - Monthly and Mean Number of Healthcare Provider Reports. Family Reporting Intervention Occurred November 2008. Solid Line Indicates Expected Number of Reports.

S-171.**FIRST IMPRESSION DURING THE RESIDENCY INTERVIEW CORRELATES WITH FINAL RANK LIST POSITION**

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INTRODUCTION: Decisions to interview residency candidates are often based upon factors such as USMLE scores and medical school performance. The interview is a more subjective aspect of the selection process. The book, *Blink: The Power of Thinking Without Thinking*, describes the concept of the ability to discern important information about a person within just a few seconds. Our interview team utilizes this concept and attempted to correlate it with other selection factors and outcomes.

METHODS: Deidentified data from 430 applicants (three years; 2007-10) were analyzed. Each applicant was interviewed by the same four faculty and one resident and assigned a "Blink" score - a score assigned and recorded within the first 30 seconds of the interview where 1= not an appropriate candidate, 5= excellent candidate. Excluded from the study were applicants who were students of our medical school or who did a rotation in our department as a Blink score cannot be assigned to someone already known by the interviewer. Spearman's correlation coefficients were determined for mean Blink score and final applicant position on the NRMP rank list, mean overall faculty score for applicant based on application and interview, applicant USMLE scores, mean score for review of ERAS materials, and mean applicant scores for structured interview questions based on the general competencies. Correlation between the overall score assigned by the resident interviewer and rank list order was also determined. A mean Blink score was determined for each gender and compared using the t test. Multiple regression analysis was utilized.

RESULTS: Using Spearman's rank correlation coefficient, significant correlations were found between the Blink score and overall faculty score, rank list position, scores for structured interview questions, review of ERAS score, and Step 2 score (Table 1). Among all the variables the best predictors of rank list position according to multiple regression analysis were overall faculty score, ERAS score, interpersonal and communication skills score, overall resident score and gender. The mean Blink score for male and female was 3.5 and 3.8 respectively ($p < 0.0001$).

DISCUSSION: The snap judgments made by the interview team (Blink score) correlated significantly with rank list position and the following scores: overall faculty score, structured interview questions, review of ERAS materials, and Step 2. Despite the Blink score correlating well with these variables, it was not among the best predictors of rank list position. Whether "Blink" assessment correlates with resident performance outcomes has yet to be studied.

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Gladwell, Malcom. (2005) *Blink: The Power of Thinking Without Thinking*.

Table 1

| Blink Score correlated: | ρ | p-value |
|---------------------------------------|---------|---------|
| Overall Faculty Score | .72202 | <.0001 |
| Rank List Order | -.61337 | <.0001 |
| Professionalism | .59177 | <.0001 |
| Interpersonal & Communications Skills | .54557 | <.0001 |
| Systems-Based Practice | .51114 | <.0001 |
| Practice-based Learning & Improvement | .49250 | <.0001 |
| Review ERAS | .35120 | <.0001 |
| Step 2 Score | .1197 | .0280 |
| Step 1 Score | .03542 | .4723 |

S-172.**MORE STRATEGIES ARE NECESSARY TO ACCOMPLISH THE SAFETY MANAGEMENT OF ULTRASOUND GUIDED CENTRAL VENOUS CATHETER INSERTION****AUTHORS:** T. Yorozu,¹ K. Moriyama,¹ Y. Shiokawa,² Y. Ohashi¹**AFFILIATION** ¹Anesthesiology, Kyorin University Faculty of Medicine, Tokyo, Japan; ²Neurosurgery, Kyorin University Faculty of Medicine, Tokyo, Japan

INTRODUCTION: There are many reports that ultrasound guided central venous catheter (CVC) insertion reduces mechanical complication.^{1,2} However, in our previous observational study, ultrasound guided CVC insertion failed to indicate significant advantage to reduce mechanical complications.³ We speculated that mere recommendation of using ultrasound devices (US) without proper training of ultrasound techniques was not sufficient to accomplish the safety management of CVC insertion. Therefore we revised the recommendation of the real time ultrasound guided CVC insertions only to the doctors who were familiar with this technique. The purpose of this study is to evaluate the improvement in reduction of mechanical complications after revising the recommendation policy for using US.

METHODS: In our hospital, certifications for CVC insertion were given to the doctors after they took the educational course of CVC insertion including the basic technique of using ultrasound. We recommended the use of US for visualization of the vein but not for real time ultrasound guided CVC insertion unless operators were thoroughly skillful with the devices. The observation sheets of CVC insertion over 17 months were analyzed with Chi square tests. The data were compared with the results of our previous study.

RESULTS: A total of 2816 observation sheets were collected. US were used in 39.5% of all cases. Overall mechanical complication rate was 2.7%. The rates of accidental arterial punctures were shown in the table. The increase of accidental arterial punctures with US use especially when the operators were junior residents or when the patients had no risk factors in our previous study has vanished in our present study.

DISCUSSION: By the change of the strategy, the risk of accidental arterial punctures with inadequate US use has been attenuated. However the benefit of US was not shown in this study yet. Therefore, in order to facilitate safety management of real time ultrasound guided CVC insertion, establishment of standard training course of US guided CVC insertion is urgent. Ultrasound guided CVC insertion failed to indicate significant advantage to reduce accidental arterial punctures. Further strategy for education to unskilled operators of ultrasound guided CVC insertion is necessary.

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2. N Engl J Med 348: 1123-33, 2003
3. Anesth&Analg 110: S206, 2010

Table 1

| | Previous study (2007.10-2009.6) | | Present study (2009.7-2010.11) | |
|-------------------------------------|------------------------------------|--------|-----------------------------------|------|
| All cases US used US not used | 3.9% 1.6% | P<0.05 | 1.4% 1.5% | n.s. |
| Risk factor(+) US used US not used | 2.7% 2.5% | n.s. | 2.3% 2.7% | n.s. |
| Risk factor(-) US used US not used | 5.0% 1.3% | P<0.01 | 1.1% 1.2% | n.s. |
| Junior resident US used US not used | 12% 4.1% | P<0.05 | 2.2% 2.0% | n.s. |

US: ultrasound devices

S-173.**MAFUTURON – THE OLDEST WRITING ON CLINICAL ANESTHESIA****AUTHORS:** K. Dote, K. Ikemune, M. Yano, T. Yamabe, T. Nagaro**AFFILIATION:** Ehime University Hospital, Toon, Japan

INTRODUCTION: In 1839, Mafuturon was written by Gendai Kamata, who was one of the excellent apprentices of Seisyu Hanaoka. In Mafuturon, Gendai said many important things about the general anesthesia using Mafututo, such as pre-anesthetic care and evaluation, induction of anesthesia, maintenance of anesthesia, post-anesthetic care, handling of children when anesthetizing them, and so on. Even though Seisyu invented the general anesthesia using Mafutusan in 1804, he did not leave any detailed writings on the method he invented. So, Mafuturon is the oldest writing on clinical anesthesia in Japan. However, many Japanese anesthesiologists do not know this fact, and do not know Gendai Kamata, because the copies of Mafuturon now exist are very rare. So, we investigated how many copies of Mafuturons are remaining in the world, and also researched the books on anesthesia written by his contemporaries in the early days of anesthesia, in the early 19th century.

METHODS: We investigated how many copies of Mafuturon are remaining in the world, by checking through the collections of the libraries in Japan, and searching through the internet. We also checked the books of anesthesia written in the early-to-mid 19th century.

RESULTS: We found 7 existing copies of Mafuturon in the world. 4 copies are in libraries in Japan, one copy is in a library in England, and 2 books are personal possessions of individuals.

The early writings on anesthesia are Davy's, written in 1800, Farady's, in 1820, Hickmann's, in 1822. Even these writings are very old, they are not on clinical anesthesia. The oldest writings on clinical anesthesia in Western countries are Morton's, written in 1846, and Snow's, in 1847. Therefore, Mafuturon, written in 1839, is the oldest existing writing on clinical anesthesia in the world.

DISCUSSION: There are seven copies of Mafuturon remaining in the world. Even the copies are very rare, Mafuturon, written in 1839, is the oldest existing writing on clinical anesthesia.

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S-174.**UNDERSTANDING SPECIALIZED HUMAN MOTION USING GESTURE ANALYSIS: A COMPARISON OF SKILL IN DIRECT LARYNGOSCOPY USING MOTION CAPTURE TECHNOLOGY**

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AFFILIATION: ¹Department of Anesthesiology, Mount Sinai Medical Center, New York City, NY; ²Simulation and Education Training Center, Banner Good Samaritan Medical Center, Phoenix, AZ

INTRODUCTION: The practice of anesthesiology involves complex psychomotor tasks such as intubation via direct laryngoscopy. There is increasing interest in the creation of high-fidelity simulations of such skills in order to reduce errors and patient harm during the learning phase of residents. The ability to quantitatively describe differences in complex hand motions performed by experts versus novices has also been difficult. This project aims to develop a means to measure psychomotor proficiency of anesthesiologists performing direct laryngoscopy under varying conditions.

METHODS: 50 subjects comprised of residents, attendings, and medical students were voluntarily enrolled. An observational, cross-sectional study design was employed. A standardized intubation protocol was videotaped with emphasis on hand movement capture. Each participant performed 4 intubations on the METI HPS simulator: an “easy” or “difficult” intubation was simulated with use of either MAC or Miller blades. End-time was marked with positive end tidal CO₂ indicating a “successful” intubation or an admission of a “failed” intubation. Hand movement video was analyzed using motion sensor technology and a proprietary computer vision algorithm. Subtle movement is detected and a “visual trail” is left, while stationary objects of the video stay dark. Velocity of movement is measured by counting the number of pixels within each video frame. An array of acceleration of hand movement is then created for each user. Principal Component Analysis (PCA) is used to reduce the dimensionality of the array and Linear Discriminant Analysis (LDA) is used to reduce the array to two-dimensions. A decision boundary is drawn from this data. The videos were also viewed and rated (1-5) by two blinded attending anesthesiologists. The qualitative data was then compared with the quantitative data to look for correlations.

RESULTS: PCA scores were generated for each expertise group. MS (35.87%), CA1 (51.25%), CA2 (75.76%), CA3 (81.6%), Att (80%). Composite PCA scores were averaged and compared: Novice (MS, CA1) = 45.36% and expert (CA2, CA3, ATT) = 79.12% ($p < 0.05$). Blinded rater scores averaged 2.73 for novice and 4.35 for expert ($p < 0.05$).

DISCUSSION: Through motion capture technology and video analysis we have developed a unique method for quantitatively describing complex psychomotor abilities such as direct laryngoscopy and intubation showing distinct differences of movement activity between levels of expertise. This data will be ultimately utilized in the creation of haptic based “next-generation” virtual laryngoscopy simulators for medical education.

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Pre Motion Capture Video Analysis



Post Motion Capture Video Analysis

S-175.**DOES A CONSENSUS EXIST IN THE TREATMENT OF PERIOPERATIVE CORNEAL ABRASIONS? A SURVEY OF U.S. ACADEMIC ANESTHESIOLOGY DEPARTMENTS****AUTHORS:** S. McIlrath, J. Ollis, D. R. Bustamante**AFFILIATION:** Department of Anesthesiology, University of Tennessee Graduate School of Medicine, Knoxville, TN

INTRODUCTION: Corneal abrasions (CA) are the most common ophthalmic complication following general anesthesia. The ASA closed claims project reported that eye injuries occurred in 3% of all claims in the database (71/2046) with CA representing 35% of all such injuries (25/71).¹ A review of the literature revealed no consensus regarding evaluation and treatment of patients with a suspected perioperative CA. The purpose of this study was to evaluate current practices in the treatment of perioperative CA among U.S. academic anesthesiology departments.

METHODS: After obtaining IRB approval, a survey was submitted to directors of 126 U.S. anesthesiology residencies using online software (SurveyMonkey). If no initial response was obtained, the survey was resubmitted to the research director and/or other administrative faculty. The survey asked whether programs specifically track the incidence of CA and whether an institutional protocol exists for the evaluation and treatment of CA. Programs with a protocol were asked to submit them, and the programs without protocols were further questioned about recommended treatment of CA. Also, programs were asked under what circumstances would an ophthalmologist or eye care professional be consulted.

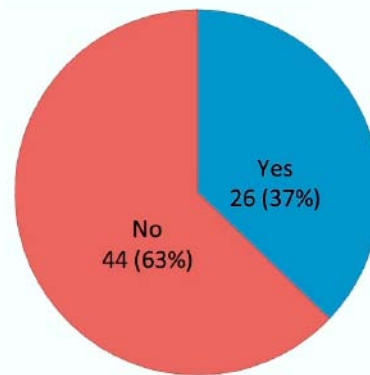
RESULTS: Responses were received from 70 of 126 programs (56%). 53% (37/70) of respondents do not currently track the incidence of CA. 63% (44/70) of responding programs do not have an existing institutional protocol (Figure 1). 74% (32/43) of programs without a protocol reported that they automatically consult an ophthalmologist or eye care professional upon initial suspicion of CA. 21% (9/43) refer patients only if symptoms persist for >24hr (Figure 2). Protocols and recommendations varied among institutions (i.e. eye patching vs. not patching; use of ophthalmic antibiotics and/or other eye drops: NSAID, saline, lubricating, etc.)

DISCUSSION: The findings of this survey suggest that no consensus exists for the evaluation and treatment of perioperative CA among U.S. academic anesthesiology departments. Furthermore, recommendations and existing protocols lack uniformity and are sometimes contradictory. Many institutions automatically proceed with an ophthalmology consultation. However, this may not be a viable or timely option outside of larger, academic medical centers. The lack of consensus among academic anesthesiology departments on the evaluation and treatment of CA suggests the need for a uniform approach to a relatively common perioperative complication. Alternatively, the lack of consensus may indicate that this complication is often self-limiting and may respond similarly to a variety of treatment options.

REFERENCES:

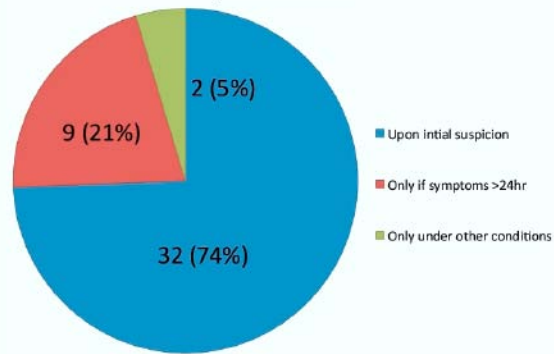
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Figure 1. Does your department have a protocol for the evaluation and treatment of corneal abrasion? n=70



63% of surveyed U.S. academic anesthesiology departments do not have a protocol for evaluation and treatment of perioperative corneal abrasion.

Figure 2. Under what circumstances should suspected corneal abrasions be evaluated by an ophthalmologist or other eye care professional? n=43



74% of surveyed departments without a protocol automatically consult ophthalmology upon initial suspicion of corneal abrasion.

S-177.**MALLAMPATI SCORE PREDICTS ANESTHESIA PREPARATION TIME, AIRWAY TRAUMA, AND ADVERSE PULMONARY OUTCOMES IN PATIENTS UNDERGOING NON-EMERGENT INTESTINAL SURGICAL PROCEDURES**

AUTHORS: D. L. Davenport,¹ W. Keach,² J. B. Zwischenberger,¹ E. A. Bowe,³ K. W. Hatton³

AFFILIATION: ¹University of Kentucky Department of Surgery, Lexington, KY; ²University of Kentucky College of Medicine, Lexington, KY; ³University of Kentucky Department of Anesthesiology, Lexington, KY

INTRODUCTION: The Mallampati score (MS) predicts difficult intubation¹ and has been linked to obstructive sleep apnea and obesity - but not to pulmonary outcomes.^{2,3} We examined MS relative to anesthesia preparation time (APT), airway trauma during intubation (ATI) and postoperative pulmonary complications.

METHODS: We queried the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) dataset for patients having intestinal surgery in 2007 or 2008. The ACS NSQIP is a prospective, systematic study of major surgery patients at 200+ hospitals. Data include preoperative, intraoperative and 30-d postoperative variables. We analyzed MS relative to APT (anesthesia start time to incision), ATI, and pulmonary complications (pneumonia, mechanical ventilation > 48 h and unplanned reintubation) using chi-square tests for trend and Kruskal-Wallis tests. We used multivariable logistic regression to adjust for patient pulmonary risk factors (ASA PS class, smoking, COPD, obesity, diabetes and 11 others), procedure type and complexity (as measured by work RVUs).

RESULTS: The database contained 101974 patients who underwent intestinal surgery. Patients without reported MS (22710, 22.3%) were excluded, leaving 79264 for analysis. The mean patient age was 53.4 ± 16.7 y and 48012 (60.6%) were female. APT increased linearly with MS ($P < .001$) from 32 minutes (interquartile range [IQR] 24-43) for MS1 to 39 minutes (IQR 29-51) for MS4. ATI was rare (196 patients, 0.2%) but increased linearly ($P = .001$) with MS. Pneumonia ($n=1382$, 1.7%), ventilation > 48 h ($n=1275$, 1.6%) and unplanned reintubation ($n=1170$, 1.5%) all increased linearly with MS ($P < .05$). After multivariable adjustment MS3 and MS4 were independent predictors of unplanned intubation versus MS1 (odds ratios [O.R.] 1.2 [95% CI 1.0-1.5, $p < .05$] and 1.7 [95% CI 1.2-2.5, $p < .01$]). MS4 was an independent predictor of mechanical ventilation > 48 h (O.R. 1.7, 95% C.I. 1.2-2.5, $p < .01$).

DISCUSSION: Our data confirm the association of MS with difficult intubation as measured by anesthesia preparation time and airway trauma in a large contemporary sample of intestinal surgery patients. We also demonstrate an independent association between MS and postoperative respiratory complications after extensive patient and procedural risk adjustment. The causal link is undeterminable from our data.

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S-178.**RESIDENT CAREER EXPECTATIONS: A SURVEY**

AUTHORS: S. N. Johnson, M. Kameyama, J. Wasnick

AFFILIATION: St. Luke's - Roosevelt Hospital, New York, NY

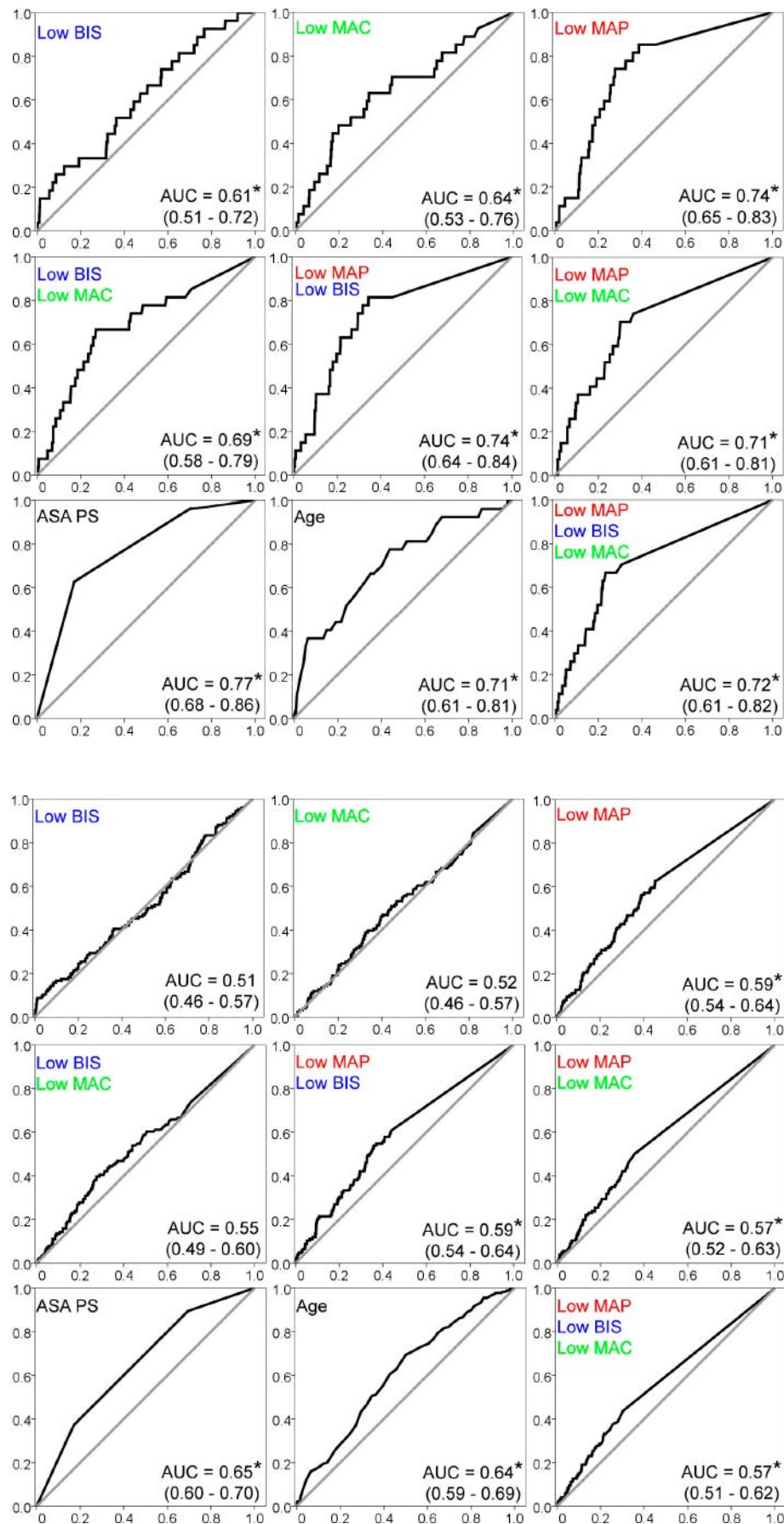
INTRODUCTION: Workforce challenges for graduating residents may change. Current opinions of future challenges were sought, with IRB approval, from resident physicians throughout the United States to determine what motivated them in choosing their medical specialty, what they expect out of their lifestyle in terms of work hours, and whether they are still optimistic about their career choice. The survey results of anesthesiology residents were particularly evaluated to determine if the opinions of anesthesiology residents differed from those of other specialties.

METHODS: With IRB approval, a 10 multiple-choice question survey was generated and distributed electronically via www.surveymonkey.com to residency programs of all specialties within the USA. The residency contact emails were obtained from the American Medical Association FRIEDA online website.

RESULTS: 516 survey responses were received. The geographic distribution of survey participants were: Northeast 29%, West 24%, Southwest 17%, Midwest 16%, and Southeast 14%. The specialty of survey participants represented were: Anesthesiology 22%, Radiology 22%, Pediatrics 17%, Emergency Medicine 10%, Orthopedic Surgery 8%, Psychiatry 8%, Internal Medicine 7%, and General Surgery 6%. In terms of the most important factor in choosing a specialty, 80% replied interest in the specialty was the most important factor. In regards to work hours and lifestyle, 64% of survey participants are planning on working part-time, with the reasons being pursuing research or a career outside of healthcare or the desire to travel. Most survey participants planned on working 50-60 hours per week (39%), followed by 27% planning on working 40-50 hours per week. In terms of practice settings, 40% would choose private practice; 39%, private practice with teaching responsibilities; and 21%, academics. 81% of survey participants were optimistic about choosing a medical career. Of the anesthesia resident responses, 81% were also optimistic about their career. Of the participants, 81% of anesthesiology residents also responded. For those not optimistic, the top 3 reasons were because of changes in reimbursement, loss of autonomy, and loan debt. In terms of their specialty choice, 85% of survey participants would choose the same specialty. The large majority that would not choose their specialty again would not choose medicine at all as a career.

DISCUSSION: Despite the ongoing changes in healthcare, most residents in all parts of the country and across different specialties are optimistic about their choice of having a medical career and their specialty. The responses of anesthesiology residents did not differ from their peers in other specialties.

REFERENCES: N/A



S-180.**RETROMOLAR FIBEROPTIC INTUBATION IN A PATIENT WITH SEVERE TRISMUS UNDERGOING NASAL SURGERY****AUTHORS:** A. Truong, J. Fang, D. Truong**AFFILIATION:** MD Anderson Cancer Center, Houston, TX

INTRODUCTION: A considerable challenge for airway management arises when restricted mouth opening does not allow passage of an endotracheal tube (ET) and concomitant contraindications to nasal intubation are present. A novel technique using the retromolar space (RMS) as the point of insertion for oral fiberoptic intubation (FOI) will be described. Patient consent was obtained for this report.

METHODS: A 50 year old 48 kg, 160 cm female presented for right dacryocystorhinostomy (DCR). In 1982, she was diagnosed with carcinoma of the soft palate treated by resection and radiation therapy. In 2008, a nasopharyngeal carcinoma was detected which was treated with chemoradiation. Subsequently, she developed progressive trismus with markedly restricted mouth opening. She also developed nasolacrimal duct obstruction. She had undergone left DCR one week earlier at which time a left nasal FOI was performed. This time, orotracheal intubation was requested since right DCR would involve the right nostril and intubation through the left nasal passage might dislodge the recently placed nasolacrimal tube.

Physical examination revealed an interincisor distance of 9 mm and it was impossible to pass a 6.0 ET through that gap (Figure 1).

In the operating room, general anesthesia (GA) was induced with propofol 100 mg and fentanyl 100 mcg. Bag and mask ventilation was achieved without difficulty and rocuronium 50 mg was given. A 3.5 mm flexible fiberoptic bronchoscope loaded with a reinforced 6.0 ET was inserted into the corner of the mouth into the RMS. The epiglottis was identified and the flexible bronchoscope was maneuvered through the vocal cords and the ET advanced for orotracheal intubation (Figure 2).

Challenging Case Report (only complete if your submission falls into the "Challenging Case Report" category. If you select the "Challenging Case Report" category on the next step, this section must be completed.): N/A

RESULTS: N/A

DISCUSSION: Located between the back of the last molar and the anterior edge of the ascending ramus of the mandible where it crosses the alveolar margin (Figure 3), the RMS is present even with complete mandibular occlusion. It has been used as a passage for pharyngeal suctioning in patients emerging from GA with their teeth clenched. This space has also been used by maxillofacial surgeons to anchor the ET to achieve optimal mandibular approximation before wiring the jaws together.¹ Even with severe trismus, the RMS can readily accommodate a 7.0 ET. Prior expertise achieved in fiberoptic bronchoscopy can be conveniently applied to retromolar FOI. Furthermore, to improve skills in this technique, trismus can be simulated by keeping the patient's mouth closed and attempting FOI from the RMS. With practice, the expertise achieved in performing this technique will confer a much needed option for securing the airway in this challenging situation.

REFERENCES:

1. Can J Anaesth 2005; 52(3):341



Figure 1



Figure 2

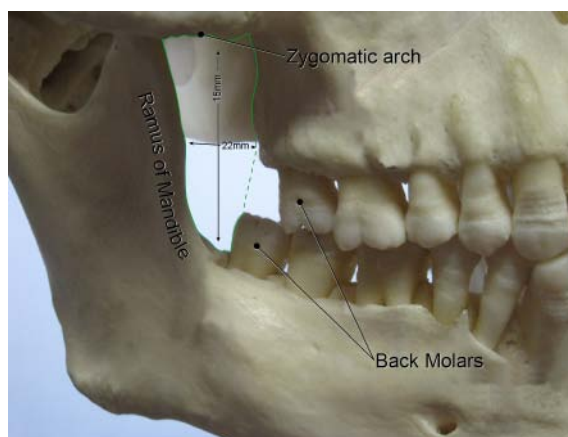


Figure 3

S-181.**ANALYSIS OF THE FREQUENCY OF HYPOTENSION DURING RESIDENCY-EFFECT OF EDUCATIONAL INTERVENTIONS AND CORRELATION WITH EVALUATION****AUTHORS:** L. C. Jameson,¹ K. Bullard,² C. J. Lace³**AFFILIATION:** ¹University of Colorado, Anschutz Medical Campus, Aurora, CO; ²University of Colorado, Anschutz Medical Campus, Aurora, CO; ³University of Colorado, Anschutz Medical Campus, Aurora, CO

INTRODUCTION: Objective assessment of resident judgment is a primary goal of ACGME, ABA and the public. Electronic anesthesia records (AIMS) allow continuous VS data thus BP management. Hypotension (HT) is accepted as undesirable and avoidance requires proficiency in assessing patient's medical condition, surgical risks and anesthesia management. A 2008 study demonstrated HT occurred more frequently in the first 4 months of CA1 year. This resulted in changes to CA1 training. This study assessed the impact of these changes on HT in CA1 and if frequency of HT in the CA2/3 years correlated with evaluations.

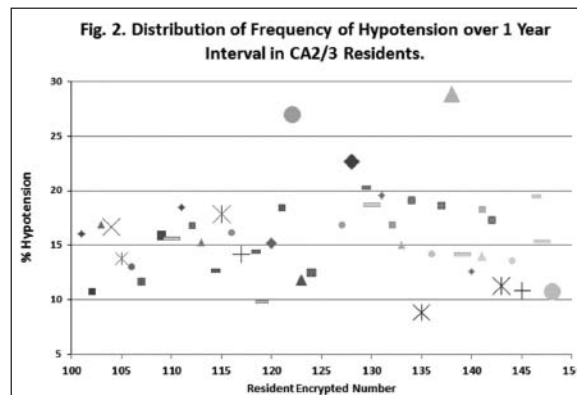
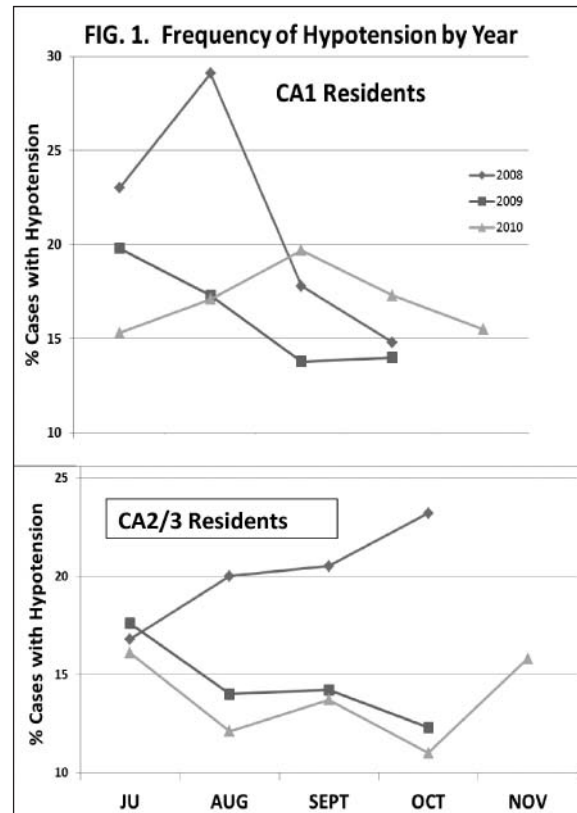
METHODS: AIMS (CPA, GE Medical) data extraction (7/2007 to 11/2010) included: freq, % cases with HT (systolic BP 35% below initial OR BP for > 5 min) occurred, total duration of HT, patient demographics, co-morbid conditions, and care giver. Cardiac, thoracic, outpatient surgery was excluded. Educational changes: 2008-None; 2009-simulation for HT, delay 1st call to 8-1, begin 1:2 staffing at 3 wks, 1:1 staff resident; 2010-delay 1st call to 8-10, begin 1:2 staffing at 4 wks, 1:1 staff faculty, reduced case difficulty. Time intervals assessed 9-07 thru 6-08, 7-08 thru 6-09, 7-09 thru 6-10, 7-10 thru 11-10. Overall yearly CA2/3 evaluations and monthly CA1 evaluations for '10 were compared to the HT freq. Identity encrypted.

RESULTS: Total patients by time intervals: '07-4083, '08-6406, '09-6864, '10-2852. Resident were (CA1/CA2/3): 4 mo-'08 6/22, '09-11/19, '10-7/23 and yearly '07-37, '08-36, '09-38. Freq of HT, duration of HT, patient demographics and % patients with co-morbid conditions were unchanged. Simulation education to identify and manage HT decreased the aggregate freq in '09, '10. Additional '10 changes delayed but did not eliminate the increase in HT (Fig 1). In the '10 class, 1 CA1 resident had an initial 44% freq of HT that corrected in one month while another continued to have a HT freq greater than the group until training changes were made (Resident/group: 23.3/15.2+7.0; 21.8/17.1+3.7; 22.2/19.7+3.2; 24.4/17.3+10.0; 9.1/15.6+9.8). CA2/3 residents with a higher freq of HT were likely to be subjectively assessed by the faculty as being in the bottom quarter of their class (Fig 2).

DISCUSSION: Increased HT is characteristic of beginning CA1 residents. Simulation was the most effective action to reduce HT. Comparison resident's frequency of HT, overall or during specific rotations, may help mentors identify educational difficulties and address them in an objective manner. Additional analysis, duration and number of intervals, may provide more specific and sensitive information.

REFERENCES:

Using AIMS To Determine Frequency of Hypotension as a Quality of Care Indicator. 2009. www.anesthesiology.com/abstracts



S-182.**MIND THE GAP: PORT SECURITY—IDENTIFYING POTENTIAL RISK FROM UNPROTECTED INTRAVENOUS LINE STOPCOCKS****AUTHORS:** K. J. Sauve, J. Schultz**AFFILIATION:** Duke University, Durham, NC

INTRODUCTION: Hospital Acquired Blood Stream Infections (BSIs) have increasingly received national attention. Catheter Related Blood Stream Infections (CRBSIs) are one portion of this. Subsequently, the Center for Disease Control has released the “Guidelines for the Prevention of Intravascular Catheter-Related Infections”.¹ At least one study found closed needle-free connectors to IV lines can reduce the incidence of CRBSIs in critically ill patients with central venous catheters when compared with open three way stopcocks.² To reduce the risk of port contamination, the CDC guidelines direct clinicians to “Cap all stopcocks when not in use”.¹ At our institution, we suspected clinical practice was not in compliance with these guidelines resulting in the potential risk of contamination to our patients undergoing surgery.

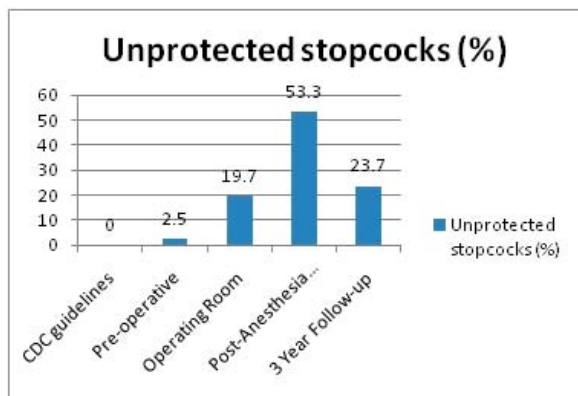
METHODS: This survey was deemed exempt by the IRB as no patient information was collected. We chose a single and typical day in the operating suite (OR) for our observation. The total number of stopcocks was recorded as well as how many were protected with a cap, “closed” connector, or syringe. Three years later, a single walkthrough of the OR was conducted to follow-up on compliance.

Results: There were 179 stopcock ports visualized in 2007 of which 3 in the pre-operative area, 16 in the operating room, and 24 in the post-anesthesia care unit were open to air. Three years later, after staff education, there were 80 stopcock ports with 19 unprotected. The results are presented below.

DISCUSSION: We found IV line ports are frequently left unprotected in the perioperative setting. According to CDC guidelines, IV ports should be protected at all times. We believe open IV ports pose a risk for gross contamination and potential blood stream infection and suspect this is not unique to our institution. Because our study highlighted widespread noncompliance with CDC guidelines our institution has mandated the use of “closed” IV tubing with non-removable needleless stopcock protectors to be used throughout the OR. Staff education appeared to have limited effects in adhering to CDC guidelines.

REFERENCES:

1. CDC Guidelines for the Prevention of Intravascular Catheter-Related Infections. MMWR Recommendations and Reports. Aug 9, 2002/51(RR10);1-26.
2. Prevention of CRBSIS in critically ill patients using a disinfectable, needle-free connector: randomized controlled trial. American Journal of Infection Control. Aug 2004. Vol 32, Issue 5, 291-295.

**S-183.****ANESTHETIC MANAGEMENT OF A PATIENT FOR NANO KNIFE SURGERY (IRREVERSIBLE ELECTROPORATION)****AIUTHORS:** K. Deepika, P. S. Manjunath, G. Narayanan**AFFILIATION:** University Of Miami/Jackson Memorial Hospital, Miami, FL

INTRODUCTION: The NanoKnife System is a next generation in minimally-invasive tissue ablation technology, designed to effectively eliminate targeted soft tissue with reduced risk of functional damage to Surrounding veins, nerves and ducts. Often described as “surgery at the cellular level,” the NanoKnife System uses electrical fields (Direct Current) to create nano-scale defects in the membranes of cells within a targeted soft tissue region, causing cell death only in the treated tissue. We present anesthetic management of a patient undergoing Nanoknife surgery to ablate a metastatic liver tumor.

METHODS: N/A

Challenging Case Report (only complete if your submission falls into the “Challenging Case Report” category. If you select the “Challenging Case Report” category on the next step, this section must be completed.): 65 yr old woman was scheduled to undergo nanoknife ablation of metastatic liver tumor. Patient had history of Resection of Colon carcinoma few years earlier. History and examination was otherwise unremarkable. On the day of surgery patient was pre medicated with Midazolam IV. Anesthesia was induced with Propofol, Rocuronium was used for muscle relaxation and fentanyl analgesia was provided. Airway was secured with appropriate size endotracheal tube(ETT). The Nanoknife procedure was done under CT imaging. The procedure lasted about 2 hours with minimal blood loss. She was extubated uneventfully and discharged home the same day upon full recovery from anesthesia.

RESULTS: N/A

Discussion: The NanoKnife System uses 2-6 electrode probes to transmit active energy from its generator to a targeted area. The system includes an energy generator, footswitch and single-use disposable electrodes. Standard electrical safety precautions must be observed during the entire procedure. The safety and success of this procedure depends on accurate placement of probes under CT/US guidance. Therefore, considerations for anesthesia outside operating room apply. Electrical pulses elicit strong muscle contractions which can be avoided under general anesthesia with adequate muscle relaxation. Airway must be secured with proper size ETT. Asynchronous energy delivery (240 PPM or 90 PPM modes) might trigger atrial or ventricular fibrillation, especially in patients with established arrhythmias, long QT syndrome or structural heart disease. It is essential to use QRS synchronized delivery of electrical energy in these patients. They should be carefully monitored for proper synchronization during energy delivery. Adequate precautions should be taken for patients with implantable electrical devices. Ablation of lesions in the vicinity of implanted electronic devices or implanted devices with metal parts should be avoided. It is important to ensure that interventions (defibrillator, etc.) and appropriately trained personnel for dealing with cardiac arrhythmias are readily available.

REFERENCES:

NanoKnife™ User Manual, AngioDynamics, Inc.

S-184.**PERFORMANCE OF STERILE TECHNIQUE FOR NEURAXIAL ANALGESIA IN ISRAEL: BEFORE AND AFTER THE RELEASE OF INTERNATIONAL GUIDELINES**

AUTHORS: Y. Ginosar,¹ E. M. Davidson,¹ S. Orbach-Zinger,³ Z. Rudich,⁴ S. Ivry,⁵ A. Ioscovich²

AFFILIATION: ¹Hadassah Hebrew University Medical Center, Jerusalem, Israel; ²Shaare Zedek Medical Center, Jerusalem, Israel; ³Rabin Medical Center, Petach Tikva, Israel; ⁴Soroka Hospital, Ben Gurion University, Beersheva, Israel; ⁵Western Galilee Hospital, Nahariyah, Israel

INTRODUCTION: We conducted a survey to assess sterile technique practices for neuraxial anesthesia in Israel before and after publication of international ASRA guidelines.¹

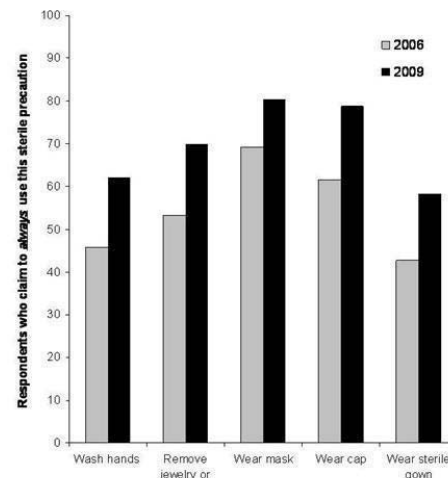
METHODS: The sampling frame was the general anesthesiology workforce in each of the four medical faculties in Israel. Representative hospitals had high volume maternity services. Data was collected anonymously over one week in each hospital; waves occurred in April 2006 and September 2009. Primary endpoint questions: handwashing, removal of wristwatch/jewelry, wearing mask, wearing hat/cap and wearing sterile gown; the answering option was: “always”, “usually”, “rarely” or “never”. Primary endpoint for analysis: respondents who both wash their hands and wear a mask (“handwash-mask combo”) - “always” vs “any other response”. We used generalized estimating equations for data analysis. Hospital was considered a random variable.

RESULTS: 135/160 (in 2006) and 127/164 (in 2009) anesthesiologists responded to the surveys; response rate 84% and 77% respectively. Respondents constituted 23% of the national anesthesiologist workforce. Data is presented graphically for: compliance (“always”) and non-compliance (“never”); overall data (Figure 1) and data broken down by resident vs attending vs time-expired “non-resident/non-attending” (NRNA) (Figure 2) and hospital data (anonymous) (Figure 2). The main outcome “handwash-mask combo” was significantly increased after guideline publication ($33\% \pm 24$ vs $58\% \pm 21$; $p=0.0058$). In addition, significant increases were seen for handwashing ($37\% \pm 25$ vs $63\% \pm 21$; $p=0.0028$) and wearing of hat/cap ($53\% \pm 26$ vs $76\% \pm 14$; $p=0.0044$). An apparent improvement in sterile technique from 2006 to 2009 is noted across all hospitals and all physician groups.

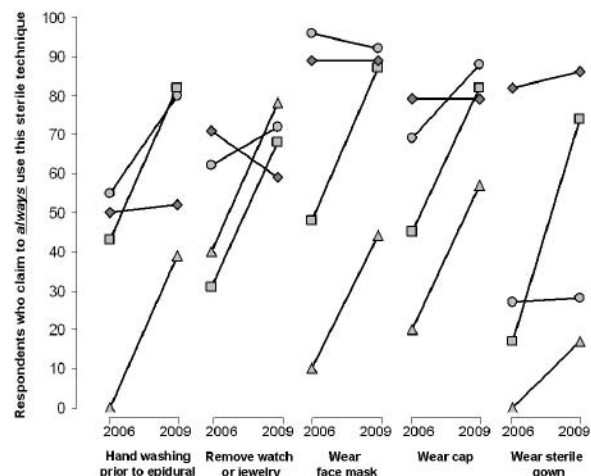
DISCUSSION: Sterile technique used by Israeli anesthesiologists improved following publication of international guidelines.

REFERENCES:

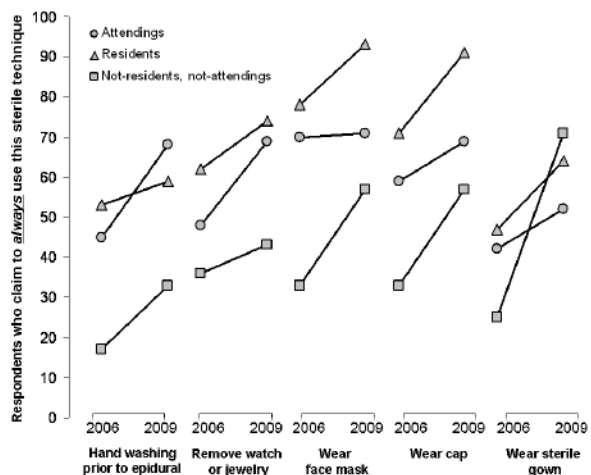
1. Reg Anesth Pain Med 2006;31: 311-323



Bar plot representing the percentage of responding anesthesiologists who always adhere to the following sterile techniques for neuraxial anesthesia: handwashing, removing jewelry or watches, wearing face mask, wearing a cap and wearing a sterile gown. The data are compared for the year 2006 (prior to the ASRA guideline) and 2009.



Percentage of responding anesthesiologists who always adhere to sterile practices for neuraxial anesthesia. The data are compared for the year 2006 (prior to the ASRA guideline) and 2009. Each symbol represents a specific individual hospital.



Percentage of responding anesthesiologists who always adhere to the sterile practices for neuraxial anesthesia. The data are compared for the year 2006 (prior to the ASRA guideline) and 2009. Attendings, residents and NRNA's (non-residents, non-attendings) are represented separately.

S-185.**A REVIEW OF PREOPERATIVE CLINIC CARDIOLOGY REFERRALS FOR ADULTS UNDERGOING INTERMEDIATE AND LOW RISK SURGERY****AUTHORS:** S. A. Calderwood, J. L. Morse, D. Michaels**AFFILIATION:** Vanderbilt University School of Medicine, Nashville, TN**INTRODUCTION:** Our Preoperative Evaluation Center (VPEC) is staffed by 16 Advanced Practice Nurses (NPs) experienced in the preoperative evaluation of adults. An attending anesthesiologist is consulted per protocol or at the discretion of the NP regarding the need for additional testing or consultation.**METHODS:** Guidelines for the preoperative evaluation of adult patients undergoing non-cardiac surgery were released in 2007.¹ After obtaining IRB approval, we performed a focused chart review to evaluate application of these guidelines in an adult preoperative clinic over a three month period during 2010.**RESULTS:** During the study, 4477 adult patients were evaluated in VPEC. Seventy patients undergoing intermediate (43) or low (27) risk procedures were referred for cardiology consultations. Sixty-four patients had at least one Clinical Risk Indicator (CRI), and 10 had 3 or more CRI.¹ The average age was 61 and 34 of the 70 referred patients were male.

Three patients with known serious heart disease (severe pulmonary hypertension, Moyamoya disease, and cyanotic congenital heart disease) were referred for an opinion regarding optimization prior to anesthesia and surgery.

Of the remaining 67 consultations, 43 (64%) were judged to be consistent with the guidelines: 19 for possible unstable coronary symptoms, 6 for arrhythmias, 2 for CHF, 7 for possible significant valvular disease, and 9 for patients having intermediate risk surgery with both poor exercise tolerance and at least one CRI.

Three referred patients had stable or atypical chest pain not needing further testing according to the cardiology consultant.

Of the remaining 21 consultations judged inconsistent with the guidelines 12 patient were scheduled for low risk procedures and 9 having intermediate risk surgery had either good exercise tolerance (7 patients) or no CRI (2 patients).

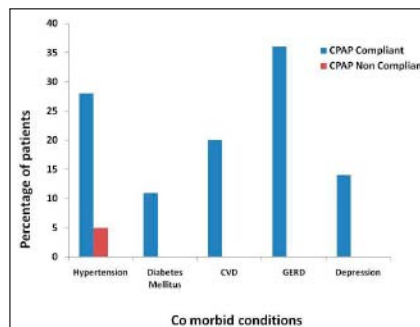
DISCUSSION: Conclusion: Based on a limited chart review, a significant number (36%) of cardiology referrals from our preoperative clinic are inconsistent with published guidelines and represent an opportunity for improved efficiency, cost savings, and better patient care. We plan to consider measures such as educational initiatives or computerized clinical decision support to decrease unnecessary referrals.**REFERENCES:**

1. Fleisher LA, Beckman JA et al. ACC/AHA 2007 Guidelines on Perioperative Cardiovascular Evaluation and Care for Noncardiac Surgery: executive summary: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to Revise the 2002 Guidelines on Perioperative Cardiovascular Evaluation for Noncardiac Surgery). *Circulation* 2007;116: 1971-1996.

S-186.**PREOPERATIVE SCREENING FOR OSA WITH STOP-BANG QUESTIONNAIRE: A FOLLOW UP STUDY****AUTHORS:** R. Subramanyam, V. Mehta, F. Chung**AFFILIATION:** Toronto Western Hospital, University Health Network, University of Toronto, Toronto, ON, Canada**INTRODUCTION:** There is a high prevalence of undiagnosed OSA in the general population. These patients are at an increased risk of perioperative complications and associated co-morbid conditions. Screening of patients in preoperative clinic may be helpful in diagnosing OSA patients and referring them for treatment. The purpose of the study was to follow-up patients screened by STOP questionnaire in the preoperative clinic, diagnosed by overnight laboratory polysomnography and subsequently received treatment. We aimed to determine the health benefits and reduction in medications for associated co-morbid conditions in OSA patients detected by preoperative screening with the STOP questionnaire.**METHODS:** Institutional REB approval and patient consents were obtained. STOP questionnaire was administered to 2,467 preoperative patients from 2005 to 2007. Among these, 679 were classified as high risk of OSA and invited for overnight PSG. A total of 211 patients underwent PSG and these patients were followed up in the present study. The severity of OSA, types of treatment and their benefits were evaluated by asking the patients to respond to a mailed questionnaire. Non-responding patients were contacted over telephone. The associated co-morbidities and change in severity of OSA symptoms with treatment were noted.**RESULTS:** We were able to contact 156 patients. 74% (128/156) patients had OSA (AHI>5) established by PSG and 26% (28/156) patients had no OSA (AHI≤5). Of 128 OSA patients, 69% (88/128) patients were prescribed CPAP therapy and the rest other forms of treatment. Of the patients receiving CPAP, 45% (40/88) patients were compliant and 55% (48/88) non-compliant (p<0.001) and their demographics were comparable. The percentage of patients with reduction in medications of each co-morbid condition is shown in Figure 1. The percentage of patients with reduction of medication for co-morbidities in CPAP compliant was significantly higher than non-complaint patients (38% vs. 3% p<0.001). Sleepiness, fatigue and snoring were significantly lower in CPAP compliant as compared to non-compliant patients. Compliant CPAP users reported favourable personality and quality of life changes with improved general well-being versus non-compliant users (87% vs 0 respectively).**DISCUSSION:** This prospective follow-up survey of OSA patients demonstrated that the screening of patients with STOP questionnaire in the preoperative clinic had long term health benefits. The timely diagnosis of OSA and treatment with CPAP helped reduce the severity of associated co-morbidities and symptoms of OSA.**REFERENCES:**

1. *Anesthesiology* 2008;108:812-821.

Figure 1: Percentage of Patients with Reduction in Medications for Associated Co-morbid Conditions



Patients may have had more than 1 pre-existing medical conditions. CVD = presence of angina, arrhythmia and/or congestive cardiac failure GERD = gastro-esophageal reflux disease

S-187.**THE EFFECT OF MAKING PROPOFOL A CONTROLLED SUBSTANCE—DOSING AND HEMODYNAMIC CONSEQUENCES****AUTHORS:** C. J. Lace, L. C. Jameson, K. Bullard**AFFILIATION:** University of Colorado, Aurora, CO

INTRODUCTION: Propofol is currently not classified by the U.S. DEA as a controlled substance. Recent media attention, combined with evidence that propofol has significant abuse potential, has led many organizations to change their regulatory policy. Our institution decided to treat P as a controlled substance, with the same requirements for distribution, returns, and wastage as other schedule II drugs. There was concern that providers might alter their propofol dosing to avoid additional paperwork causing subsequent hemodynamic implications for patients or that there would be a previously hidden illicit demand for propofol. This study was designed to assess the propofol administration pattern before and after it became a schedule II drug.

METHODS: AIMS (Centricity perioperative Anesthesia, GE Medical) data was extracted for the 6 months prior and 6 months after the date propofol became controlled. Measures examined included: mean propofol dose at induction and total propofol dose/case; average propofol dose by weight (mg/kg) at induction and for the entire case; number of patients with hypotension ($>20\%$ drop in systolic BP) within 15 min of induction, number of patients requiring ephedrine or phenylephrine within 15 minutes of induction; number of cases where exactly 200 mg of propofol was administered throughout the entire case. TIVA was excluded.

RESULTS: In the six months prior to making propofol a schedule II drug, the mean induction dose was 121 mg or 1.93 ± 0.749 mg/kg with 14.5% of patients having hypotension, 44.67% of the hypotensive patients received phenylephrine or ephedrine. Exactly 200mg of propofol was given to 92/6146 (1.4%) patients; the average dose for entire case was 2.27 ± 0.682 mg/kg (Figs. 1 & 2). After propofol was controlled, the average induction dose was 124.27mg or 1.89 ± 0.818 mg/kg with 16.5% hypotension, 45% of these patients received phenylephrine or ephedrine. Exactly 200mg of propofol was given to 220/7359 (3.0%) patients; the average dose for entire case was 2.27 ± 0.682 mg/kg (Figs. 3 & 4)

DISCUSSION: It is likely the US DEA will reclassify propofol as a schedule II drug. The addiction and abuse potential was unrecognized when propofol was initially released. Our experience with propofol as a schedule II drug has shown that while the number of patients receiving an exact vial dose (200mg) has increased slightly, there was no significant change in all other dosing measures or the frequency of hypotension. Treating propofol as controlled did not shift practice patterns nor did it expose inappropriate use of the drug. It is not known if the propofol supply had an impact on use.

REFERENCES: N/A**S-188.****BACTERIAL GROWTH FROM INTRAOPERATIVELY COLLECTED NON-MESENTERIC LYMPH NODES****AUTHORS:** B. Ittzes,¹ I. Batai,² D. Trasy,¹ I. Batai,¹ M. Kerenyi²**AFFILIATION:** ¹Anesthesia and Intensive Care Unit, University of Pecs, Pecs, Hungary; ²Medical Microbiology, University of Pecs, Pecs, Hungary

INTRODUCTION: Bacteria originating from the patients own flora is responsible for a large number of postoperative septic complications. The best known route is bacterial translocation from the gut. Bacterial translocation is defined as the passage of gastrointestinal bacteria across the gut wall to local mesenteric lymph nodes, and from there to distant sites. Bacterial translocation is known to occur in humans and is associated with an increased incidence of septic morbidity. The human studies focusing on bacterial translocation examined only mesenteric lymph nodes or that of from oral cavity cancer patients.^{1,2} In this study we examined axillary, para-aortic or iliacal lymph nodes for bacterial growth in patients undergoing elective surgery.

METHODS: Approval for the study was obtained from the locally organized Ethical Committee. A lymph node was harvested from patients undergoing elective breast operation or surgery for occlusive peripheral vascular disease. The lymph nodes were homogenized and were cultured on blood, chocolate, eosin methylene blue and anaerobic blood agar plates directly and following enrichment. The samples were incubated for 48 hours under aerobic and anaerobic conditions at 37°C and then they were examined for bacterial growth. There was no restriction in the antibiotic regimen in the perioperative period. Preoperative cephalosporin was given to 10 of the vascular surgery patients. None of the patients whom axillary lymph nodes were harvested received antibiotic.

Twelve para-aortic or iliacal and 28 axillary lymph nodes were evaluated.

RESULTS: Anaerobic bacteria grew from 4 of the 12 para-aortic or iliacal lymph nodes (33%), and 8 out of the 28 axillary lymph nodes (28%). Antibiotic was given to all of the vascular surgery patients where bacterial growth was detected. No aerobic bacteria recovered from any sample.

DISCUSSION: Our human results suggest that anaerobic bacteria survive not only in mesenteric lymph nodes but in other areas of the lymphatic system as well. It means that there is a chance for anaerobic bacterial contamination during surgery that supposed to be in a sterile environment. These finding may be taken into consideration when antibiotics are chosen in the perioperative period.

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1. Ann R Coll Surg Engl 2002; 84:424 (2) Br J Surg 1990;77:487
Support: Univ Pecs, Grant AOK KA-34039/10-03 and AOK KA-34039/10-13.

Equipment Monitoring

S-189.**HEMODYNAMIC RESPONSES TO TRACHEAL INTUBATION WITH THE PENTAX-AWS® VIDEO LARYNGOSCOPE OR MACINTOSH LARYNGOSCOPE IN PATIENTS SCHEDULED FOR CARDIOVASCULAR SURGERY**

AUTHORS: Y. Ishida, T. Aoyama, U. Kondo, S. Yamakawa, M. Nakamura, M. Nonogaki

AFFILIATION: Department of Anesthesia, Yokkaichi Municipal Hospital, Yokkaichi, Japan

INTRODUCTION: The Pentax-AWS® (Airway Scope; Hoya Corporation, Tokyo, Japan), a video laryngoscope, enables the visualization of the larynx without necessitating the alignment of the oral, pharyngeal, and tracheal axes, thereby facilitating a reduction in the upward lifting force, which is otherwise required during tracheal intubation.¹ We hypothesized that intubations performed with Pentax-AWS® video laryngoscopes would attenuate hemodynamic responses as compared to when Macintosh laryngoscopes are used. We compared the hemodynamic responses to tracheal intubation between Pentax-AWS® video laryngoscopes and Macintosh laryngoscopes in patients scheduled for cardiovascular surgery.

METHODS: Patients were randomized to undergo tracheal intubation with either the Pentax-AWS® video laryngoscope (n = 20) or Macintosh laryngoscope (n = 20). The heart rate (HR), systolic blood pressure, and diastolic blood pressure (DBP) were recorded at the following instances: before induction; immediately after the insertion of the laryngoscope into the oral cavity; and at 30 s, 1, 2, and 3 min after the removal of the laryngoscope.

RESULTS: All patients were successfully intubated in a single attempt. The Cormack and Lehane grade with the Pentax-AWS® video laryngoscopes were greater than that with the Macintosh laryngoscopes. The duration of intubation with the Macintosh laryngoscopes were shorter than that with the Pentax-AWS® video laryngoscopes. Tracheal intubations with the Macintosh laryngoscopes considerably increased the HR and DBP.

DISCUSSION: The increases in HR and BP after tracheal intubation were lesser with the Pentax-AWS® video laryngoscope than with the Macintosh laryngoscope. This finding suggests that the Pentax-AWS® video laryngoscope may help in preventing the adverse outcomes following tracheal intubation in high-risk patients.

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Hemodynamic responses to tracheal intubation with the Pentax-Aws® Video Laryngoscope or Macintosh Laryngoscope in patients scheduled for cardiovascular surgery

| | | | |
|----------------------|------------|-----------|-------------|
| Introduction | Statistics | Results 2 | Discussion |
| Background | Results 1 | Figure 1 | Limitations |
| Methods | Table 1 | Figure 2 | Conclusions |
| Anesthesia induction | Table 2 | Figure 3 | References |

S-190.**OPTIMIZING ENDOTRACHEAL TUBE ADVANCEMENT DURING ORAL FIBEROPTIC INTUBATION: A RANDOMIZED COMPARISON BETWEEN A PARKER FLEX-TIP ENDOTRACHEAL TUBE AND A STANDARD ENDOTRACHEAL TUBE ORIENTED 90 DEGREES COUNTERCLOCKWISE**

AUTHORS: W. A. Weigel, T. C. Dean

AFFILIATION: Virginia Mason Medical Center, Seattle, WA

INTRODUCTION: During oral fiberoptic intubation, advancement of an endotracheal tube (ETT) into the trachea is occasionally impeded by laryngeal structures. The curved flex tip Parker ETT has been shown to improve the likelihood of successful advancement as opposed to a standard ETT that is advanced in neutral orientation. However, a Parker tube has not been compared to a standard ETT oriented 90 degrees counterclockwise from the neutral position. We hypothesize that fiberoptically-guided advancement of an ETT into the trachea will be more successful when using a Parker tube than a 90 degrees counterclockwise oriented standard ETT.

METHODS: This randomized controlled trial compares the rate of successful advancement of a fiberoptically-guided endotracheal tube into the trachea. Two groups are compared: a Parker flex tube (Parker Group; n=57) versus a standard ETT oriented 90 degrees counterclockwise (Standard Group; n=58). Our primary outcome is the first pass success rate of advancing the ETT into the trachea.

RESULTS: First pass success occurred in 48 of 57 (84%) patients in the Parker Group vs. 39 of 58 (67%) of patients in the Standard Group (P=0.0497).

DISCUSSION: When advancing an ETT over an oral fiberoptic scope and into the trachea, a Parker curved flex tip ETT is statistically more likely to be placed successfully on the first pass than is a standard ETT oriented 90 degrees counterclockwise. The clinical relevance of this observation should be weighed against the 2-fold higher cost of a Parker tube.

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Figure 1. Anterior-Posterior views of the studied endotracheal tubes. A. A view of the standard (left) and Parker ETT (right) to show the differences in tip design. B. Standard orientation of the ETT tips. C. Orientation of the ETT tips for this study.

S-192.**THE FLEXBLADE ARTICULATING VIDEOLARYNGOSCOPE: A MANIKIN EVALUATION****AUTHORS:** K. P. Rothfield, M. Koehlein**AFFILIATION:** Saint Agnes Hospital, Baltimore, MD

INTRODUCTION: Although video and optical laryngoscopes provide advantages in airway visualization, tracheal intubation may still be unsuccessful. All of the current devices are rigid, and therefore do not conform to individual patient anatomy. The Glidescope (Bothell, WA) requires a two-handed technique and precise alignment of the ETT and glottis.¹ Although the Airtraq optical laryngoscope (King Systems, Noblesville, IN) contains a guiding channel for the ETT, alignment with the trachea may still prove problematic, and may require adjuncts such as the bougie.² An articulating videolaryngoscope with a guiding channel has been developed (FlexBlade, AI Medical Devices, Williamston, MI). The purpose of this evaluation was to determine the feasibility of this design for tracheal intubation.

METHODS: The FlexBlade articulating videolaryngoscope utilizes a blade with a self-contained solid state video imager as well as an integral LCD viewing screen. The device was tested using a Laerdal Heartcode Airway Manikin (Laerdal Medical, Wappingers Falls, New York). The device was held alongside the manikin to illustrate the design concept. The blade is gently curved at rest (1st panel). Squeezing the handle of the device articulates the blade and the ETT to an angle greater than 90 degrees (2nd panel).

RESULTS: The blade of the device was advanced into the mouth of the manikin, and the handle was squeezed as the blade is advanced until the glottis was centered. The 3rd panel shows the device and ETT in situ. Note that the tip of the blade is in view at the top of the image. Advancing the tube through the channel resulted in endotracheal intubation.

DISCUSSION: The FlexBlade articulating videolaryngoscope is a promising design that may solve some of the challenges associated with current videolaryngoscope technology. Further evaluation in patients will be necessary.

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**S-193.****INTUBATION IN MORBIDLY OBESE PATIENTS. A RANDOMIZED CLINICAL TRIAL COMPARING GLIDESCOPE® AND FOSTRACH (TM).****AUTHORS:** M. Ydemann, L. Rovsing, J. Sylvestersen, P. Quarford, D. Joergensen, K. S. Olsen**AFFILIATION:** Department of Anesthesiology, Copenhagen University Hospital, Glostrup, Denmark

Introduction: Several potential problems are related to airway management in morbidly obese patients, including difficult mask ventilation, difficult intubation and a decreased apnea tolerance. Therefore, prompt and safe airway management is highly important.

The purpose of our study was to compare tracheal intubation of morbidly obese patients using the GlideScope®(GS) and Fostrach™(FT). Both devices are previously shown to be safe and appropriate (1,2). Primary endpoints were intubation time and number of attempts.

METHODS: The study was prospective, randomized and blinded to the patient. 100 patients, scheduled for bariatric surgery, were randomized to GS or FT. Patients in need of crash intubation, previously impossible mask ventilation or impossible intubation, were excluded.

All patients were placed in ramped position and preoxygenated for 5 minutes (PEEP 5). The anesthesia was induced with Remifentanyl and Thiopental and muscular paralysis was obtained by Rocuronium. Intubation was performed by anesthetists experienced in handling both devices.

RESULTS: There was no significant difference in intubation time ($p=0.86$). Mean time was GS 49 sec [95%CI:40-57] and FT 61 sec [95%CI:46-76]. Successful tracheal intubation in first attempt: GS 92% [95%CI:82%-97%] and FT 84% [95%CI:72%-92%]. There was no incident with clinical relevant desaturation, no difference in mucosal damage (7 in each group), and no significant difference in intubation difficulty score ($p=0.86$). We registered 1 esophageal intubation using GS, and 6 in 5 patients using FT ($p=0.13$). There was no difference in postoperative hoarseness ($p=0.73$) and pain score ($p=1$).

DISCUSSION: No statistically significant difference was found between the two methods as regards difference in time to successful tracheal intubation, number of esophageal intubations, the need to change intubation method, mucosal damage, postoperative hoarseness and pain score. Both methods turned out to be safe and easy. However, the results suggest that GS might be superior to FT as the success rate in the first attempt tended to be higher using the GS. More over esophageal intubation and prolonged intubation time were more frequent using FT.

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S-194.**A METHODOLOGY FOR EVALUATION AND PROCUREMENT OF VIDEO LARYNGOSCOPES WITH THE AIM OF IMPROVING AIRWAY MANAGEMENT IN A UNIVERSITY HOSPITAL****AUTHOR:** K. L. Gil**AFFILIATION:** Northwestern University Feinberg School of Medicine, Chicago, IL

INTRODUCTION: Cost-containment concerns on the part of medical facilities promote a tendency to ignore requests to acquire recently developed equipment... particularly frustrating with devices proven to have superiority over older, cheaper tools in the realm of airway management. The aim of this study was to develop a specific evaluation protocol to make a successful "purchase recommendation" of videolaryngoscopes to Northwestern Memorial Hospital (NMH).

METHODS: An airway equipment subcommittee (AES) of attending anesthesiologists was formed to evaluate four distinct videolaryngoscope models [1-4]: Glidescope® GVL, McGrath®, Pentax AWS®, and BERC-KAPLAN DCI®.

1. The AES performed a literature search (OVID, PUBMED) including usage, Cormack-Lehane laryngoscopic views, time to intubation, successful intubation rates, and risks. The AES arranged educational in-services and produced sign-out, evaluation, and instructional tip sheets.

2. After a clinical trial period with a single videolaryngoscope (VL) model, the AES made a judgment considering its merits. If the VL had enough advantages, the AES advanced it for clinical trial by all other non-AES colleagues, who went through a similar evaluation period, while the AES moved forward with the next model.

3. The AES reviewed all four models with regard to evaluation data, literature support, and information on cost, durability, servicing availability, timely device replacement capability, and warranties.

RESULTS: Based on statistical analysis of AES data, the Glidescope® GVL achieved the highest ranking re success rate, optical clarity, field of view, widest patient application, and least difficulty. A successful proposal to NMH resulted in a \$97,000 purchase (7 VL systems, 16 blades).

DISCUSSION: Prior to this study, NMH only had rigid laryngoscopes, flexible fiberoptic bronchoscopes, light wands, Laryngeal Mask Airways, ProSeal LMAs, and Fastrachs. Unexpected operating room appearances of airway devices brought by individual staff members for trial, provoked safety concerns. Lack of a systematic method to assess newly released airway inventions made "equipment-stagnation" a byword. With the protocol, the AES was instrumental in supplying literature and testimonials, while emphasizing the words: "patient safety" in each paragraph of the proposal. This achievement was the first significant purchase of "new-age" airway devices in over a decade at NMH and clearly demonstrated that this protocol should be a pattern for successful equipment procurement in all healthcare centers.

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Evaluator's Name: _____ Date _____

< CIRCLE the estimated value in each category of your videolaryngoscope experience. >
(Please leave evaluation sheet in BOX where the videolaryngoscope is kept)

This is my: 1 2 3 4 5 6 7 8 9 10th or _____ time using this VL.

Anticipated airway difficulty: 10 9 8 7 6 5 4 3 2 1 0
(Most difficult = 10) (Based on my patient description below)

Abnormal airway history: _____

Airway examination: Interdental distance _____ Hyomental distance _____
Mallampati score _____ Neck extension in degrees _____
Height _____ Weight _____ Any other airway abnormalities _____

Ease of set up (Easiest = 10) 10 9 8 7 6 5 4 3 2 1 0
(Not including obtaining the device)

Ease of insertion to visualize: (Easiest = 10) 10 9 8 7 6 5 4 3 2 1 0

Ease of ETT passage: (Easiest = 10) 10 9 8 7 6 5 4 3 2 1 0

Optic clarity (Best = 10) 10 9 8 7 6 5 4 3 2 1 0

Optic wide field of view (Largest = 10) 10 9 8 7 6 5 4 3 2 1 0

Attempts made 1 2 3

Glottic view Grade 1 2 3 4

Usefulness (Most useful = 10) 10 9 8 7 6 5 4 3 2 1 0
(Was the glottic view I obtained much better than the view I predicted I would get with conventional laryngoscopy?)


Describe any difficulty with this VL, including breakability & injury to patient: _____

If I had to abandon the VL in this case and choose an alternative device, which one was chosen and why? _____


What was alternate airway device choice's glottic view? Grade 1 2 3 4

Would I prefer this VL for routine or difficult cases? Yes or No Why? _____


OVERALL ASSESSMENT ... (Best = 10) 10 9 8 7 6 5 4 3 2 1 0




Curve ETT – according to VL



Enter mid - mouth



Once in mouth, look at screen, & go deeper & lift up as Miller or Mac laryngoscope & critical pressure to improve glottic view




GLIDESCOPE


This videolaryngoscope (VL) is available in the small equipment room for evaluation by everyone

Requirements:


- Fill out the sign-out sheet
- Put dirty scope in specimen bag
- Page techs to clean scope
- Attendings to fill evaluation form (with input of residents, CRNAs)



Look at mouth to insert ETT into oropharynx, either retroglottic or regular approach



Look at video screen. As soon as ETT tip passes between cords, have assistant slowly pull stylet while holding ETT in glottis tightly



More tips are on the card sheets in the small equipment room and from Airway Equipment Subcommittee Members

Tips for Glidescope use:

1. Use medium blade for most adult patients whose height is < 6 feet
2. Use large blade for those who are taller (≥ 6 feet)
3. Align video cable arrow to the notch along the scope and connect ONLY by a slow straight push into the scope (DO NOT TWIST)
4. To disconnect, ONLY pull cable straight out (DO NOT TWIST)
5. Video picture may need adjustment on menu
6. Keep ETT curved to approximately same angle as the laryngoscope blade or hockey stick
7. Keep the scope midline upon entering the mouth
8. When looking at the video screen, try to visualize soft palate and uvula while sweeping toward posterior oropharynx, and then look for epiglottis/glottis
9. As a laryngoscope, you may have to shift slightly or move vertically in the sagittal plane to visualize the glottis until you see a "good enough" view (scope being farther out may be better)
10. External neck pressure may also help to achieve a view of the glottis (doesn't have to be perfect)
11. Look at the mouth to insert the ETT over the tongue, and only then look again at the video screen to advance it
12. If your ETT angle is quite curved, once you enter the glottis, have assistant pull the stylet out

Glidescope Intubation Tips

S-195.**IN VITRO PERFORMANCE EVALUATION OF TWO RAPID FLUID INFUSION DEVICES**

AUTHORS: L. M. Capan,^{1,2} N. Chakiryan,² S. M. Miller,^{1,2} D. K. O'Neill,² J. Jacobson,^{1,2} E. A. Martinez^{1,2}

AFFILIATION: ¹NYU School of Medicine, New York, NY;
²Bellevue Hospital Center, New York, NY

INTRODUCTION: Rapid infusion devices are becoming increasingly popular for the administration of warm fluids and blood in hypovolemic patients. A recently developed system, Thermacor 1200 (Smisson-Carlledge Biomedical LLC, Macon, GA), consists of a central device to which a disposable cartridge of fluid lines attaches. Performance characteristics of this device have yet to be evaluated. We compared the Thermacor 1200 with a currently utilized infusion device, FMS 2000 (Belmont Instrument Corp., Billerica, MA), to evaluate maximum flow rates, accuracy of actual versus set flow rates, fluid warming capabilities, and air bubble elimination.

METHODS: A Thermacor 1200 and an FMS 2000, owned by our institution, were evaluated in vitro after being tested for proper functioning. FMS 2000 was tested with the packaged 4.5ft patient line, and Thermacor 1200 with packaged 3ft (TC3) and 6ft (TC6) patient lines. Maximum flow rates of lactated Ringer's (LR) and expired packed red blood cells (PRBCs) were measured with 22, 20, 18, 16, 14 and 8.5F gauge catheters, using a graduated cylinder and stopwatch. Flow rate accuracy was determined by comparing the actual versus displayed flow rates, for LR and PRBCs. Temperature was measured, at various flow rates, with an electronic probe (Wavetek 23XT, San Diego, CA) positioned 3cm from the distal port of the outflow tubing, for LR and PRBCs. Air elimination capability was determined, for LR only, by infusing fluid into an inverted 20mL syringe submerged in a bucket of water, and measuring the resulting air trapped in the syringe. All measurements were repeated six times. Data were analyzed using one-factor ANOVA, and the Tukey multiple comparisons method. Statistical significance was defined as $p < 0.05$.

RESULTS: Maximum flow rates were higher with TC3 and TC6 than with FMS 2000 in most instances, especially when using larger catheter bores (Table 1). Flow rates were more accurate with TC3 and TC6 than with FMS 2000 for LR (1.4, 1.6, and 3.5% variance from target rate, respectively; $p < .001$) and for PRBCs (2.1, 2.6, and 5.9% variance from target rate, respectively; $p < .001$). Temperatures of delivered fluid were higher with TC3 and TC6 as compared to the FMS 2000 for LR (38.0, 37.8, and 36.8°C. respectively; $p < .001$) and PRBCs (38.2, 38.1, and 37.2°C, respectively; $p < .001$). Air was not detected in fluid infused from either device.

DISCUSSION: In this experiment, the performance of the Thermacor 1200, at both lengths of patient line, was superior to that of the FMS 2000 in that it infused LR and PRBCs at higher and more accurate flow rates, at higher temperatures.

References: N/A

Table 1. Maximum Flow Rate (mL/min) for Various Catheter Gauges

| | ThermaCor (3 ft.) | ThermaCor (6 ft.) | FMS 2000 |
|-----------------------|-------------------|-------------------|---------------|
| Ringer's Fluid | | | |
| Catheter Gauge | | | |
| 22 | 101 (3.2) | 98 (1.3) | 101 (1.9) |
| 20 | 152 (3.7) | 154** (2.6) | 147 (4.0) |
| 18 | 252* (5.9) | 250** (5.0) | 242 (3.6) |
| 16 | 497† (10.3) | 474 (13.2) | 492*** (10.6) |
| 14 | 805*† (29.2) | 722 (30.0) | 722 (8.6) |
| 8.5F | 1163*† (29.3) | 1041** (36.1) | 731 (5.9) |
| Packed RBCs | | | |
| Catheter Gauge | | | |
| 22 | 51 (2.5) | 52 (2.7) | 52 (1.7) |
| 20 | 74* (1.8) | 78** (6.6) | 57 (0.6) |
| 18 | 141*† (9.6) | 129 (5.1) | 120 (6.8) |
| 16 | 371*† (4.2) | 320 (13.4) | 353*** (9.7) |
| 14 | 559*† (33.6) | 496 (16.2) | 499 (8.1) |
| 8.5F | 1168*† (33.4) | 1069** (53.0) | 654 (15.6) |

Data are expressed as: mean (SD). (n = 6) for each value.

* TC3 significantly greater than FMS ($p < .05$)

** TC6 significantly greater than FMS ($p < .05$)

*** FMS significantly greater than TC6 ($p < .05$)

† TC3 significantly greater than TC6 ($p < .05$)

S-196.**INTRA-OPERATIVE FLUID OPTIMIZATION REDUCES THE INCIDENCE OF VENOUS THROMBOEMBOLISM IN TOTAL KNEE ARTHROPLASTY****AUTHORS:** Y. Asakura, H. Takagi, H. Tsuchiya, Y. Kanayama**AFFILIATION:** Nagoya Kyoritsu Hospital, Nagoya, Japan

INTRODUCTION: Venous thromboembolism (VTE) and the subsequent development of pulmonary embolism (PE) is a major cause of post-operative mortality in total knee arthroplasty (TKA). Although the risk has been reduced by less than 15% following the introduction of fondaparinux, the prevalence reaches as high as 40% for VTE and 2-7% for PE without an appropriate thromboprophylaxis. Recently, with the introduction of Vigileo/FloTrac, a continuous monitor of patients' hemodynamic status using an online analysis of arterial pressure waveform, the goal-directed fluid (GDF) management has been shown to result in better outcomes in high risk surgical patients. We retrospectively evaluated whether the goal-directed fluid management has affected the incidence of post-operative development of VTE following TKA.

METHODS: This is a retrospective non-randomized comparative study with the patients assigned groups based on the surgery date (pre-GDF versus post-GDF period). All anesthesia and the medical records of the patients who had undergone computer-navigated TKA in our facility between January 2009 and March 2010 were retrospectively reviewed. Forty patients were identified, among whom 25 patients underwent TKA under restrictive GDF management and 15 patients underwent under liberal fluid administration. In GDF group, crystalloid solution was given keeping SVV (stroke volume variance) measured by Vigileo/FloTrac less than 10% so as not to rise more than 10% for a sustained period of more than 5 minutes. In the liberal group, the anesthesiologist was free to give any amount of fluid intraoperatively. Detection of VTE was carried out on the third post-operative day in all patients by compression ultrasonography carried out by the skilled cardiovascular ultrasound technicians. All the patients were given once-daily subcutaneous injection of fondaparinux following 24 hours after the surgery.

RESULTS: The amount of fluid infused was significantly larger in GDF group (average; 3162mL versus 2627mL; $p=0.0008$). The incidence of development of VTE was significantly lower in GDF group (4/25 versus 7/15; $p=0.037$). The odds ratio of subsequent development of VTE in liberal group as compared to GDF group was 2.19 (95%CI; 0.03-79.98).

DISCUSSION: Intra-operative fluid optimization in high-risk surgical patients has been shown to result in increased hemodynamic stability, decreased lactate concentration, and lower rate of complications. We have shown that intra-operative fluid optimization resulted in lower incidence of VTE development in TKA.

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S-197.**IN VITRO EVALUATION OF SUPRALARYNGEAL AIRWAYS: DEVELOPMENT OF STANDARD METHODS TO ASSESS PHYSICAL DESIGN AND PATIENT INTERFACE****AUTHORS:** P. B. Batchelder,¹ J. M. Goldman,² C. Crowley¹**AFFILIATION:** ¹Clinimark Labs, Louisville, CO; ²Massachusetts General Hospital, Department of Anesthesia and Critical Care, and Partners HealthCare System Biomedical Engineering, Boston, MA

INTRODUCTION: A standard in vitro method to assess clinical performance of supralaryngeal airways (SLA) is needed. International Standards Organization requirements for SLA's rely on the use of cadavers or human subjects for patient interface tests. [1] While that testing may be most representative of clinical performance, it is not readily reproduced, takes a significant amount of time, and results among different studies may vary depending on size of the patient or cadaver population. The purpose of this study was to develop a set of in vitro tests, utilizing an anatomically correct mannequin and other tools, which allow pre-clinical evaluation of pertinent clinical aspects of SLA's.

METHODS: Elements of physical design that can directly affect clinical performance (cuff durability, presence of 15mm ventilation connector, esophageal lumen size, etc.) and critical aspects of patient interface (ventilation seal, aspiration protection, etc.) were the focus of this test suite. Using flow meters, force gauge, basic volume sizing tools, and anatomically correct mannequin, 11 tests were developed: Ventilatory Position, Ventilatory Opening, Airway Bite Resistance, Kinking, Audible Leaks, Dead Space Volume, Ventilation Opening / Max Instrument Size, Esophageal Lumen Dia, Cuff Tear, Tube Stiffness and Aspiration Protection. Four airways were tested; results were compared to cadaver studies and product labeling.

RESULTS: Results of this 'pre-clinical' test suite correspond with product labeling and some published cadaver studies. Table 1

The Covidien Combitube demonstrated a high degree of Aspiration Protection, followed by the Rusch Easytube; the Intersurgical i-gel and King Systems LTS-D failed to display Aspiration Protection. In Airway Bite Resistance, most resistant was i-gel (>75lbs) and least resistant was LTS-D (6.7lbs). Combitube and Easytube demonstrated unobstructed ventilation in all head positions. i-gel was obstructed in the full flexion position and LTS-D leaked at the proximal cuff seal in full flexion position.

DISCUSSION: Based on ISO standards and using an anatomically correct mannequin, 11 tests that evaluate the physical design and patient interface of SLA's were developed. These tests can provide a way to conduct staged testing to provide initial benchmark of performance which may strengthen the argument to conduct more expensive and time consuming tests in cadavers and patients. This test set was reviewed and commented on by the ASTM F29 SLA Standards Committee Meeting 10/2008.

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S-198.

WITHDRAWN.

S-199.**VOLATILE ANESTHETIC AGENT SELECTION AND LOW-FLOW ANESTHESIA: AN AUDIT****AUTHORS:** E. Young, T. Tarr**AFFILIATION:** Wirral University Teaching Hospital, Upton, United Kingdom**INTRODUCTION:** Many anesthetic machines now record comprehensive data, allowing analysis of costs of anesthesia for individual cases.

The purpose of this study was to quantify anesthetic volatile agent and gas use in a snapshot of 50 anesthetics, to find out anesthesiologists' preferences and the extent of use of low flows. Calculations about cost implications were also made.

Methods: Information about the duration of 54 cases and quantities of oxygen (O₂), nitrous oxide (N₂O), air and agent used was collected from the electronic logbooks on four Dräger® Primus® (Dräger®, Lübeck, Germany) anesthetic machines.

Microsoft® Excel® was used to calculate median (inter-quartile range [range]) agent and gas use per unit time.

Results: Figure 1 shows agent and gas use in 54 cases. Anesthesia was maintained with sevoflurane (sevo) in O₂ and N₂O in 24 cases (44%), with sevo in O₂ and air in 18 (33%), with isoflurane (iso) in O₂ and N₂O in 11 (20%), and with iso in O₂ and air in one case (2%). Median (inter-quartile range [range]) case duration was 55.5 (28-125 [12-459]) minutes.

To estimate median fresh gas flows (FGF), carrier gas (N₂O or air) use was calculated per unit time (Table 1). Median carrier FGF was 0.88 L min⁻¹, suggesting a median total FGF of less than 2 L min⁻¹.

Detailed data about agent consumption (from the vaporizer) and uptake (by the patient) were analyzed for 19 of 42 sevo cases and 4 of 12 iso cases (Table 2).

The British National Formulary² prices are £27 (\$41 USD) for 250ml Baxter® iso and £123 (\$186) for 250ml non-proprietary sevo. Three cases were chosen to exemplify the effect of FGF and agent choice on cost (Table 3): agent cost varied from £0.65 (\$1) to £30.50 (\$46) among these three cases.

DISCUSSION: There was a preference for sevo over iso, and N₂O with O₂ was used more often than air with O₂. This audit demonstrates that choice of agent and FGF can have significant cost implications, and that availability of individual case data allows useful analysis.

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2. British National Formulary 60, September 2010.

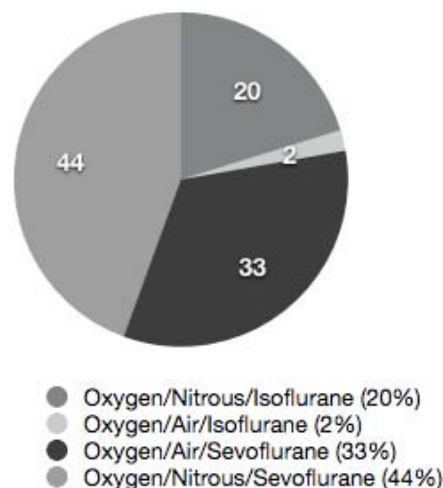


Fig 1: Gas and volatile combinations (frequency %)

| Agent | Median fresh gas flow (L min ⁻¹) |
|-----------|--|
| All cases | 0.88 (0.59-1.3 [0.07-3.83]) |
| Sevo | 0.75 (0.55-1.22 [0.07-3.83]) |
| Iso | 1.17 (0.99-1.34 [0.57-2.18]) |

Table 1: Fresh gas flow: median (interquartile range [range])

| Agent | Consumption (ml h ⁻¹) | Uptake (ml h ⁻¹) | Difference scavenged (ml h ⁻¹) |
|-------|-----------------------------------|------------------------------|--|
| Sevo | 18 (15-28 [4-60]) | 6 (4-9 [1-22]) | 12 (9-20 [2-60]) |
| Iso | 9 (7-13 [4-25]) | 4 (3-8 [2-16]) | 5 (4-6 [2-9]) |

Table 2: Agent consumption and uptake

| Case | 1 | 2 | 3 |
|--|-------------|------------|------------|
| Duration (h:min) | 3:06 | 3:40 | 3:28 |
| Agent | Sevo | Sevo | Iso |
| N ₂ O flow (L min ⁻¹) | 1.37 | 0.63 | 0.57 |
| Agent consumed (ml) | 62 | 13 | 14 |
| Agent taken up (ml) | 10 | 6 | 8 |
| Scavenged difference (ml) | 52 | 7 | 6 |
| Agent cost (£) (USD) | 30.5 (\$46) | 6.4 (\$10) | 0.65 (\$1) |

Table 3: Cost analysis examples

S-200.**VOLUME RESPONSIVENESS IN CHILDREN,
A COMPARISON OF STATIC AND DYNAMIC INDICES**

AUTHORS: J. Chandler,¹ E. Cooke,¹ M. Hosking,² N. Froese,¹ W. Karlen,¹ J. Ansermino¹

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INTRODUCTION: Assessing intravascular volume status in children is challenging and guided by little evidence.¹ Extensive literature in adults has shown that dynamic indicators of volume responsiveness are superior to static indicators at predicting cardiac output responses to fluid administration.^{2,3} The aim of our study was to compare static indicators (central venous and pulmonary arterial occlusion pressures, CVP and PAOP) and peripheral dynamic indicators (pulse pressure variation, ΔPP , pulse oximeter plethysmograph variation, ΔPOP , and plethysmograph variability index, PVI) as predictors of volume responsiveness in children.

METHODS: Following institutional review board approval, a prospective study was performed. Children undergoing cardiac catheterization for transcatheter repair of left to right shunts or electrophysiology studies under general anesthesia were recruited. Exclusion criteria were clinical instability, unrepaired shunts or rhythms other than sinus rhythm.

Data was collected following completion of the procedure; a pulmonary artery catheter was placed under fluoroscopic guidance. Pulse oximeter plethysmograph, central venous, arterial and pulmonary arterial waveforms were recorded and analyzed retrospectively. Cardiac output (CO) was measured using thermodilution at baseline and after a fluid bolus (10 ml/kg). The indices: CVP, PAOP, ΔPP , ΔPOP and PVI were also calculated for both time points. The ability of each variable to predict the cardiac output response was assessed using Pearson Correlations.

RESULTS: Twenty children were recruited, with one exclusion due to clinical instability. Median age was 6.09 years (range: 1.2 - 16.1 years) and median weight was 26.3 kg (range: 8.9 - 74 kg). There was a poor correlation between prebolus values of the three dynamic indices and the cardiac output change (ΔPP : $R^2 = 0.036$, $p = 0.48$; ΔPOP : $R^2 = 0.02$, $p = 0.55$; PVI: $R^2 = 0.047$, $p = 0.37$). Similarly initial and changes in values of static indicators demonstrated poor correlation with change in cardiac output (CVP: $R^2 = 0.016$, $p = 0.6$; PAOP: $R^2 = 0.002$, $p = 0.84$).

DISCUSSION: This study failed to show any ability of static or peripheral dynamic indicators to predict the cardiac output response to fluid administration in children.

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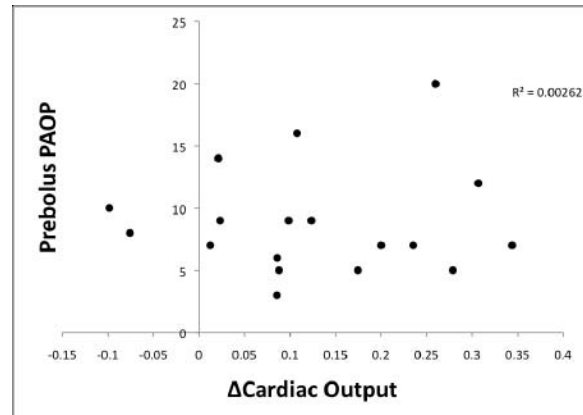


Figure 1: Pulmonary Artery Occlusion Pressure vs Cardiac Output response

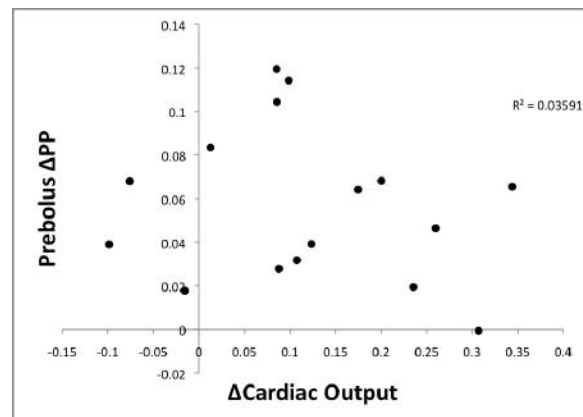


Figure 2: Pulse pressure variation vs Cardiac Output response

S-201.**USING THE INFLATING SYRINGE AS A SAFETY VALVE TO LIMIT LARYNGEAL MASK AIRWAY CUFF**

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INTRODUCTION: Overinflation of the laryngeal mask airway (LMA) cuff is thought to be the etiology underlying many of the complications associated with the use of this device. Until now, there has not been a clinically acceptable method to ensure that the cuff pressure is maintained less than the recommended maximum value of 60 cm H₂O (44 mm Hg). Halder and Immanuel¹ noted during a prospective audit that 76% (43/56) of LMA cuff pressures were greater than 60 cm H₂O. Even more worrisome, almost half (48%) of the intra-cuff pressures were greater than 120 cm H₂O, a level twice that recommended. Seet and colleagues² recently reported a reduction in postoperative pharyngolaryngeal complications from 46% with routine LMA cuff care (mean cuff pressure 155±78 cm H₂O [114±57 mm Hg pressure]) to 13% when the LMA cuff pressure was limited to < 60 cm H₂O pressure. We observed that following inflation of an LMA with the pre-packaged syringe, if the syringe remained engaged to the spring-loaded pilot valve leading to the cuff, the syringe plunger commonly rebounded, resulting in a lesser degree of LMA cuff inflation. We hypothesized the intra-cuff pressure of the LMA forced the syringe plunger to rebound and, more importantly, that the residual LMA cuff pressure would be closer to or even within the recommended “safe zone” of pressure (i.e., ≤ 60 cm H₂O).

METHODS: We inflated sizes #2 and #5 LMAs with air to 40, 60, or 120 mm Hg starting pressures, using 30-mL and 60-mL BD™ and B Braun™ syringes; we then allowed the syringe plungers to recoil to equilibrium before removing the syringe from the LMA inflation port. Residual LMA cuff pressures following complete passive recoil were measured (n = 20 measurements for each trial) and recorded.

RESULTS: Minimal residual cuff pressures for a number of combinations of syringes and starting pressures resulted in safe residual LMA cuff pressures. There were minimal differences in the final residual LMA cuff pressure between the LMA sizes (#2 vs. #5), type of syringe used for cuff inflation (BD vs. BB), syringe volume (30 mL vs. 60 mL), or starting cuff inflation pressure (30, 60 or 120 mm Hg).

DISCUSSION: These data demonstrate an efficient, practical and easy method to achieve an initial equilibrium recoil LMA cuff pressure that is less than, or very near to, the recommended upper safe limit of 60 cm H₂O (44 mm Hg).

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S-202.**THE ROLE OF IMPEDANCE CARDIOGRAPHY IN DETERMINING A FUNCTIONING EPIDURAL CATHETER**

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INTRODUCTION: Endotracheal Cardiac Output Monitor (ECOM) is a non-invasive monitor which uses impedance cardiography to measure changes in hemodynamic parameters such as stroke volume (SV), cardiac output (CO), cardiac index (CI) and systemic vascular resistance (SVR) associated with surgical or anesthetic interventions. The goal of this study was to determine the role of hemodynamic changes induced by epidural anesthesia at the end of surgery in prediction of dermatomal blockade and effective pain control during the first 24 hours of the postoperative period.

METHODS: Twenty patients undergoing intra-abdominal surgery who would otherwise be offered an epidural catheter for post operative pain relief, and would have an arterial line placed for intraoperative monitoring, were enrolled into this study. After placement of an epidural catheter and establishment of general anesthesia, systolic, diastolic and mean blood pressures (SBP, DBP, MAP), SV, CO, CI, and SVR, were monitored and recorded in 15 minute intervals using the ECOM monitor. At the start of abdominal closure the epidural catheters were bolused with 5 ml of 0.25% bupivacaine in ten minute intervals for a total of 10 ml volume. The same hemodynamic parameters were then recorded at five minute intervals until the conclusion of surgery. In the post anesthesia care unit, dermatomal blockade was assessed using temperature discrimination at 10 and 20 minutes after arrival. The number of dermatomes blocked, the PACU VAS pain scores, intravenous pain medication administration, and patient satisfaction on 0-10 scale with 10 being very satisfied were recorded through the first 24 hours post-operatively.

RESULTS: Significant reduction was observed in SBP, DBP, and MAP as well as in SVR after starting epidural anesthesia. No change in CO, CI, HR or SV was observed (Figure 1). The effectiveness of epidural anesthesia was then evaluated in patients with (Group 1) or without (Group 2) significant SVR reduction. Level of dermatomes blocked and average 24 hour VAS pain scores were significantly different between these two groups based on student's t-test. Average post-anesthesia care unit pain score and patient satisfaction were not statistically different between the two groups (Figure 2).

DISCUSSION: Epidural anesthesia significantly decreases systolic, diastolic and mean blood pressure as well as SVR without changing SV, CO and CI. Patients with significant change in SVR have more levels of dermatomal blockade and lower average 24-hour VAS pain scores.

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S-203.**A STUDY OF THE CHARACTERISTICS OF A VIDEO BRONCHOSCOPE SUITABLE FOR RESOURCE POOR ENVIRONMENTS****AUTHORS:** A. E. Neice, J. G. Brock-Utne, M. Bokoch**AFFILIATION:** Stanford University Medical Center, Stanford, CA

INTRODUCTION: Recent advances in electronics have made low cost (<100USD) miniature video cameras available. Several manufacturers offer cameras have diameters less than 4mm and are suitable for use in a video bronchoscopic devices. This has resulted in considerable excitement that perhaps low cost video bronchoscopes can be developed to aid intubations in situations that a fiberoptic bronchoscope would be prohibitively expensive (for example, hospitals in the developing world, paramedics in developed countries, etc.) The goal of this project was to identify engineering challenges in the development of this new technology.

METHODS: This study consisted to two phases. In the first phase, medical students entering anesthesiology, emergency medicine, and critical care were asked to use fiberoptic bronchoscopes in a number of different ergonomic configurations and their preferences were noted. In the second phase, a proof of concept engineering prototype of a video fiberoptic bronchoscope was developed, with close attention paid to initial and ongoing costs to the user.

Challenging Case Report (only complete if your submission falls into the “Challenging Case Report” category. If you select the “Challenging Case Report” category on the next step, this section must be completed.): N/A

RESULTS: While the use of a videocamera as opposed to a fiberoptic bundle makes a number of new configurations for a bronchoscope possible, medical students generally preferred configurations that were quite similar to existing bronchoscopes. A functional proof of concept prototype was developed for less than 500USD, and several unexpected engineering challenges in its design were identified.

DISCUSSION: This project demonstrates the feasibility of low cost video bronchoscopes for resource poor environments. The ongoing user cost must be considered as well as the upfront cost and to this end minimizing the costs associated with sterilization are of paramount concern. Disposable covers seem to be the most feasible option although these cause several difficulties of their own, including image degradation and increased difficulty of endotracheal tube advancement. These can be overcome through suitable material selection and cover design.

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S-204.**MITRAL ANNULAR DISPLACEMENT, POCKET ECHOCARDIOGRAPHY, AND THE NOVICE ECHOCARDIOGRAPHER: USING DIGITAL MOTION TRACKING SOFTWARE TO ASSESS LEFT VENTRICULAR FUNCTION**

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INTRODUCTION: The pocket echocardiograph (PE), a miniaturized, hand-held ultrasound, is a growing option for rapid bedside assessment of left ventricular (LV) function in both perioperative and critical care settings. Recent research with speckle-tracking of the mitral annulus has shed new light on an old concept of mitral annular displacement (MAD) as a surrogate for ejection fraction in assessing LV systolic function.^{1,2} With an easy target for a novice echocardiographer to follow, MAD may potentially assist the novice with a more accurate and rapid estimation of LV function at the bedside where other current modalities are impractical or unavailable. We propose using digital motion tracking software coupled with PE to fill this void providing rapid, easily obtainable, and accurate data on LV systolic function.

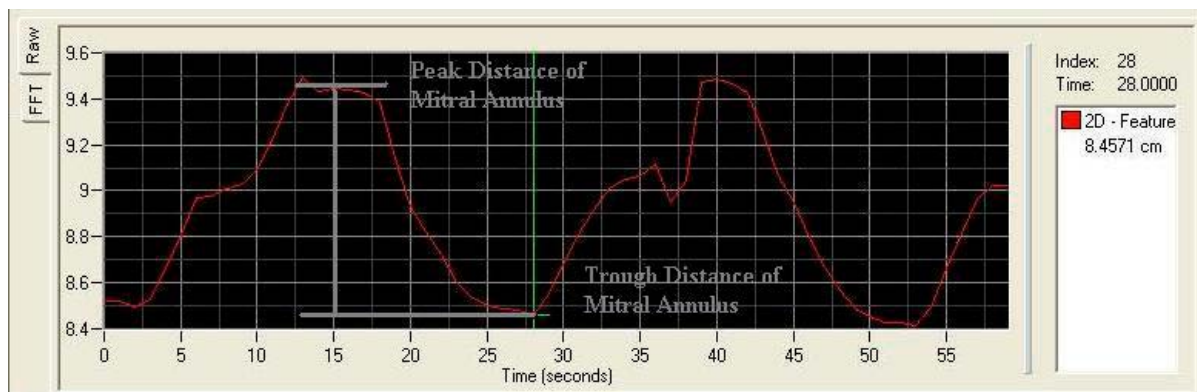
METHODS: Using PE's (P10, Siemens AG, Henkestrasse, Germany) acquired by novice echocardiographers and digital motion tracking software (ProAnalyst, Xcitex, Cambridge, MA), two-dimensional movement of the septal mitral annulus was graphed and longitudinal measurements throughout the cardiac cycle recorded from PE images (Figure 1). We then compared MAD measurements with expert EF interpretations from formal transthoracic echocardiogram (TTE) exams. Polynomial analysis was used to determine an R value of paired points of MAD distance in millimeters to expert interpretations of EF.

RESULTS: Of the 40 PE subjects, 9 (23%) were discarded because we were unable to clearly identify the mitral annulus. The mean MAD was 8.85 +/- 2.38 mm with a range of 3.30 - 13.38 mm. Expert TTE EF mean was 52.35 +/- 12.98% with a range of 15-70%. There was a quadratic relationship between MAD and EF with an R value of 0.78, similar to prior work with full-sized echocardiographs.³

DISCUSSION: A PE obtained by a novice echocardiographer coupled with digital motion tracking software can measure longitudinal movement of the septal mitral annulus. The values of MAD with this system are also comparable to a novice echocardiographer's visual EF interpretation.³ Further studies with higher quality imaging devices will likely decrease the number of un-interpretable echocardiograms. Future applications with semi-automated or even automated systems may allow rapid and accurate assessment of LV function at the bedside of critically ill and perioperative patients.

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S-205.**ARTIFACTS IN RESEARCH DATA OBTAINED FROM ANESTHESIA INFORMATION AND MANAGEMENT SYSTEMS**

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AFFILIATION: University Medical Center Utrecht, Utrecht, Netherlands

INTRODUCTION: Anesthesia Information and Management Systems (AIMS) are useful as a resource for research databases. However, by retrieving data from the monitoring systems, AIMS cannot decide whether or not a certain value is a 'true' value or an artifact. Such unreliable estimates may influence research results or introduce confounding. To prevent the AIMS from storing artifacts as values, intelligent filtering during data capturing can be applied in addition to filtering already applied in the monitoring system. We assessed the reliability of AIMS data for research purposes by measuring the occurrence rate of artifacts in vital parameter values recorded in our AIMS.

METHODS: This prospective observational study included 86 adult patients, who were monitored by a Datex Ohmeda® system. Measurements from this system are automatically stored in the AIMS. In order to prevent capturing artifacts, data are recorded only after applying a filter. For HR, saturation, ST-segment and IBP the median value per minute is calculated and stored. The NIBP is recorded every time it is measured.

In addition to the AIMS collecting data, data were collected manually in the operating room (including different procedures), and evaluated as to whether they were a reliable measurement or an artifact.

First, a stored value was considered to be a possible artifact if it deviated from a fixed normal range (HR and saturation) or a range relative to a baseline value (ST-segment, NIBP and IBP). Second, a value was considered to be a possible artifact if it instantly deviated from the trend of preceding values. Finally, if a value was clearly unreliable, even if it was in the normal range, it was considered a possible artifact.

All possible artifacts were verified with the attending anesthesiologist as to whether it concerned a true value or an artifact.

RESULTS: The study included 86 patients (35 ENT surgery, 29 general and 22 neurosurgery), of which 84 (98%) received general anesthesia. HR, NIBP, saturation and ST-segment were measured in all patients, whereas IBP was measured in twelve. In total 9534 minutes of anesthesia time were recorded (Table 1) and the incidence of true artifacts ranged from 0.02% (95% CI: 0.01-0.08%) for HR to 13.49% (95% CI: 12.20-14.89%) for IBP measurements. The incidence of artifacts in IBP measurements was often (53%) caused by relocation of the pressure sensor.

DISCUSSION: For research purposes, storing a median value per minute to filter capturing of continuous vital parameter values in an AIMS database provides reliable data for HR and saturation, with artifact rates below 0.5% and reasonable reliability for ST segment and NIBP data (artifact rates 4.7% and 2.3%, respectively).

REFERENCES: N/A

S-206.**ANESTHESIA INFORMATION MANAGEMENT SYSTEM ERGONOMICS: A NOVEL METHOD FOR ANALYZING DOCUMENTATION WORKFLOW**

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AFFILIATION: ¹Massachusetts General Hospital, Boston, MA; ²Vanderbilt University, Nashville, TN

INTRODUCTION: A well designed anesthesia information management system (AIMS) can facilitate accurate and contemporaneous documentation without interfering with clinical workflow. High quality documentation supports real-time decision support, patient care and billing. We created a graphically oriented documentation workflow and developed a methodology for comparing it against a traditional documentation workflow. Our hypothesis was that a multi-modal evaluation strategy using a simulated clinical environment could allow detection of changes in documentation accuracy, AIMS interactions required and differences in cognitive workload.

METHODS: Twenty anesthesiologists and anesthesia residents were enrolled in an evaluation of two workflow methodologies for documenting essential elements of an anesthetic. Participants were split into two groups. The first group documented a routine case start using the traditional existing workflow, followed by a training session with a graphically oriented workflow and then use of that workflow in documentation of a second case start. The second group utilized workflows in the opposite order. All participants completed a workload assessment and all sessions were recorded. Perceived workload, workflow pathway length, extent of interaction, documentation time and accuracy of documentation were compared between the two workflows.

RESULTS: The evaluation methodology successfully differentiated the documentation workflows with participants preferring the graphical workflow. Use of the graphical workflow was demonstrated to improve documentation accuracy, reduce interactions necessary for key aspects of documentation and produced a shorter workflow pathway. Total documentation time was lower for the traditional workflow. The graphical workflow reduced the perceived pace of the documentation task.

DISCUSSION: AIMS documentation workflows can be successfully compared using a simulated clinical environment. The use of a graphically oriented workflow created a more uniform approach to the documentation process and resulted in dramatic improvements in documentation quality while decreasing the required number of AIMS interactions. Rigorous evaluation methodology should be utilized to optimize and evaluate AIMS workflow.

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S-207.**DEVELOPMENT OF A MOBILE MONITORING AND COMMUNICATIONS SOLUTION FOR ANESTHESIA TEAM MEMBERS****AUTHORS:** M. Görges,¹ J. Ansermino²**AFFILIATION:** ¹Electrical and Computer Engineering Department, The University of British Columbia, Vancouver, BC, Canada; ²Department of Anesthesiology, Pharmacology and Therapeutics, The University of British Columbia, Vancouver, BC, Canada

INTRODUCTION: The operating room (OR) suite at BC Children's Hospital uses a central monitoring station, which integrates vital signs and alarms from eight ORs and multiple offsite locations. There are drawbacks to the message exchange system of one-way numeric pagers that is currently used between anesthesia team members: 1) monitoring data is available only in an office separate to the ORs, 2) the paging system only transmits a callback number, and 3) distance of phone from the anesthesia workstation makes paging cumbersome. To improve information exchange, and simplify communication between anesthesia team members, a mobile application using wirelessly connected personal digital assistants (PDA) is proposed.

METHODS: A work domain analysis (WDA)¹ of the anesthesia assistant environment² identified three main functions of the mobile device: room subscription/authentication, messaging, and vital sign display.² Based on the hierarchical model obtained through the WDA, paper prototypes were developed using a participatory rapid prototyping process.³

RESULTS: Eleven screens were developed: 1) Three overview screens: one showing OR number, three vital sign values and the anesthetic phase; an extended version including trend indicators (Fig. 1a), and; a waveform screen similar to a traditional patient monitor (Fig. 1b); 2) Two room subscription/authentication screens: map based room subscription (Fig. 2a) and login using personal identification numbers; and 3) Six messaging screens: messaging overview (Fig. 2b), paging with two different levels of severity, trend-based alarms, reminder setup, and a chat screen.

DISCUSSION: With strong potential to provide easy information exchange and communication between anesthesia team members, thereby improving their situational awareness,⁴ the proposed mobile application may improve patient safety. Future work includes the implementation of the user interface on a PDA or smart phone and a server component facilitating information gathering, message exchange, and alarm generation.

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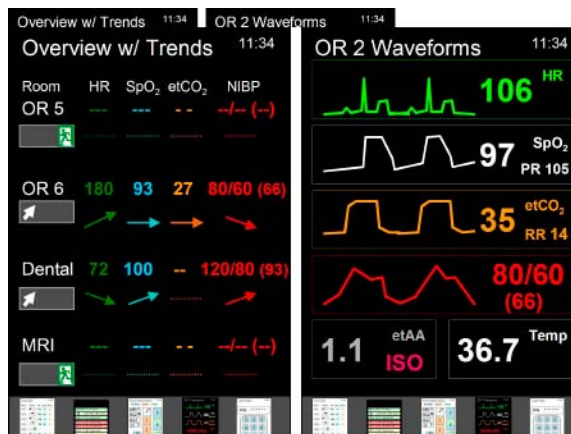


Figure 1: Overview and waveform screens

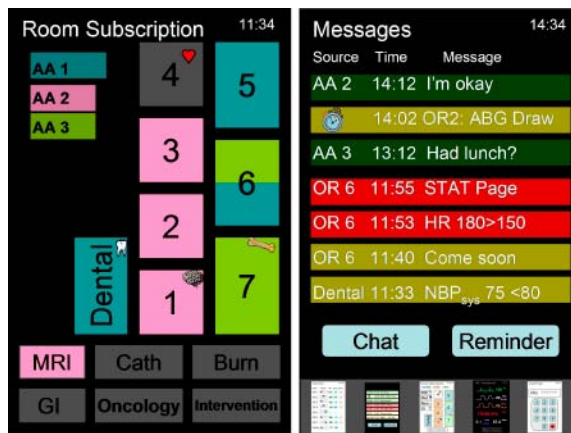


Figure 2: Room subscription and messaging screens

S-208.**BIS CAN PREDICT SHALLOW ANESTHESIA MORE EFFECTIVELY THAN AEP INDEX****AUTHORS:** M. Uchida,¹ M. Ozaki²**AFFILIATION:** ¹Anesthesiology Division, Syonan Kamakura General Hospital, Kamakura, Japan; ²Department of Anesthesiology, Faculty of Medicine, Tokyo Women's Medical University, Shinjyuku, Japan**INTRODUCTION:** Recently apeEX® (Medical Device Management Ltd., UK) has been marketed for clinical use in Japan. The purpose of this study was to compare BIS and AEP index with midazolam (MDZ) and MDZ plus propofol (PRO) anesthesia.**METHODS:** After IRB approval, eleven patients (ASA I-II) who underwent general anesthesia were included in this study. Measurement of BIS (BIS monitor A-2000, Aspect Medical System Inc., USA) and AEP index were started before induction and continued to be recorded every five minutes during anesthesia. A bolus of MDZ 0.1-0.15 mg/kg and rocuronium bromide 0.6 mg/kg was infused for induction. Infusion of remifentanyl 0.2-0.3 µg/kg/min was started 5 min before induction. After induction and before the operation, PRO was started at 2-5 µg/ml and infusion was continued at 2-3 µg/ml using a target-controlled infusion pump (Graseby 3500, Graseby Medical Ltd., UK). Effect-site concentration of MDZ (mCe) was simulated using TIVAtrainer ver.8 (EuroSIVA). BIS values measured at 10 min after MDZ infusion and the values measured at 20 min after PRO infusion were started were compared statistically using Student's t-test. A p value <0.01 was considered to be statistically significant. Time-course plots (order 5) were drawn using SigmaPlot 11.2 (Systat Software Inc., USA).**RESULTS:** mCe reached the maximum at 130 ± 42 ng/ml (mean \pm SD) 10 min after the infusion. BIS showed the 1st plateau (64 ± 8) 10 min after MDZ infusion and the 2nd plateau (35 ± 7.8) 20 min after PRO infusion was started. BIS values measured at the 1st and 2nd plateaus were significantly different.AEP indices decreased gradually after MDZ infusion and reached a plateau (37 ± 8.7) 20 min after MDZ infusion and kept almost the same level after PRO infusion was started.**DISCUSSION:** One of the subparameters incorporated in BIS is the suppression ratio (SR). Bruhn et al (1) reported that up to 40% SR, BIS remains constant regardless of SR. However, beyond a SR of 40%, BIS and SR correlate linearly and BIS can be calculated as $BIS = 50 - SR/2$. In the treatment of refractory status epilepticus, MDZ infusion is one of the most effective therapies to attain cessation of seizures that occur mainly before or during burst suppression (BS). Ulvi et al (2) reported that the mean MDZ dose to achieve cessation of seizures was 8 µg/kg/min (258-305 ng/ml).

During the 1st plateau, patients might be sleeping without having BS. BIS indicated a state of shallow anesthesia, but AEP index could not distinguish shallow (1st plateau) from deep (2nd plateau) anesthesia. BIS is able to predict shallow anesthesia more effectively than AEP index, because of its algorithm.

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S-209.**ANALYSIS OF EFFICACY OF NEW ADHERENT SYSTEM FOR P-6 ACUPRESSURE DEVICE TO REDUCE PERIOPERATIVE NAUSEA AND VOMITING****AUTHORS:** R. Pitts, A. K. Dahan, A. Sternlicht**AFFILIATION:** St. Elizabeth's Medical Center, Boston, MA**INTRODUCTION:** Acupressure at the P6 point on the ventral aspect of the forearm has been shown to be effective in reducing the incidence of N & V in an approximately equivalent effect to pharmacologic treatment.¹ The currently available device employs an elastic strap, which can retain fluids and could act as a tourniquet upon IV infiltration. Because of this, a new clean tape system for adherence of the acupressure button was evaluated. After IRB approval, we studied the tape system's capability to adhere to the skin and maintain pressure on the P6 acupressure point. The US FDA requested that the study be performed prior to granting marketing authorization.**METHODS:** 24 patients aged 18-85 of equal sex representation undergoing surgery with planned hospitalization were enrolled in the study. Assessments of tape adherence and acupressure button placement were performed at 0, 1, 2, 6, 12, 24, and 30 hours. A three point rating system was used to assess efficacy of the tape system. The study protocol had pre-defined criteria for determining success, and the primary endpoint related to the ability of the tape system to maintain the acupressure P6 button in place in the majority of patients throughout the study period. Secondary endpoints assessed the tape system itself and safety. Efficacy in terms of potential N & V reduction was not assessed in this study. Based on an anticipated standard deviation of 0.2 and the simple 3 point assessment scale, the study was anticipated to have 94% power in regards to the primary endpoint.**RESULTS:** A total of 24 patients were enrolled in the study, 19 of whom had 24 hour data available for analysis. The pre-defined primary and secondary endpoints of the study were met. The tape system was able to maintain P6 pressure for 6 hours in 86% of patients (19/22) and 68% of patients at 24 hours (13/19). No adverse events occurred.**DISCUSSION:** The new tape system successfully maintained pressure on the P6 point during a relevant time period of 6 hours, and in most patients at 24 hours. This was previously shown (with the elastic strap P6 acupressure device) to have an equivalent anti-nausea effect to pre-operative metaclopramide (0.2 mg/kg) or ondansetron (0.15 mg/kg) (2). The tape system is potentially more suitable for perioperative use than the elastic strap that is used to secure the currently marketed acupressure device. The efficacy of the tape system for P6 acupressure anti-emetogenic effect needs to be confirmed.**References:**

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Device in place over P6 acupressure point

S-210.**REAL-TIME CALCULATION OF ARTERIAL WAVEFORM VARIATION IN THE FREQUENCY-DOMAIN****AUTHORS:** R. H. Thiele, D. Colquhoun, M. Durieux**AFFILIATION:** University of Virginia, Charlottesville, VA

INTRODUCTION: During positive pressure ventilation, blood pressure varies at the frequency of respiration. This “respiratory variation” is related to fluid responsiveness. Unfortunately, most monitoring systems do not quantify respiratory variation. We therefore investigated the feasibility of building a flexible, affordable monitor capable of quantifying this important clinical variable.

METHODS: After IRB approval and informed consent was obtained 10 patients undergoing liver transplantation were enrolled. A voltage proportional to arterial pressure was recorded from the analog output of a TRAM 4a Monitoring System (GE, Fairfield, CT) by a USB-6009 Digital Voltmeter (National Instruments, Austin, TX).

An algorithm implemented in SignalExpress 2009 (National Instruments, Austin, TX) batch processed sixty seconds of data at a time, first decomposing the arterial waveform into its component frequencies using Fast Fourier Transformation, and then calculating the ratio of the peaks between 0.1-0.5 Hz (caused by positive pressure ventilation) and 0.8-3 Hz (caused by cardiac contraction). We refer to this ratio as the Spectral Peak Ratio (SPR).

Respiratory rate, heart rate and the SPR were each displayed on trend graphs, as well as in large digits to represent the current value in real time. See Figure 1.

In offline analysis, SPR was compared with time-domain measures of variability: Systolic Pressure Variability (SPV), Pulse Pressure Variability (PPV) and Stroke Volume Variability (SVV) over the entire dataset by an algorithm implemented in MATLAB Software (The Mathworks, Nantick, MA).

RESULTS: After removing artifactual data (obtained around the time of arterial line sampling or flushing by identifying systolic pressures outside the range of 0-300 mm Hg), 1717 minutes of data (83%) remained for analysis. Comparisons between SPR and time domain-based metrics are presented in Table 1.

DISCUSSION: Respiratory variation is quantifiable using inexpensive off-the-shelf hardware and software. Hardware for our device costed less than \$400 and can be modified to function with any monitoring platform that outputs arterial pressure as an analog voltage.

SPR correlates well with SPV, PPV, and SVV, well-validated predictors of fluid responsiveness. The metric and software described may offer clinicians a cost-effective alternative for assessing respiratory variation in real time.

Future work will focus on examining the performance of this device in various clinical scenarios, specifically focusing on response-time and the ability of SPR to predict fluid responsiveness.

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| SPR vs | R | R2 | Spearman |
|--------|-------|-------|----------|
| SPV | 0.574 | 0.330 | 0.740 |
| PPV | 0.497 | 0.247 | 0.784 |
| SVV | 0.440 | 0.194 | 0.804 |



S-211.**ROUTINE 3-LEAD ECG ST SEGMENT MONITORING
IN THE RECOVERY ROOM****AUTHORS:** J. A. van Waes, L. Van Wolfswinkel, W. A. Van Klei**AFFILIATION:** University Medical Center Utrecht, Utrecht, Netherlands

INTRODUCTION: Postoperative myocardial infarction is a major cause of mortality after noncardiac surgery.^{1,2} In the perioperative period, myocardial ischemia generally occurs as ST segment depression on the electrocardiogram (ECG). Such ST segment changes most often occur at the end of surgery and during recovery. Lead V3 to V5 of a 12-leads ECG are most sensitive to detect these changes.^{3,4} During recovery, however, patients are often routinely monitored using a 3-leads ECG. The aim of this study was to assess the ability of continuous 3-leads ECG ST segment monitoring to detect postoperative myocardial ischemia.

Methods: This observational cohort study included 7715 patients above 60 years of age undergoing noncardiac surgery under general anesthesia. All patients were monitored during surgery and recovery by a Datex Ohmeda® system. Data were obtained from an electronic anesthesia record-keeping system. This system stores the median values per minute of all measured ST segment levels of lead II. ST segment depression was defined as a depression of ≥ 0.1 mV for at least 10 successive minutes. For each patient, all stored ST-segment levels during recovery were compared to both an absolute ST segment level (i.e. compared to 0) and to an individual baseline pre-induction ST-segment level (i.e. the median ST-segment level before induction of anesthesia). The outcome (postoperative myocardial infarction) was defined as a Troponin I level of $\geq 0.1 \mu\text{g/L}$. Troponin was only measured if myocardial ischemia was clinically suspected. We calculated the incidence of ST segment depression, sensitivity and specificity, and the positive and negative predictive values.

Challenging Case Report (only complete if your submission falls into the “Challenging Case Report” category. If you select the “Challenging Case Report” category on the next step, this section must be completed.): N/A

RESULTS: Table 1 shows baseline characteristics. In 327 (4.2%) patients ST segment depression of ≥ 10 minutes was detected if an absolute threshold was used, and in 167 (2.2%) patients when the ST segment was compared to the individual baseline ST segment level (Table 2). The sensitivity and specificity of ST segment monitoring were 23% and 96% using absolute ST depression and 11% and 98% using the individual baseline ST segment. The PPV and NPV were 7% and 99% for both thresholds.

DISCUSSION: ST segment changes during recovery from non-cardiac surgery occur infrequently on a 3-leads ECG and routine 3-lead ECG ST segment monitoring is not adequate in detecting myocardial ischemia. In order to detect and treat postoperative myocardial ischemia, anesthesiologists should consider alternative strategies to monitor the occurrence of myocardial ischemia in patients undergoing non-cardiac surgery.

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S-212.**EFFICACY OF THE GLIDESCOPE
DOUBLE LUMEN TUBE STYLET**

AUTHORS: K. P. Rothfield,^{1,2} K. Crowley,¹ M. Lathom,¹
T. Nguyen,¹ M. Agrawal,¹ J. E. Pellegrini^{1,2}

AFFILIATION: ¹Saint Agnes Hospital, Baltimore, MD;
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INTRODUCTION: In contrast to conventional laryngoscopy, the Glidescope videolaryngoscope (Verathon, Bothell, WA) may be associated with easier laryngeal visualization than endotracheal tube placement.¹ Intubation with double lumen endotracheal tubes (DLT) may be thwarted by the fact that the integrated stylet of these tubes is intended for use with conventional laryngoscopes, and its gentle curve is far less than the acute angle required for optimal Glidescope intubation. Although the built-in conventional endobronchial tube stylet may be shaped to a steeper curve by the intubator, the tip of the tube may hang up on the anterior tracheal wall or cricoid depression, preventing further insertion. An ingenious solution to this problem is to “reverse load” the DLT onto the stylet to prevent the endobronchial tube from catching on soft tissue.² Along these lines, Verathon has developed a special rigid stylet that reverse loads the DLT (Image 1). The purpose of this study was to evaluate the efficacy of this device. We hypothesized that the Verathon DLT stylet would prevent the tube tip from seizing on the anterior tracheal wall.

METHODS: After IRB approval and informed consent, 6 ASA Class III adult patients scheduled for elective thoracic surgery under general anesthesia with endobronchial intubation were enrolled. In addition to basic demographic data, procedural time, Cormack-Lehane score, and relative intubation difficulty on a 0-100 visual analog scale (VAS). The Glidescope Cobalt videolaryngoscope was employed. A standard left-sided Mallinckrodt Broncho-Cath endobronchial tube (Nellcor, Boulder, CO) was loaded onto the Glidescope DLT stylet (Image 2). Insertion technique was identical to that used with a single lumen ETT and Glidescope, with no rotation during placement. After insertion, endobronchial tubes were guided into final position with the aid of a flexible fiberoptic bronchoscope.

RESULTS: All 6 patients were intubated successfully on the first attempt with the Glidescope Cobalt videolaryngoscope and DLT stylet. Mean time for intubation was 27 seconds. Average difficulty by VAS was 13.5. No complications, including esophageal intubation, dental or soft tissue trauma, were observed.

DISCUSSION: This pilot study suggests that the Glidescope DLT successfully overcomes the difficulties sometimes encountered when the Glidescope is used for endobronchial intubation. Further clinical evaluation is warranted.

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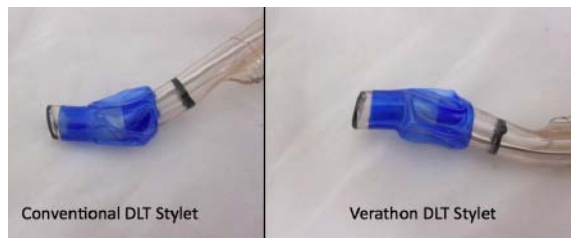


Image 1: Conventional vs. Verathon DLT stylet



Image 2

S-213.**A CASE REPORT ON CARDIOQ™: A TOOL TO
DETECT AORTIC STENOSIS****AUTHORS:** E. Sreshta, M. P. kinsky**AFFILIATION:** University of Texas Medical Branch, Galveston,
TX

INTRODUCTION: We report the use of an esophageal Doppler (CardioQ,™ Deltex Medical) to diagnose aortic stenosis. CardioQ™ has not traditionally been used to assess aortic valvular area. Esophageal Doppler uses continuous ultrasound, in the descending aorta, to measure aortic blood flow velocity. A propriety nomogram converts aortic blood flow velocity into stroke volume. Additional calculations include cardiac output, corrected flow time (FTc - an index of preload) and acceleration time (an index of cardiac contractility).

METHODS: An 83 year old female with colovaginal fistula underwent a sigmoidectomy and intestinal re-anastomosis. Significant past medical history included hypertension, hyperlipidemia and coronary artery disease. Following induction, we placed a CardioQ™ probe in her esophagus to monitor cardiac preload and cardiac output. The intraoperative course was uneventful. Blood pressure and heart rate (HR) were within normal limits. The corrected flow time was maintained between 360 - 410 ms with i.v fluid. The estimated blood loss was 50 mL and her urine output was 170 mL over 4 hrs. She received 1700 mL of lactated Ringer's and 300 mL of 5% albumin. The cardiac output, displayed by CardioQ™, was consistently elevated (9.1 - 10.4 L/min). In lieu of the high cardiac output, a post-operative transthoracic echocardiogram was performed that showed an enlarged left atrium and a calcified aortic valve. The aortic valve area, calculated by continuity equation, was 1.3 cm².

RESULTS: N/A

DISCUSSION: Transesophageal Doppler measures aortic blood flow velocity. By integrating the velocity over time (velocity time integral or VTI), the stroke distance can be estimated. Stroke volume (SV) can then be calculated from the VTI multiplied by the aortic valve area (AVA) and cardiac output (CO) from SV X HR. Precise measurements of the AVA require direct valvular imaging or invasive cardiac catheterization. The CardioQ™ utilizes a nomogram to estimate AVA based on age, height and weight. The abnormally high CO and SV, in this patient, suggests a calculation error, given that other high cardiac output states e.g., sepsis, were not evident. Since the CardioQ™ utilizes a fixed AVA based nomogram, the elevated aortic velocity in this patient inaccurately overestimated CO, a finding consistent with aortic stenosis.

Esophageal Doppler is traditionally used to estimate perioperative cardiac output and other cardiac functional indices. We report that aortic valve area can be indirectly inferred from an erroneously high cardiac output and stroke volume using the CardioQ™'s fixed nomogram.

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S-214.**PREPARATION OF GE-HEALTHCARE AESTIVA® ANESTHESIA WORKSTATIONS FOR USE WITH MALIGNANT HYPERTHERMIA-SUSCEPTIBLE PATIENTS****AUTHORS:** E. E. Whitaker, T. Kim**AFFILIATION:** Johns Hopkins Medical Institutions, Baltimore, MD

INTRODUCTION: Introduction: Patients with malignant hyperthermia may have a potentially fatal hypermetabolic response to volatile anesthetics. The concentration of anesthetic needed to trigger a malignant hyperthermia crisis is unknown.¹ Animal studies suggest the minimum concentration may be >5 ppm.² The Malignant Hyperthermia Association of the United States (MHAUS) provides instructions on purging anesthesia machines prior to use to reduce the risk of exposure.³ These recommendations were based on older generation machines. We sought to determine the time required to purge the Datex-Ohmeda Aestiva® Anesthesia Workstation of desflurane, sevoflurane and isoflurane.

METHODS: An Aestiva® anesthesia machine (GE Healthcare, Madison, Wisconsin) equipped with TEC vaporizers containing desflurane, isoflurane, or sevoflurane were used for this investigation. Gas measurements were taken with an InFraRan Specific Gas Analyzer (Wilks Enterprises, East Norwalk, CT), with an accuracy of ± 1 ppm. The machine was primed for 2 hours in VC mode with a VT of 500 ml, RR of 10 BPM, I:E ratio of 1:2 and a PEEP of 5 cm H₂O with a fresh gas flow (FGF) of oxygen at 3 lpm. During the

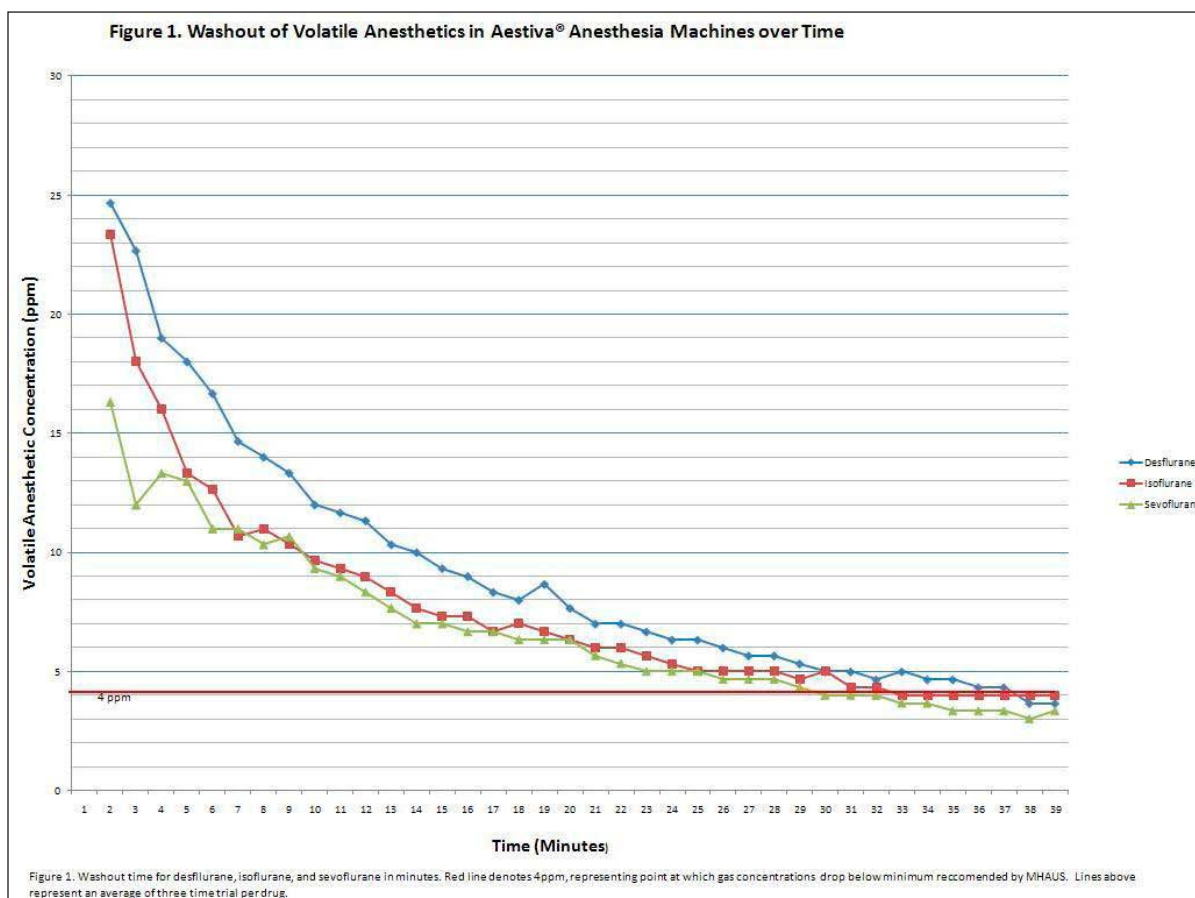
priming phase, the vaporizer was set to desflurane 7%, sevoflurane 2.5 %, or isoflurane 1.2%. During the washout phase the vaporizer was removed, the FGF was set to 15 lpm of oxygen with the same ventilator settings. A T-piece attachment was placed on the inspiratory outlet of the anesthesia machine with sampling of the gas concentration at 1 minute intervals until the gas concentration was less than 5 ppm.

RESULTS: On average, it took 28 minutes for the desflurane concentration to reach less than 5 ppm, 24 minutes for the isoflurane concentration, and 21 minutes for sevoflurane (see figure 1.)

DISCUSSION: Examination of the Aestiva® revealed several major points. First, these results demonstrate the washout time exceeds the time recommended by MHAUS. Desflurane required the longest washout time, although it is recognized as the least soluble gas. Previous studies had focused on halothane or isoflurane to derive the necessary washout time.⁴ This study provides information about the washout characteristics of desflurane, sevoflurane and isoflurane. Our limited study suggests a minimum washout time of 28 minutes to prepare the Aestiva® for caring for MH-susceptible patients.

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S-215.**INTRAOPERATIVE MANAGEMENT OF AN ISCHEMIC HAND AFTER RADIAL ARTERY CATHETERIZATION****AUTHORS:** B. N. Maryak, S. R. Clendenen**AFFILIATION:** Mayo Clinic, Jacksonville, FL

INTRODUCTION: Arterial catheterization is generally a safe procedure. Serious complications are rare; the incidence of permanent ischemic complications is estimated to be 0.09%¹. Complications include hematoma, bleeding, pseudoaneurysm, infection, nerve damage, and ischemia. Risk factors for hand ischemia associated with radial artery cannulation are controversial but limited data does suggest that low cardiac output, hypotension, and high-dose vasopressors may increase the risk¹. We present the intraoperative management of a patient with chronic atrial fibrillation, chronic anticoagulation, and hypertension who developed hand ischemia after placement of a radial artery catheter.

METHODS: A 75-year-old male with an epidural abscess causing C2 to C5 cord compression was scheduled to undergo decompressive laminectomy and abscess drainage. Standard ASA monitors were applied with the pulse oximeter sensor placed on the left hand. After induction of general anesthesia, a 20G angiocath was placed in the left radial artery on the first attempt without difficulty and confirmed by arterial tracing. Two minutes later the pulse oximeter alarmed with loss of the waveform, the arterial tracing dampened, and the hand turned white. Blood pressure at that time was transiently low, 82/48, and was treated with vasopressin, albumin, and calcium chloride. Lidocaine was injected into the arterial catheter and Doppler was applied revealing decreased blood flow. The catheter was then removed and nitropaste was applied to the hand without improvement. A hand surgeon's recommendation was a temporary sympathectomy by a stellate ganglion block. With a known cervical spine abscess, the stellate ganglion injection was avoided and an ultrasound-guided left supraclavicular block was preformed using a 22G short bevel, injecting 20cc of 0.2% ropivacaine.

RESULTS: Within minutes after the supraclavicular block the hand regained its original color and blood flow was confirmed by Doppler and return of pulse oximetry waveform.

DISCUSSION: The literature on the treatment of ischemic complications from arterial cannulation is extremely limited. There is utility in this stepwise approach to manage hand ischemia from radial artery catheterization. Ultimately treatment is aimed at the underlying mechanism, but in this case of probable vasospasm, pulse oximetry and Doppler can be used to evaluate blood flow, lidocaine and/or papavarine for vasodilation, catheter removal, nitropaste for vasodilation, and ultimately stellate ganglion block for sympathectomy and reversal of ischemia.

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S-216.**SPECTRAL PEAK RATIO OFFERS A SITE-INDEPENDENT MEANS OF ANALYZING RESPIRATORY VARIATION IN ARTERIAL PRESSURE WAVEFORMS**

AUTHORS: R. H. Thiele, D. Colquhoun, J. Tucker-Schwartz, M. Durieux

AFFILIATION: University of Virginia, Charlottesville, VA

INTRODUCTION: Arterial pressure variation that occurs at the frequency of respiration is predictive of fluid responsiveness in patients receiving positive pressure ventilation. Systolic Pressure Variation (SPV), Pulse Pressure Variation (PPV), and Stroke Volume Variability (SVV) have been described.

Traditional indices are based in the time-domain, and are related to the morphology of pressure waveform which may vary at different sites in the arterial tree. The accuracy of these indices may be influenced by the fidelity with which peripheral sites represent more central blood pressures.

We sought to assess site-variability and develop a novel means of assessing respiratory variation in the frequency-domain (Spectral Power Ratio, SPR). SPR is calculated by Fast-Fourier Transforming a pressure tracing and comparing the amplitudes of the respiratory and cardiac frequencies. We used liver transplantation as a model.

METHODS: After IRB approval, 10 patients undergoing Liver Transplantation were consented and enrolled. An additional arterial pressure transducer was added in both the radial and femoral arterial lines. Waveforms were recorded by a NI USB-9237 microvoltmeter.

Electrical interference was removed with a 50Hz filter. Waveforms were analyzed with an investigator-created MATLAB program. Artifacts associated with accession of the lines were removed. Values for SPV, PPV, SVV, and mean arterial pressure variability (MAPV) were calculated using 15s of data and SPR calculated using one minute of data. Each measurement was repeated at 5s intervals, with medians recorded for all data points in a 60s period.

RESULTS: A total of 2073 data points were produced after analysis, 1717 data points remained after artifact removal. R2 and Spearman correlation values were calculated between the radial and femoral value for each index (Table 1) and are displayed in Figure 1.

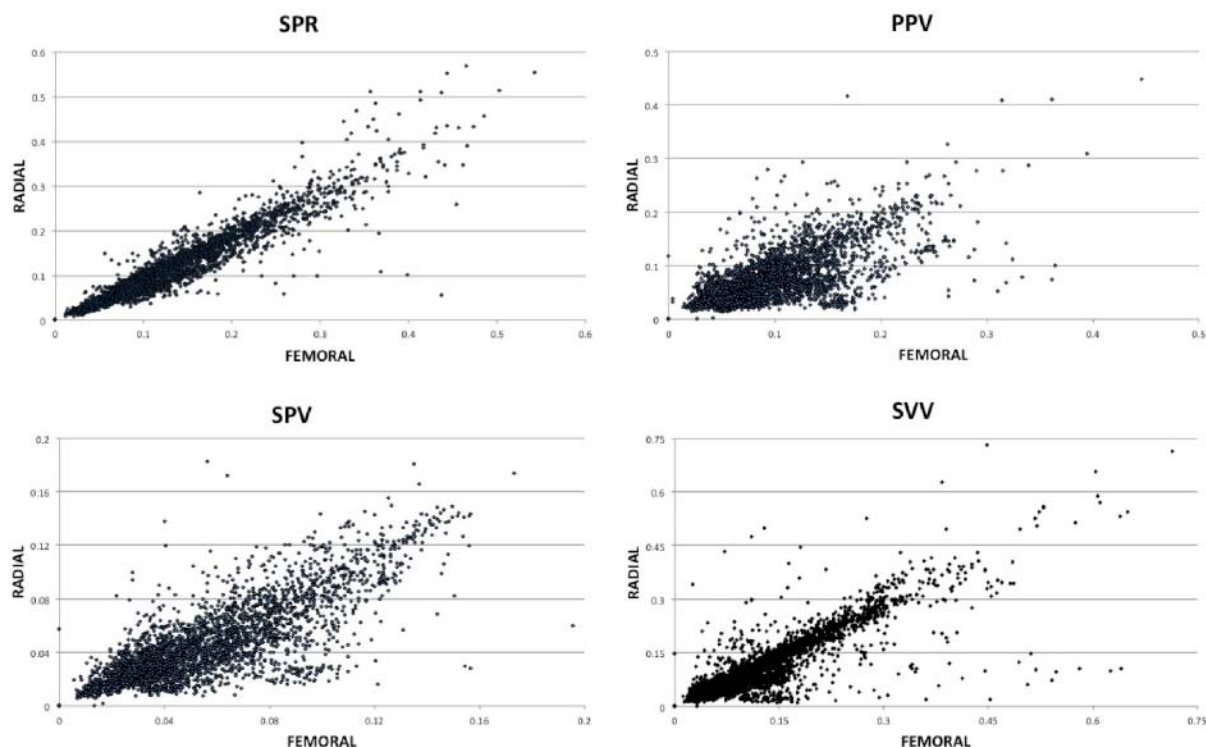
DISCUSSION: Spectral Peak Ratio, a novel, frequency domain-based method of assessing respiratory variation, was significantly less site-dependent as compared to time domain-based techniques. Interestingly, of the time domain-based techniques, MAPV outperformed SVP, PPV, and SVV.

It is unsurprising that a relatively poor correlation exists in metrics which are dependent on peak and trough blood pressure values which vary significantly between sites in this clinical context. The SPR method, which analyzes arterial signals based on their component harmonic waveforms, appears to be site independent. Future work will be required to determine whether this site-independence improves upon the predictive capabilities of respiratory variation.

REFERENCES:

Crit Care Med 37: 2642, 2009

| Index | R2 | Spearman |
|-------|-------|----------|
| SPV | 0.066 | 0.719 |
| PPV | 0.080 | 0.637 |
| SVV | 0.090 | 0.756 |
| MAPV | 0.157 | 0.840 |
| SPR | 0.830 | 0.952 |



S-217.**DEEP SEDATION FOR ENDOSCOPIC RETROGRADE CHOLANGIOPANCREATOGRAPHY: A COMPARISON BETWEEN CLINICAL ASSESSMENT AND NARCOTREND™ MONITORING****AUTHORS:** S. Amornyotin, W. Chalayonnawin, S. Kongphlay**AFFILIATION:** Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand

INTRODUCTION: Moderate to deep sedation is generally used for endoscopic retrograde cholangiopancreatography (ERCP). The depth of sedation is usually judged by clinical assessment and EEG-guided monitoring. The aim of this study was to compare the clinical efficacy of clinical assessment and Narcotrend™ monitoring during sedated ERCP.

METHODS: 138 patients who underwent ERCP in a single year, were randomly assigned to either group C or N. Patients in group C (90) were sedated by using MOAA/S scale. Patients in group N (48) were sedated by using the Narcotrend™ system. The MOAA/S scale 1 or 2 and the Narcotrend stage D0-E0 (index 27-36 to 57-64) were maintained during procedure. The primary outcome variable of the study was the total dose of propofol used during the procedure. The secondary outcome variables were complications during and immediately after procedure, and recovery time.

RESULTS: All endoscopies were completed successfully. Mean total dose of propofol in group C was significantly lower than in group N. However, the mean dose of propofol, expressed as dose/kg or dose/kg/hr in both groups, was not significantly different ($p=0.400$, 0.227). Recovery time, patient tolerance and satisfaction, and endoscopist satisfaction was comparable among the two groups. Sedation-related adverse events during and immediately after the procedure, such as hypotension, hypertension, tachycardia, bradycardia, transient hypoxia, or upper airway obstruction in group C (62.2%), were significantly higher than in group N (37.5%) ($p=0.006$).

DISCUSSION: Clinical assessment and Narcotrend-guided sedation using propofol for deep sedation demonstrated comparable propofol dose and recovery time. Both monitorings were equally safe and effective. However, the Narcotrend-guided sedation showed lower hemodynamic changes and complications as compare to the clinical assessment-guided sedation.

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S-218.**THE STORZ D-BLADE VIDEOLARYNGOSCOPE: COMPARISON TO THE GLIDESCOPE COBALT****AUTHORS:** K. P. Rothfield,^{1,2} M. Guth,¹ M. Lathom,¹ K. Lopez,¹ M. Agrawal,¹ J. E. Pellegrini^{1,2}**AFFILIATION:** ¹Saint Agnes Hospital, Baltimore, MD; ²University of Maryland Nurse Anesthesia Program, Baltimore, MD

Introduction: The Glidescope® Cobalt videolaryngoscope has revolutionized airway management by simplifying the process of intubation.¹ It provides a panoramic view of vocal cords with minimal patient manipulation by introducing a video imager on a steeply curved (60 degree) blade. In contrast, the Karl Storz Endoscopy C-MAC videolaryngoscope uses a video-enabled conventional Mac blade. Karl Storz has recently introduced the D-Blade steeply-curved videolaryngoscope (Image 1). Like the C-MAC, the close proximity of the video imager to the blade allows the tip of the device to be visible at all times. In contrast, the Glidescope imager is aimed at the area beneath the blade only, and not the device itself. The purpose of this study was to compare the performance of the D-Blade with the Glidescope. We hypothesized that they would have similar characteristics.

METHODS: After IRB approval and informed consent, 30 adult patients scheduled to undergo elective general endotracheal anesthesia were enrolled. Patients were randomly assigned to intubation with either the D-Blade or Glidescope. If the randomly selected device was already in use, the opposite device was used. In addition to basic demographic data, procedural time (blade in to blade out), Cormack-Lehane score, and device insertion difficulty were recorded. In most cases, the Glidescope rigid stylet was used with the both the Glidescope and the D-Blade.

RESULTS: 12 patients were randomized to the Glidescope, and 18 to the D-Blade. All but two patients in each group were intubated on the first attempt. All four of these patients were successfully intubated on the second attempt. There were no significant differences in any of the recorded variables. However, the view of the vocal cords was more likely to be temporarily blocked by the endotracheal tube with the D-Blade (1/12 Glidescope vs. 8/18 D-Blade, $p < 0.05$). Mean time for intubation was under 17 seconds for both devices. No complications, including esophageal intubation, dental or soft tissue trauma, were observed.

DISCUSSION: The Storz D-Blade resembles the Glidescope Cobalt blade in overall appearance and function. Although the close proximity of the video imager to the laryngoscope affords additional control by continuously imaging the blade tip, this design feature may also be responsible for the loss of glottic visualization during tube advancement. Further evaluation is necessary to evaluate the significance of this phenomenon.

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S-219.**THE RELATIONSHIP BETWEEN BISPECTRAL INDEX VALUES AND VOLATILE ANESTHETIC CONCENTRATIONS DURING THE MAINTENANCE PHASE OF ANESTHESIA IN THE B-UNAWARE TRIAL**

AUTHORS: E. L. Whitlock,¹ A. Villafranca,² B. J. Palanca,¹ E. Jacobsohn,² A. Evers,¹ M. Avidan¹

AFFILIATION: ¹Washington University School of Medicine, Saint Louis, MO; ²University of Manitoba, Winnipeg, MB, Canada

INTRODUCTION: Alterations in levels of hypnosis during anesthesia are hypothetically reflected by changes in electroencephalography (EEG) waveforms and EEG-derived indices, like the bispectral index (BIS). It is suggested that BIS monitoring allows practitioners to minimize volatile anesthetic administration safely during maintenance of anesthesia, as long as the BIS value remains <60.¹ This potential use assumes that beyond loss of responsiveness, there is a reliable and reproducible dose-response relationship between anesthetic effect-site concentrations, EEG waveforms, and the EEG-derived BIS. We evaluated the associations between BIS values, end-tidal anesthetic concentrations (ETAC), and patient characteristics during maintenance of anesthesia in the B-Unaware trial (NCT00281489).

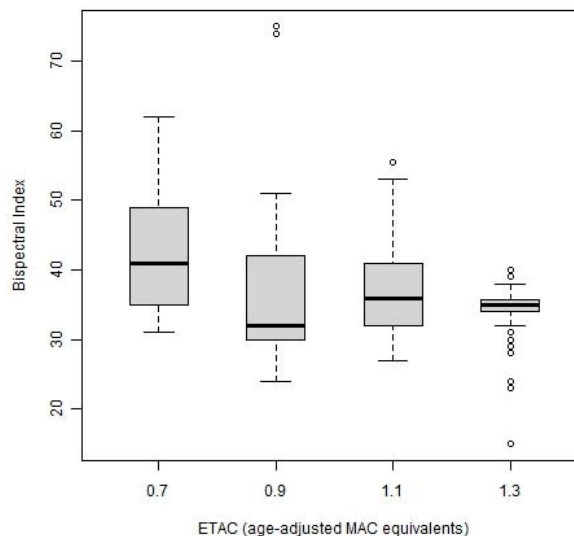
METHODS: Periods of pharmacokinetically stable ETAC during the intraoperative anesthetic maintenance phase in 1,102 patients were included. Independent relationships between BIS values, ETAC (expressed in age-adjusted MAC equivalents), patient characteristics and 1-year postoperative mortality were determined using a generalized estimating equation (GEE). Single-patient and population BIS-ETAC relationships were further explored with descriptive statistics and graphical representations.

RESULTS: Data from 1,102 patients with 3,385,978 data points were analyzed. With the parameters included in the model, the GEE yielded the following best predictive equation: $BIS = 59.8 - 1.9$ (if age <60) - 1.4 (if female) - 3.8 (if ASA physical status >3) - 2.6 (if dead at 1 year) - 14.9 * MAC. While this model demonstrates an average population dose-response relationship between ETAC (MAC) and BIS, both the strength and reliability of this relationship varied greatly among individual patients. Single-patient median BIS values did not reliably decrease with increasing ETAC (Figure 1). Single-patient linear regression analysis yielded a median BIS-ETAC relationship of -8 BIS units per 1 MAC increase (interquartile range [IQR] -30 to 0) and a median coefficient of determination of 0.16 (IQR 0.031 to 0.50).

DISCUSSION: Independent of pharmacokinetic confounding, BIS correlates poorly with ETAC values, is relatively insensitive to clinically significant changes in ETAC, and is vulnerable to substantial inter-individual variability. The inter-individual variability and the frequent relative invariance of the dose-response relationship between ETAC and BIS render unfeasible the goal of finely titrating volatile anesthetic based on the BIS during maintenance of anesthesia. Patient factors might also diminish the inter-individual reliability of the BIS as an indicator of anesthetic concentration.

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S-220.**INTRAVENOUS EXTENSION SETS –
WHEN MORE IS LESS****AUTHOR:** R. Marks**AFFILIATION:** University of Miami Miller School of Medicine,
Miami, FL

INTRODUCTION: Intravenous extension sets are convenient to use because they allow for rapid disconnection and reconnection of intravenous fluids. This is especially true when it is necessary to rotate the position of the operating table. Unfortunately, these devices may slow down the maximal rate of flow. Unlike intravenous catheters, however, this information is not always printed on the packaging. The purpose of this study is to measure the maximal rate of flow of these devices and to determine when and in combination with which catheters, they become the rate limiting factor.

METHODS: The measurements were made using a one liter bag of normal saline connected to a Y-type blood set (Braun Medical Inc.) of 87 inches, a 4-way stopcock (Smith Medical Inc.) and another 35 inch extension set (Braun). To the end of this set, we connected three different size intravenous catheters, a 14G, 16G and 18G, with maximal flow rates of 350 ml/min, 215 ml/min and 105 ml/min respectively. (All three catheters were 1.25 inches long). The fluid bag was pressurized to 300 mmHg and the time required to fill a 100 ml container was measured. After each measurement, the fluid was returned to the bag so that the starting volume would not differ. Each measurement was performed five times and the average time was used to calculate the maximal flow rate. After these baseline measurements were determined, we then attached an 8 inch smallbore extension set (Braun) and repeated the process with each of the different catheter sizes. We also performed the same measurements using the Ultrasite® valve alone.

RESULTS: The measurements are summarized in the attached table. The baseline measurements were essentially identical to the maximal flow rates printed by the manufacturer on the packaging of the intravenous catheters. Attaching the Ultrasite® valve (Braun Medical Inc.) reduced the maximal flow to 250 ml/min which is in accordance with the specifications published by the manufacturer. Connecting the small bore extension set (consisting of the Ultrasite® valve and an 8-inch extension) reduced the maximal flow rate to approximately 180 ml/min.

DISCUSSION: The results of this study clearly establishes the rate limiting factor when using the smallbore extension set with different size intravenous catheters. When using an 18G catheter, the extension set had no effect. When using a 16G catheter, the maximal flow rate can still be achieved if one only uses the ultrasite valve. With a 14G catheter, even using the ultrasite valve alone will significantly reduce the maximal flow rate (from 350 to 250 ml/min).

REFERENCES:

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Effect of extension set and catheter size on maximal flow rate

| Maximal flow rate | 14G | 16G | 18G |
|-------------------------------|-----|-----|-----|
| Published rate | 350 | 215 | 105 |
| Measured rate | 350 | 215 | 105 |
| Ultrasite® valve | 250 | 215 | 105 |
| Ultrasite® with extension set | 182 | 181 | 105 |

Flow rates are in ml/min



Smallbore Extension Set with ULTRASITE® valve and male leuc lock adapter Braun Medical Inc. Model #473438

S-221.**ACCURACY OF THE DEROYAL NASOPHARYNGEAL TEMPERATURE PROBE IN PATIENTS UNDERGOING HEATED INTRAPERITONEAL CHEMOTHERAPY**

AUTHORS: K. P. Rothfield,^{1,2} K. Crowley,¹ A. de Julio,¹ S. Langlois,¹ M. Agrawal,¹ J. E. Pellegrini^{1,2}

AFFILIATION: ¹Saint Agnes Hospital, Baltimore, MD; ²University of Maryland Nurse Anesthesia Program, Baltimore, MD

INTRODUCTION: Because avoidance of unintended hypothermia is one of the goals of the Surgical Care Improvement Project (SCIP), it is essential to accurately assess temperature. Although rectal temperature is considered the gold standard for measuring core temperature, this site is inconvenient for anesthesia providers, who typically measure temperature in the esophagus. The esophagus is not practical in many surgical procedures, or when the airway is secured with an LMA. Previously, nasopharyngeal temperatures were assessed with user-modified skin probes.¹ DeRoyal has recently introduced a miniature, thermister-equipped temperature probe designed exclusively for nasopharyngeal use (Image 1). The purpose of this study was to validate measurements made with this device against the gold standard in patients undergoing a procedure associated with wide swings in core temperature.²

METHODS: After IRB approval and informed consent, 14 ASA Class III adult patients scheduled to undergo elective general anesthesia were enrolled. 12 of the 14 patients were undergoing treatment of omental cancer with heated intraperitoneal chemotherapy (HIPEC). Temperature measurement was performed simultaneously with DeRoyal nasopharyngeal and rectal temperature probes. After allowing five minutes for stabilization, temperatures were recorded at 15 minute intervals until emergence from anesthesia. Data analyzed using descriptive and inferential statistics.

RESULTS: There was a strong correlation between rectal and NP temperature measurements at all temperatures < 37° C (Graph). When temperatures exceeded 37° C, there were significant differences between measurements, with higher core temperatures reported with rectal measurements. This may have been the result of selective warming of the rectal temperature probe due to its proximity to the heated intraperitoneal fluid. No complications such as bleeding or nasal irritation were observed.

DISCUSSION: Based on the results of this pilot study it appears that temperature measurements made with the DeRoyal NP probe correlate well with rectal core temperatures less than 37° C, prior to the intraperitoneal instillation of heated chemotherapeutic agents. HIPEC causes a mismatch between intraabdominal and NP temperature readings. The DeRoyal NP probe appears to be a viable option for the accurate measurement of core temperature. Further evaluation is warranted.

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Image 1

**S-222.****INSERTION OF PROSEAL™ LMA AT PRONE POSITION CAN SHORTEN THE TIME FROM ANESTHETIC INDUCTION TO INCISION**

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AFFILIATION: Tokyo Women's Medical University Medical Center East, Tokyo, Japan

INTRODUCTION: Induction of anesthesia and insertion of a laryngeal mask airway (LMA) after prone positioning for minor surgery was reported by Ng A¹ et al. in 2002. Since then, this method has been applied for minor surgery such as dorsal lipoma and some lumbar surgeries. An advantage of this method is that patients, especially obese ones, take the prone position by themselves while consciously checking for their own discomfort, which might contribute to shortening of the stay in the operating room (OR).²

No report describes a comparison of the time needed for ordinary intubation at a supine position with that for insertion of ProSeal™ LMA (PLMA) in a prone position. This study compares the two methods to clarify whether the induction and insertion of PLMA in a prone position can reduce the time from patient arrival of the OR to skin incision and the time for anesthetic induction to skin incision compared with the time necessary for ordinary intubation in a supine position.

METHODS: We enrolled 30, ASA physical status 1-2 patients from whom IRB and written informed consent had been obtained prior. They were scheduled for elective plastic surgery in a prone position for less than 2 hr. Patients were assigned into one of two groups randomly using envelope method: Control and PLMA groups. Control group patients were induced by propofol 2 mg/kg, fentanyl 50-100 µg, and vecuronium bromide 0.1 mg/kg intravenously with intubation in a supine position. Subsequently, staff moved them to a prone position. The PLMA group patients took a prone position by themselves and were induced by fentanyl 50-100 µg and propofol 2 mg/kg; then PLMAs were inserted. We evaluated the time from arrival of the OR to incision (T1), the time from anesthetic induction to incision (T2), and hemodynamic changes of each group. For analyses, Student's t-test was used for group data; p<0.05 was inferred as significant.

RESULTS: T1 was 43.1±9.8 min for the Control group and 30.6±9.3 min for the PLMA group (p=0.002). T2 data were, respectively, 38.3±10.9 min and 23.3±8.5 min (p=0.0003). No significant difference in hemodynamic change was found between the two groups.

DISCUSSION: The time from the arrival of the OR to incision, and the time from the anesthetic induction to incision were shorter by 15 and 17.5 min using of PLMA insertion for a prone position than for ordinary intubation in a supine position. Consequently, this methodology can facilitate efficient turnover in the OR when patients can take a prone position.

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S-223.**DIGITAL REGIONAL NERVE BLOCK AND ACCURACY OF
NON-INVASIVE HEMOGLOBIN MONITOR**

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Introduction: Blood hemoglobin levels (Hb) can be continuously monitored by noninvasive spectrophotometric sensors (Masimo SpHb). While this sensor often correlates well with invasively obtained blood samples analyzed by standard laboratory Co-Oximetry (tHb), SpHb sometimes may not be as accurate as is clinically necessary. (1) Because the accuracy of SpHb is perfusion dependent, we proposed that increasing finger perfusion (PI) by a lidocaine digital nerve block (DNB) would improve the accuracy of SpHb.

Methods: After approval from our Committee on Human Research and written patient consent, 16 adult patients received general anesthesia for spine surgery and received a DNB (1% lidocaine) of one finger. Initial SpHb - tHb measurements were determined before surgical incision and approximately every hour thereafter. Primary outcomes were based on differences between SpHb - tHb. These patients were compared to a group of patients (N=20) previously studied who did not undergo DNB. (1) The SpHb - tHb difference was defined as "very accurate" if it was < 0.5 gm/dl, "accurate" if it was between 0.5 - 1.5 gm/dl and "inaccurate" if the difference was > 2.0 gm/dl. PI was also identified for both groups of patients.

Results: Data consisted of 46 paired measurements of SpHb - tHb which were compared to the 78 measurements in our previous study. (1) Overall, 48% of the SpHb - tHb measurements were very accurate in the DNB patients as compared to 24% of the patients without a DNB. (Table, p=0.01) Before surgical incision, the SpHb - tHb differences were initially inaccurate 25% of the time in both groups of patients. Subsequently, only 7% of the measurements (N=32) in DNB patients versus 20% of those (N=58) in the patients without a DNB (1) had SpHb - tHb measurements which were inaccurate. In patients with a DNB, 50% were very accurate as compared to only 26% in patients without a DNB. (1) (Table, p=0.02) The PI was both higher and less variable in the patients with a DNB.

Discussion: A DNB significantly increased the number of measurements that were very accurate (ie. SpHb - tHb < 0.5 gm/dl) and decreased measurements which were inaccurate (ie. SpHb - tHb > 2.0 gm/dl). (Table) Presumably the DNB increased blood flow to the finger as evidenced by the improved PI. We conclude that a DNB or alternative method for increasing finger blood flow (eg. topical vasodilator or hand warming) would increase the accuracy of SpHb during critical times (eg. blood loss) in the perioperative period.

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of hemoglobin monitoring in patients undergoing spine surgery. *Anesth Analg* (In Press)

S-224.**USE OF SIMULATION METHOD FOR EVALUATION OF EXPERIMENTAL AUDIBLE ALARMS IN ANESTHESIA MONITORING****AUTHORS:** C. Bennett, R. McNeer**AFFILIATION:** University of Miami Miller School of Medicine, Miami, FL

INTRODUCTION: Audible alarms for anesthesia monitoring in the intraoperative environment have come under recent scrutiny due to the inefficacies of current alarm strategies.¹ Audible alarms are of particular concern, because a majority of alarm-related medical error results in brain injury or death, carrying a median claim of nearly \$500,000.² Alarm guidelines have been recommended by several organizations, including the IEC³ as well as a multi-organizational panel consisting of members from APSF, ASA, and AANA. Here, the authors present a simulation methodology for the evaluation of novel audible alarm sonification strategies.

METHODS: The simulation method involves a custom software package that was designed to work without the need to modify existing monitoring equipment. Instead, this method reads streaming physiological data (e.g., heart rate or SpO₂), and presents an alternate auditory display for human factors evaluation. The software incorporates two modular components: serial parsing (to extract and read patient information) and the auditory display. Serial communication depends on the protocol specific to each audible alarm device. Several free serial comm programs exist^{4,5}

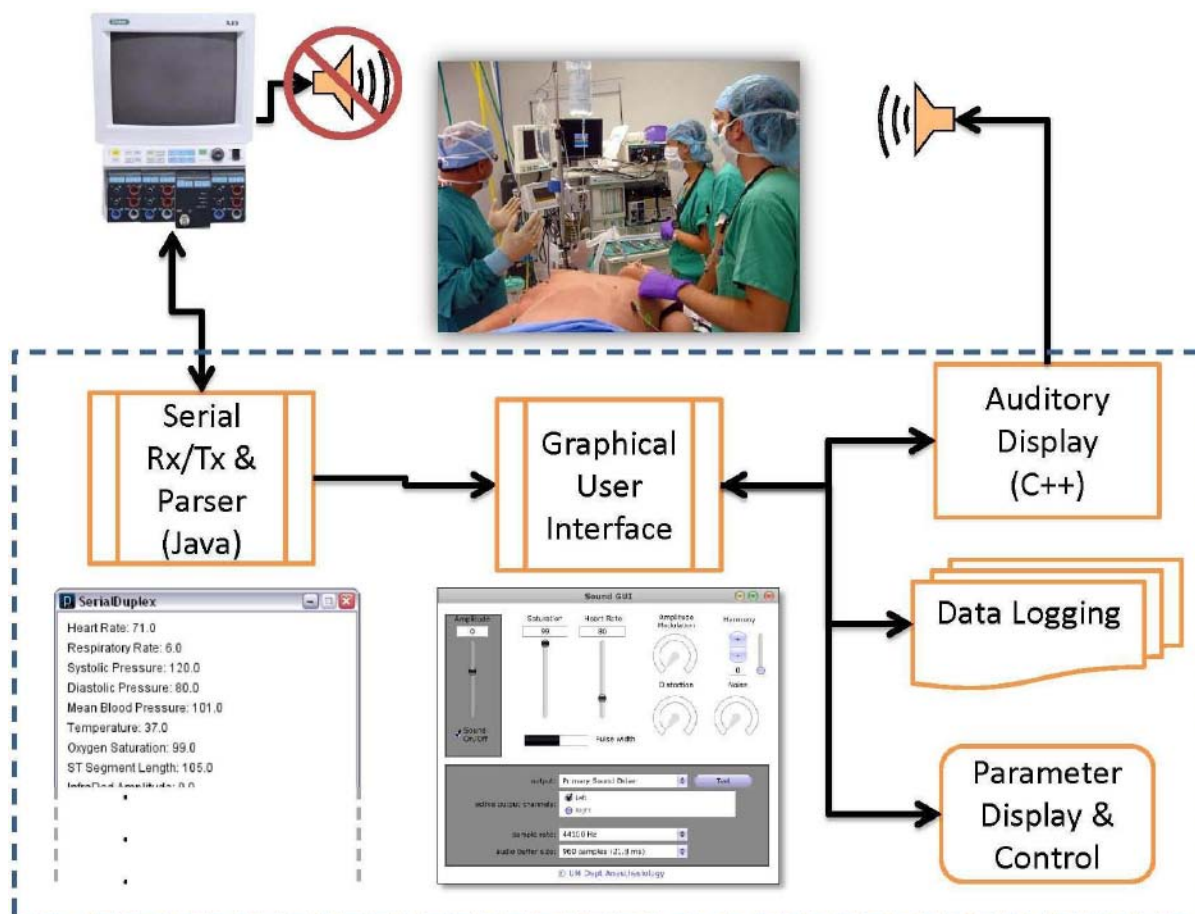
however a custom Java application was developed for this study. The continuous auditory display (CAD) component was written in C++ using JUCE libraries. The CAD was designed with parametric thresholds and corresponding medium- or high-urgency alarms. Furthermore, several auditory dimensions were included; e.g., amplitude modulation, frequency modulation, noise generation, harmonic components, waveshaping, and pulse width modulation. Each of these acoustic dimensions was mapped to patient events. One such example is the annunciation of a noise generator to the pulse-oximeter CAD when a ventilation threshold (e.g., respiratory rate) is breached.

RESULTS: The system was successfully interfaced with a Datex AS/3 during a simulation scenario, with equipment alarms bypassed and experimental alarms made audible.

DISCUSSION: This methodology is ideal for human patient simulation and for the validation of a novel audible alarm scheme. This software package allows for several audible alarms to be quickly and interchangeably evaluated. Furthermore, the sessions (including patient and alarm status) can be logged for future inspection.

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A block diagram of the hardware and software configuration is shown. The alarms of the equipment were silenced, and the auditory display presented novel alarms for validation in simulation environments.

S-225.**AISYS® ANESTHESIA WORKSTATION: WASHOUT TIME FOR TRACE ANESTHETIC GASES****AUTHORS:** A. Fernandez, T. Kim**AFFILIATION:** Johns Hopkins University, Baltimore, MD

INTRODUCTION: The United States Malignant Hyperthermia Association has guidelines for purging anesthesia machines based on early models. The Datex Ohmeda Aisys® anesthesia workstation, newer generation machine, includes; electronic vaporizer system and advanced breathing system (ABS); conveys gases from the common gas outlet to the patient. Presently, no guidelines exist for purging newer anesthesia machines of trace gas.

METHODS: Aisys anesthesia workstation using the Aladin cassette vaporizer (Datex-Ohmeda, Madison, Wisconsin) was tested for trace anesthetic gases. The anesthesia machine ventilator was set for volume control mode: Vt 500 ml, RR 10 bpm, I:E 1:2 and PEEP 5 cmH₂O with fresh gas flow (FGF) of oxygen at 3 lpm, while ventilating a 2 L rebreathing bag for each trial. The anesthesia machine was primed with the following gas concentrations on three separate occasions: desflurane 7% and 1.2%, sevoflurane 2.5% and isoflurane 1.2%. After the two hour priming period, the vaporizer and ABS was removed and a t-piece placed onto the common gas outlet. The ventilator settings remained the same, the oxygen fresh gas flow rate was increased to 15 lpm. Anesthetic gas measurements were taken with an InfraRan Specific Gas Analyzer (Wilks Enterprises, Inc., Norwalk, Ct.) using a sampling wand attached to the t-piece intermittently aspirating gas samples at 60 second intervals until the gas concentration fell below 5 ppm.

RESULTS: Trace gas below 4 ppm was attained after 17 min and 16 min when Aisys workstation was primed with 7% and 1.2% desflurane. Sevoflurane and isoflurane recorded the quickest times to 4 ppm with 7 and 8 minutes, respectively.

DISCUSSION: To eliminate a potential anesthetic gas source, the ABS was removed and trace gas measurements sampled at the common gas outlet. Although least soluble, and less likely to be retained by machine components, desflurane had the the slowest washout times. Equivalent washout times for desflurane at 7% and 1.2% eliminated the agent's high vapor pressure as a possible cause. Further research is necessary to elucidate this finding. Finally, the safe gas concentration 5 ppm is arbitrary. In the methods, trace gas was sampled until concentrations reached 4 ppm, since the gas analyzer was accurate within ± 1 ppm. This study was designed to determine the elimination of anesthetic agent from the breathing system after disconnecting the agent and initiating high fresh gas flows. New guidelines on purging volatile gases for the Aisys® anesthesia machine can be extrapolated from this data improving safety for MH-susceptible patients.

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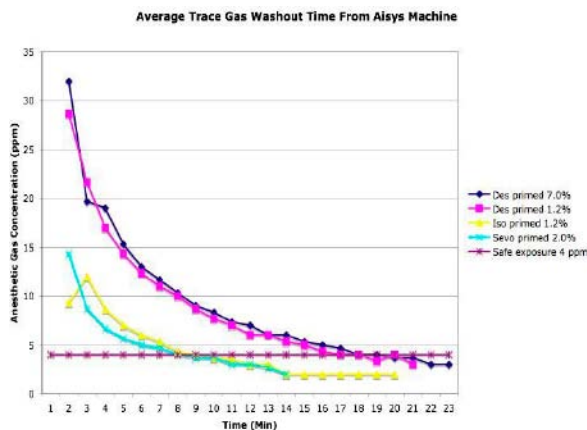


Figure 1: The Aisys anesthesia was primed three times either with Desflurane, Sevoflurane or Isoflurane at the indicated concentrations. This graph represents the average wash out time in minutes for each anesthetic agent studied. 4 ppm is below the level of accepted safe trace anesthetic gas exposure (5 ppm).

S-226.**DISPARATE MOTION-RESISTANT PULSE OXIMETRY SPO₂ AND PULSE RATE PARAMETERS IN AN AWAKE, UN-SEDATED NEONATE****AUTHORS:** E. Du1,² G. V. Goresky,^{1,2}**AFFILIATION:** 1University of British Columbia, Vancouver, BC, Canada; 2British Columbia Children's Hospital, Vancouver, BC, Canada

INTRODUCTION: A case of ECG and saturation monitor SpO₂-pulse rate disparity is presented. Intravenous atropine was administered, possibly unnecessarily, before ECG readings indicated a true heart rate at three times the displayed pulse rate. This artifact in measurement was a previously unrecognized failure of motion-resistant pulse oximetry.

METHODS: N/A

Challenging Case Report (only complete if your submission falls into the "Challenging Case Report" category. If you select the "Challenging Case Report" category on the next step, this section must be completed.): An 11-day-old female patient with a history of bilateral cleft lip/palate presented to the dental operating room for a cleft palate oral impression procedure. The patient was otherwise healthy. In the operating room, motion-resistant pulse oximetry (Masimo Radical-7 Pulse CO-Oximeter, Masimo Corporation, Irvine, CA) indicated a pulse rate in the 150 to 215 BPM range and SpO₂ in the mid-90% range. Correspondingly, the patient appeared pink and saturated. The first oral impression was taken with the patient awake and un-sedated. During this procedure, the agitated patient appeared bradycardic (pulse rate in the 40 to 90 BPM range, SpO₂ in the mid-80% range). A patient plethysmographic waveform with good shape was present. Because of the bradycardia, an IV was placed and atropine (0.1 mg) was administered to the patient for suspected vagal bradycardia. The pulse oximeter sensor was readjusted and a patient plethysmographic waveform with good shape was again found to be present. When the bradycardia did not improve, yet the patient remained pink and SpO₂ remained in the mid-90% range, ECG leads were placed. A disparity was found between the pulse oximeter pulse rate (40 to 100 BPM range) and the ECG heart rate (200 to 230 BPM range), with SpO₂ values in the 90-100% range (Figs. 1 and 2). A second oral impression procedure was commenced and completed successfully. The patient was closely followed and found to be pink and feeding well when examined one hour later.

Results: N/A

DISCUSSION: Masimo's Rainbow Signal Extraction Technology (SET) was developed to enable their pulse oximeters to be motion tolerant.¹ Although rare, instances of accurate SpO₂ and inaccurate pulse rate extraction do occur with Rainbow SET pulse oximeters when excessive patient motion is present. It may, therefore, be good clinical practice to supplement motion-resistant pulse oximetry measurements with ECG readings or frequent heart auscultations while monitoring patients during neonatal cleft palate oral impression procedures, when patients are awake and un-sedated. The additional source of heart rate information would help clinicians ascertain the accuracy of pulse oximetry measurements and may reduce the occurrence of unwarranted drug administration.

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1. Radical-7 Signal Extraction Pulse CO-Oximeter with Rainbow Technology Operator's Manual. Irvine, CA: Masimo Corporation, 2008

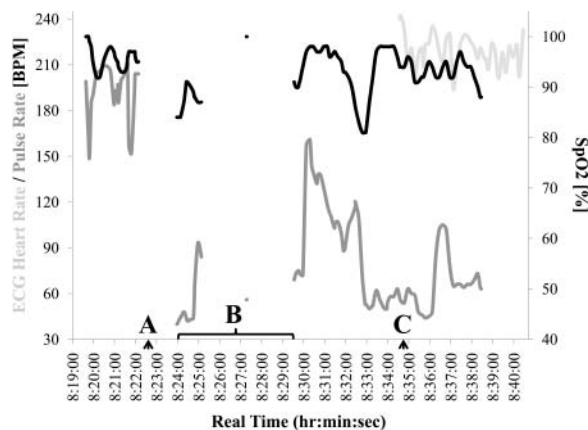


Figure 1. Patient's recorded heart rate, pulse rate, and arterial oxygen saturation (SpO₂) trends. Time point A: Patient is preoxygenated and the first oral impression attempt is commenced. Time period B: Patient develops what appears to be bradycardia on the anesthesia monitor (Datex-Ohmeda S/5, GE Healthcare, Helsinki, Finland). Patient's pulse oximeter sensor is repositioned. An IV is placed and atropine (0.1 mg) is administered. Time point C: ECG leads are placed on the patient, revealing a disparity between ECG heart rate and displayed pulse rate. SpO₂ values mimic the ECG heart rate. The second and final oral impression procedure is commenced shortly.



Figure 2. Datex-Ohmeda anesthesia monitor at approximately 0838 hours, photographed using an available iPhone (iPhone 4, Apple Inc., Cupertino, CA). Disparity between the ECG heart rate of 219 BPM and the pulse rate of 73 BPM (latter value received by the Datex-Ohmeda anesthesia monitor from the Masimo Radical-7) can be seen. SpO₂ value, although lower than values during the time period immediately prior, mimics the ECG heart rate.

S-227.**THE COLLECTION RATE OF SEVOFLURANE FROM WASTE ANESTHETIC GASES BY USING ANESCLEAN, THE SYSTEM FOR TREATING WASTE ANESTHETIC GASES****AUTHORS:** J. Ota, K. Nishikawa, S. Saito**AFFILIATION:** Department of Anesthesiology, Gunma University Graduate School of Medicine, Maebashi, Japan

INTRODUCTION: Volatile anesthetic gases used for patients are currently discharged into the atmosphere without being processed. However, waste anesthetic gases should be ideally treated before disposal in terms of the protection of the global environment. The system for treating waste anesthetic gases, Anesclean, has been developed recently. This system can collect sevoflurane from waste anesthetic gases, and then decompose nitrous oxide (N₂O) into N₂ and O₂ immediately. The purpose of this study was to evaluate the efficacy of this treating system, Anesclean, on the collection rate of sevoflurane in our university hospital.

METHODS: In 2007, three equipments of Anesclean were introduced in our new operating rooms to treat waste anesthetic gases. All waste anesthetic gases from operating rooms are collected into an adsorbent cylinder, where sevoflurane is adsorbed and removed. The remaining gas is passed into a catalytic reactor, where nitrous oxide is decomposed into nitrogen and oxygen. Because adsorbed sevoflurane is desorbed and collected as a liquid form, we can measure the amount of sevoflurane collected. The total amount of sevoflurane consumed in the past three years (2007-2010) was also measured to calculate the removal rate of sevoflurane.

RESULTS: The amount of sevoflurane consumed in our university hospital was 310 l in 2007, 303 l in 2008, and 314 l in 2009. The amount of sevoflurane collected was 118 l in 2007, 127 l in 2008, and 160 l in 2009. Thus, calculated collection rate was 38%, 42%, and 51 %, respectively. These data show that approximately 50 % of sevoflurane used is actually collected and removed before disposal into the atmosphere in our current situation.

DISCUSSION: The waste anesthetic gas treating system, Anesclean, was effective to collect sevoflurane in our operating rooms. Given that volatile anesthetic recovery rate by Anesclean is more than 99.5%; our data suggest that there is considerable gas leakage before collecting waste anesthetic gases. In addition, it has been reported that approximately 5% of sevoflurane absorbed is biotransformed 1). In order to improve the collection rate of sevoflurane, we need to pay more attention to minimize gas leakage during anesthetic procedure.

REFERENCES:

1. Anesthesiology 82:1369-1378, 1995

S-228.**WITHDRAWN.**

S-229.**ABILITY OF THIRD GENERATION VIGILEO-FLOTRAC TO MEASURE CHANGES IN CARDIAC OUTPUT INDUCED BY PHENYLEPHRINE, EPHEDRINE, AND INCREASED PRELOAD: A COMPARISON STUDY WITH ESOPHAGEAL DOPPLER**

AUTHORS: L. Meng,¹ B. S. Alexander,¹ N. P. Tran,² K. Laning,² Z. Kain,¹ M. Cannesson¹

AFFILIATION: ¹Department of Anesthesiology & Perioperative Care, University of California, Irvine Medical Center, Orange, CA; ²University of California, Irvine School of Medicine, Irvine, CA

INTRODUCTION: Cardiac output (CO) monitoring based on pulse contour analysis (Vigileo-FloTrac) has the potential to be used for goal directed fluid therapy in the perioperative setting. However, factors such as vasopressor usage may impact Vigileo-FloTrac's reliability in tracking CO changes. Our main aim was to test the 3rd generation Vigileo-FloTrac system's ability to accurately measure the changes in CO induced by pressor administration and increased preload in comparison with esophageal Doppler measurements.

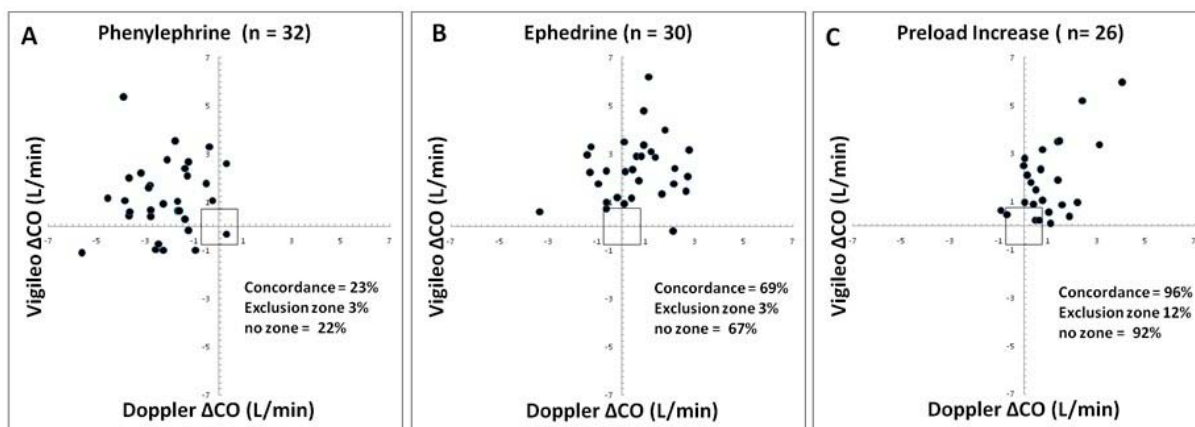
METHODS: In 33 anesthetized patients, CO was monitored simultaneously by Vigileo-FloTrac (COFT) and esophageal Doppler (COED). Hemodynamic challenges included: phenylephrine (to increase vasomotor tone), ephedrine (to increase myocardial contractility and heart rate), and whole body tilting (to increase preload). Measurements were performed before and after each intervention.

RESULTS: Overall, 176 pairs of CO measurements were obtained. The mean COED was 5.4 ± 1.9 L/min, and the mean COFT was 5.3 ± 1.9 L/min ($p=0.37$). The agreement between COED and COFT was 0.14 ± 2.13 L/min while the mean percent error was 66%. The trending ability of COFT versus COED was 23% (concordance) after phenylephrine treatment, 69% (concordance) after ephedrine treatment, and 96% (concordance) after whole body tilting.

DISCUSSION: The 3rd generation Vigileo-FloTrac tracks CO well after preload changes. However, it tracks phenylephrine-induced CO change poorly and ephedrine-induced CO change marginally. The overall agreement between the absolute values measured by Vigileo-FloTrac and esophageal Doppler is poor.

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S-230.**THE USE OF A NOVEL PULSATILE CEREBROSPINAL FLUID MODEL TO ASSESS PRESSURE MANOMETRY AND FLUID SAMPLING THROUGH SPINAL NEEDLES: SUPPORT FOR THE USE OF A 22G SPINAL NEEDLE WITH A TAPERED 27G TIP**

AUTHORS: Y. Ginosar,¹ Y. Ginosar,² J. Lovett,² Y. Smith,¹ T. Ben-Hur,¹ E. M. Davidson¹

AFFILIATION: ¹Hadassah Hebrew University Medical Center, Jerusalem, Israel; ²High school summer project, Jerusalem, Israel

INTRODUCTION: Despite increased incidence of PDPH,¹ 22G needles are routinely used for lumbar puncture because of shorter CSF pressure equilibration times and CSF sampling times. We used a novel pulsatile CSF model to assess these variables for different spinal needles and compared them with a tapered spinal needle with a 22G shaft and a 27G tip (22/27G; Temena Polymedic, Carriere-sur-Seine, France).

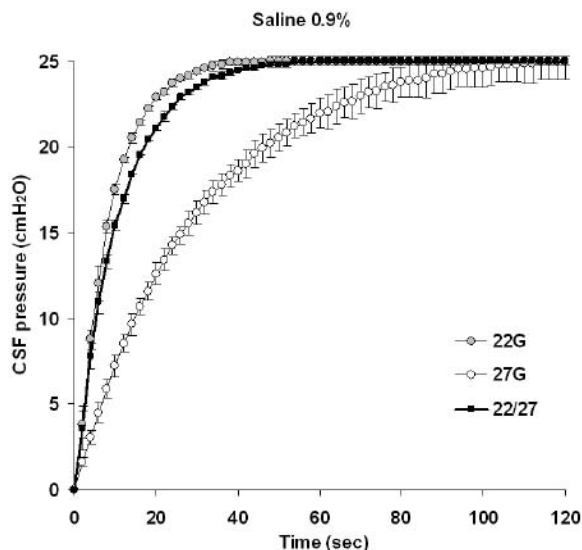
METHODS: A fluid bag was inflated to create a pulsatile fluid reservoir with a pressure of 25/15 cmH₂O. We tested 18G, 20G, 22G, 24G, 25G 26G, 27G and 22/27G spinal needles, which were inserted into the sampling port. CSF pressure was measured every 2 seconds for 120 seconds by manometry. Saline 0.9% and mannitol 20% were tested separately. The time to produce a 1ml CSF sample was measured. All measures were made in triplicate.

RESULTS: CSF pressure equilibration time (sec) was 40.7 ± 6.4 , 108.7 ± 6.1 and 51.3 ± 4.6 for the 22G, 27G and 22/27G needles. 22G vs 27G and 22/27G vs 27G $p < 0.0001$; 22G vs 22/27G not significant (1-way ANOVA with Bonferroni). CSF sampling time (sec) was 40.3 ± 3.1 , 225.3 ± 10.0 , and 63.0 ± 5.2 for the 22G, 27G and 22/27G needles. 22G vs 27G and 22/27G vs 27G $p < 0.0001$; 22G vs 22/27G not significant (1-way ANOVA with Bonferroni). Saline was different from mannitol for both measurements and all needles ($p < 0.0001$) (1-way ANOVA).

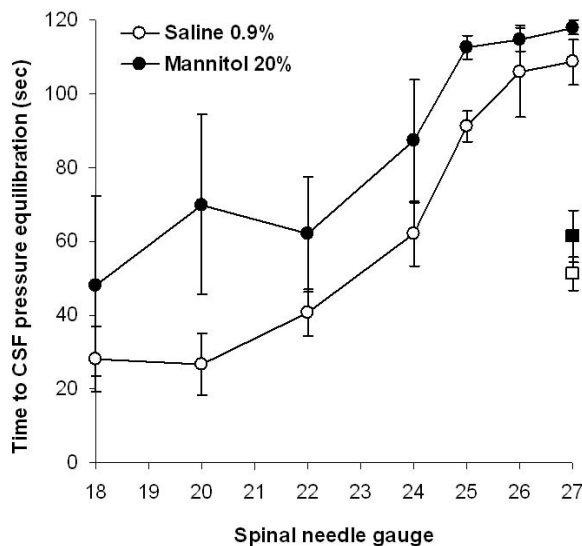
DISCUSSION: A 22/27G tapered spinal needle has similar flow properties to the 22G needle but the 27G tip avoids the unacceptably high incidence of PDPH.

REFERENCES:

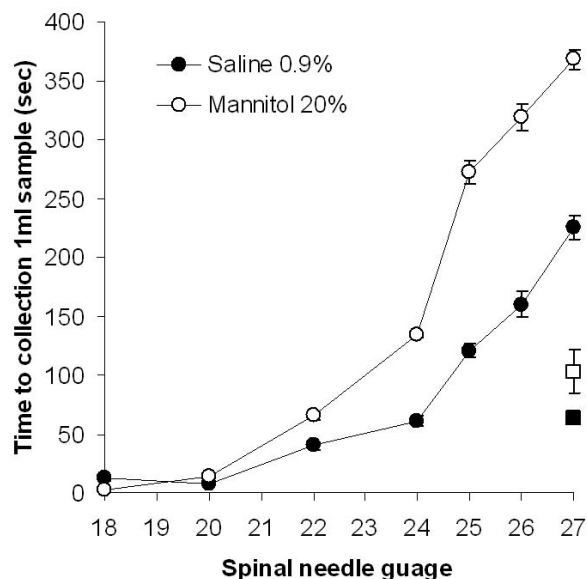
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Measured CSF pressure over time for saline 0.9%. 22G and the 22/27G needles were not significantly different from each other, but both were significantly different from the 27G needle ($p < 0.0001$ RM-ANOVA).



Time to final equilibrated CSF pressure for a range of spinal needles. The equilibration time increased with increasing needle size and with increasing fluid viscosity. The square symbols represent the 22/27G spinal needle, with a 27G tip and 22G shaft; CSF pressure equilibration times through this needle were not different from the traditional 22G spinal needle.



Time to collect 1ml CSF sample for a range of spinal needles. The sample collection time increased with increasing needle size and with increasing fluid viscosity. The square symbols represent the 22/27G spinal needle, with a 27G tip and 22G shaft; CSF sample collection times through this needle were not different from the traditional 22G spinal needle.

S-231.**OPTIMAL SAMPLING FREQUENCY OF PULSE OXYGEN SATURATION (SpO₂) IN ANESTHETIZED PATIENTS DURING SURGERY****AUTHORS:** A. Rao,¹ J. P. Henneman,¹ J. M. Ehrenfeld²**AFFILIATION:** ¹Massachusetts General Hospital, Boston, MA;²Vanderbilt University Medical Center, Nashville, TN

INTRODUCTION: Pulse oximetry (SpO₂) is a sensitive noninvasive method to determine arterial hemoglobin saturation. Detection of transient desaturations depends on sampling frequency (SF) of the SpO₂ measuring device which, however, differs between manufacturers. Generally, the higher the SF, the greater the likelihood of detecting an instance of desaturation and vice-versa. We aimed to identify an appropriate tradeoff between SF and the risk for not detecting instances of desaturation for patients undergoing elective surgery.

METHODS: Following IRB approval, SpO₂ data, sampled every 2s using fingertip probes, were obtained from 82 adult patients undergoing elective surgery using the Masimo Rainbow Radical 7 Signal Extraction Pulse CO-Oximeter (Masimo Corp., Irvine, CA). The effect of reducing the SF was studied by successively subsampling offline data. By methodically skipping intervening SpO₂ values, resultant data sets appear to have an SF of 4s, 6s and so on up to 60s. For each patient, 30 subsampled data sets were analyzed as follows

1. Each instance of SpO₂<100 was considered "information"
2. Net "information" per available data point was plotted as a function of the SF.
3. Number of instances where SpO₂<90% was calculated for each SF.
4. Duration of SpO₂<90% was calculated.

Challenging Case Report (only complete if your submission falls into the "Challenging Case Report" category. If you select the "Challenging Case Report" category on the next step, this section must be completed.): NA

RESULTS: Of the 82 patients, 62 (75.6%) had no desaturation event and 22 (24.4%) experienced at least 1 instance of desaturation ranging from 2s to 134s in the original unreconstructed data (Figure 1). As expected, upon subsampling, there was a decay in observed number of hypoxemic events with decreasing SF. The 'information' decay profiles from 4 patients with hypoxemic events suggests that the trade-off inflection point corresponds to an SF of 10s (Figure 2).

DISCUSSION: By artificially lowering the SF, fewer instances of hypoxemia are recognized. An SF of 10s strikes a balance between missing instances of hypoxemia and constraints of hardware due to oversampling. Notably, SpO₂ devices such as Anesthesia Information Management Systems (AIMS) sample every 30s - adequate for an electronic chart, but too low to detect intraoperative events. While the relevance of momentary desaturations is yet to be understood, clinicians need to be aware of the SF of SpO₂ devices to avoid ambiguity make a valid inference.

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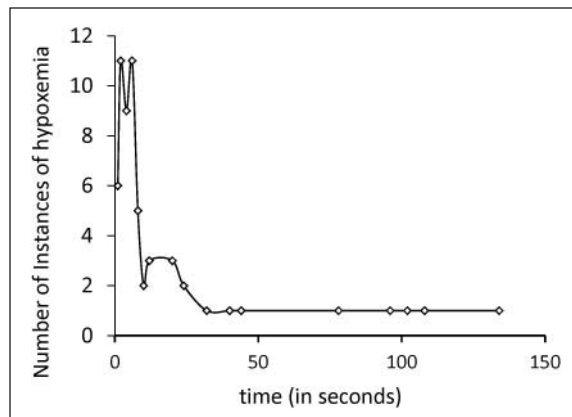


Figure 1: Duration of hypoxemia and the frequency of occurrence in 20 patients undergoing elective surgery. Most desaturation events lasted for shorter lengths of time < 1 minute

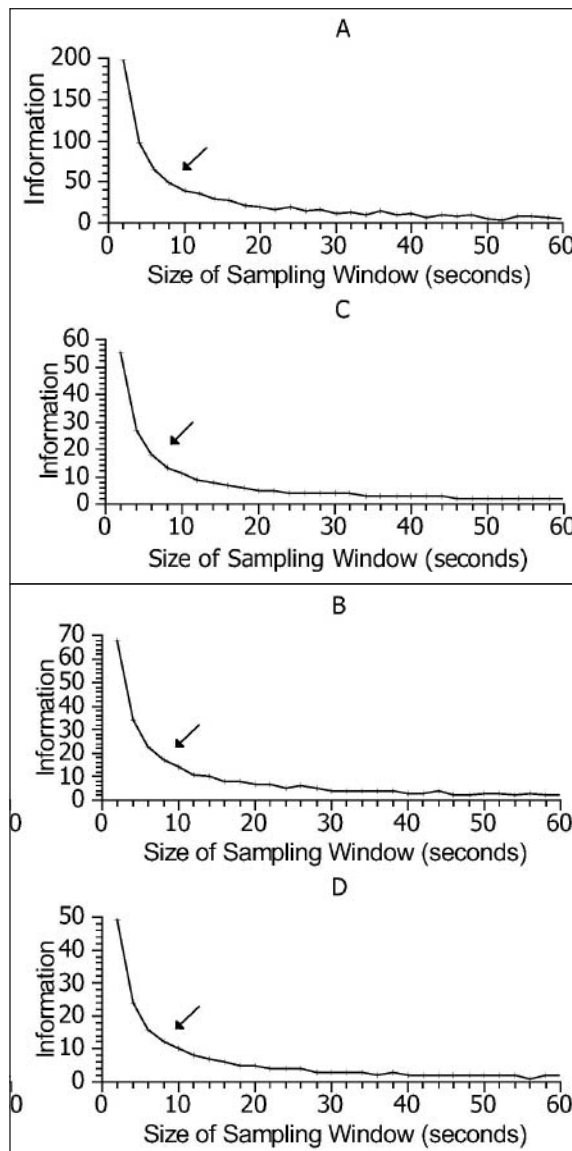


Figure 2: Data for 4 patients shows 'information' is lost as the SF is decreased with a trade-off indicated (arrow) around 10 seconds

S-232.**MINIMUM VOLUME LOADING TEST TO EVALUATE HYDRATION IN PATIENTS****AUTHORS:** A. Andrijauskas,¹ C. Svensen,² J. Ivaskevicius¹**AFFILIATION:** ¹Vilnius University Clinic of Anaesthesiology and Intensive Care, Vilnius, Lithuania; ²Department of Clinical Science and Education, Karolinska Institutet/Södersjukhuset, Section of Anaesthesiology and Intensive Care, Stockholm, Sweden**INTRODUCTION:** Evaluation of perioperative hydration status is important and challenging. Minimum Volume Loading Test (mVLT) for evaluation of body hydration is a development of the Volume Loading Test VLT.¹ Crystalloid fluid challenges are given and hemodilution is evaluated by a mathematical model (Bolus Induced Response of Deviations mathematics, BIRD-math). The aim is to discriminate between presumably dehydrated preoperatively and euhydrated postoperatively patients.**METHODS:** After approval by the Ethic Committee, 12 total knee arthroplasty (TKA) patients were included in observational study (TAB.1). They were presumably dehydrated after overnight fast preoperatively, and euhydrated after postoperative 24 hrs in ICU. All subjects went through 2 mVLTs (FIG.1). Invasive arterial and venous hemoglobins, also noninvasive total hemoglobin (SpHb™, Radical 7, Masimo, USA) were recorded (FIG.2). Hemodilution and its deviations were evaluated by BIRD-math (FIG.3). Deviations of dilution (BIRDs) between peak and acute residual checkpoints (PRD), also between residual and baseline (RBD) were put into BIRD-trends. They were compared to standardized trends (matrix BIRD-trends, BIRD-matrix) aiming to determine the corresponding hydration shifts that allow the definition of preexisting status (FIG.4). Statistical analysis was performed to determine difference between arterial, venous and capillary BIRD-trends (TAB.2).**RESULTS:** Based on arterial and venous dilution, mVLT confirmed relative preoperative dehydration and postoperative normohydration since the same volume load induced shift to opthydration preoperatively, and maxihydration postoperatively. Thus, inter-day difference of BIRDs after 3rd fluid challenge was significant ($p<0,014$) with no difference of variances ($p<0,716$).**DISCUSSION:** Different preexisting hydration was determined from arterial and venous dilution. Capillary trends were not sufficient enough. Probably capillary Hb is too much affected by the high-rate transcapillary fluid shifts. Also, even 1 min averaging time for SpHb can thus be too long, and important shifts may be missed. Nevertheless, dynamics of capillary plasmadilution is an attractive measure since it may provide clues to changes of transcapillary filtration-absorption ratio. Interpretation of such data may probably provide information about the hydration of perfused site or even the whole body. The project was partly supported by a grant from European Society of Anaesthesiology (2009).**REFERENCES:**

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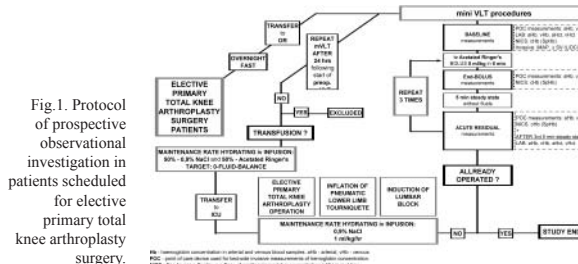
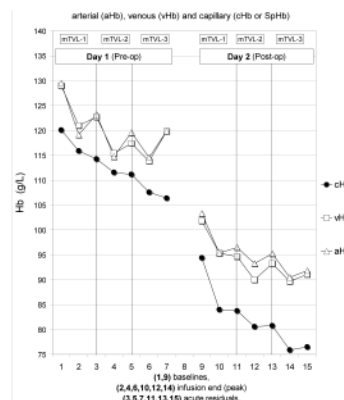


Fig.1. Protocol of prospective observational investigation in patients scheduled for elective primary total knee arthroplasty surgery.

Fig.2. Arterial (aHb), venous (vHb) and capillary (cHb or SpHb®) hemoglobin concentration trends of TKA patients during three mini test volume loads (mTVL): at baseline before each infusion, at the end of bolus (peak) and following 5 min steady state (acute residual). A perfect hydration plateau specific pattern of close-to-equal consecutive acute residual Hb values is seen only in 3rd preoperative test fluid challenge (mVLT step) and only in arterial trend (see enframed part of the trend).



BIRD-matrix trends (RBD and PRD)

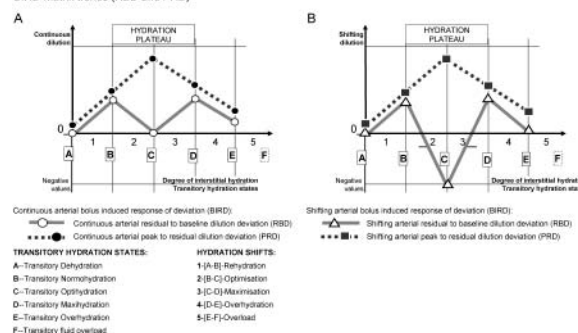


Fig.4 A-B. Identification of preexisting hydration status and mVLT induced hydration shifts. The BIRD-matrix trends are used for identification of hydration shifts by determining the corresponding parts of the BIRD-matrix and actual plasmadilution derived BIRD-trends. Hydration states reached by test fluid loads during mVLT are transitory since 5 min steady state after the fluid load is too short for complete intercompartment fluid equilibration. Maintenance infusion can transform transitory hydration state into permanent. A. Matrix trends of continuous residual to baseline deviation of dilution (RBD), and peak to residual deviation (PRD). B. Matrix trends of shifting RBD and PRD.

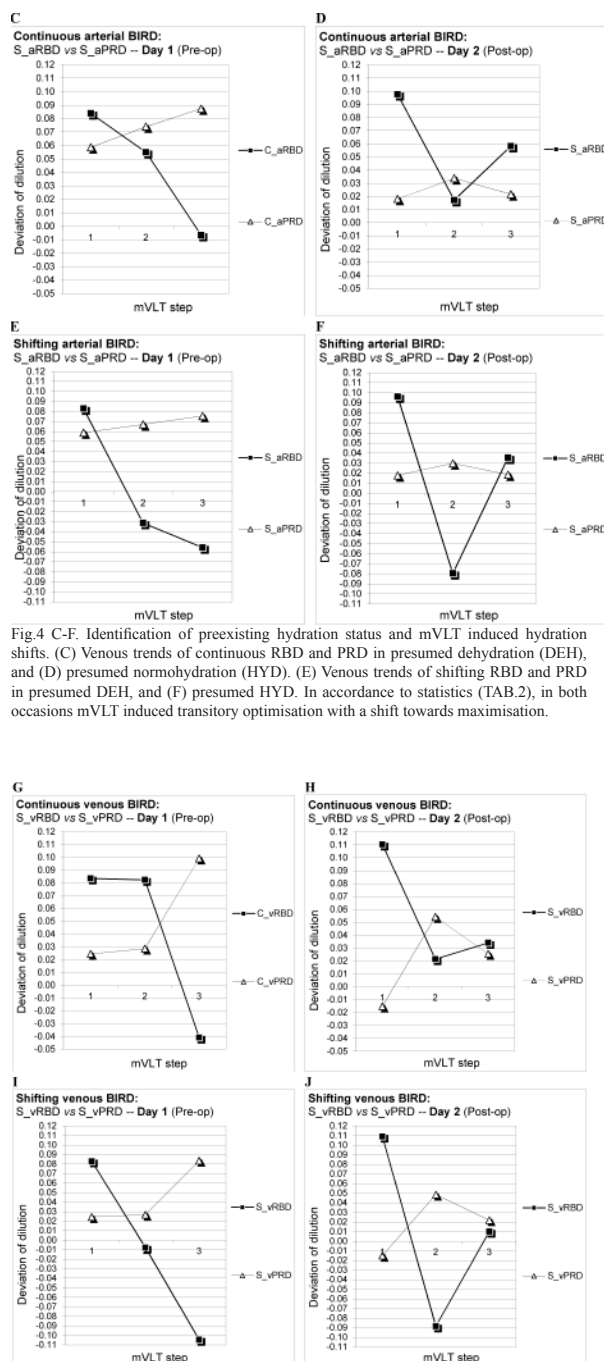


Fig.4 C-F. Identification of preexisting hydration status and mVLT induced hydration shifts. (C) Venous trends of continuous RBD and PRD in presumed dehydration (DEH), and (D) presumed normohydration (HYD). (E) Venous trends of shifting RBD and PRD in presumed DEH, and (F) presumed HYD. In accordance to statistics (TAB.2), in both occasions mVLT induced transitory optimisation with a shift towards maximisation.

Fig.4 G-H. Identification of preexisting hydration status and mVLT induced hydration shifts. (G) Venous continuous RBD and PRD on Day 1, and (H) Day 2. (I) Venous shifting RBD and PRD on Day 1, and (J) Day 2. As a summary, in accordance to statistics (TAB.2), mVLT induced transitory preoperative optimization and postoperative maximization of hydration.

S-233.

ACOUSTIC RHINOMETRY AND SNIFF TEST FOR NASAL PATENCY EVALUATION IN PATIENTS WITH MANDIBULAR FRACTURE

AUTHORS: M. Benbassat, A. Azad, D. Arnaudov, J. Hardy, D. Raphael

AFFILIATION: University of Southern California, Los Angeles, CA

INTRODUCTION: In patients with a mandibular fracture, nasotracheal intubation (NTI) may be needed, and a decision must be made as to which naris should be selected. A commonly performed test is the qualitative sniff test. Acoustic rhinometry (AR) allows the quantification of the area of the nasal passage at different depths into the cavity. In this pilot study, we sought to determine the prognostic value of the sniff test and the AR test in predicting easy air passage.

METHODS: This pilot study was approved by the USC+LAC IRB. Twenty seven ASA I-III patients (25 males, 2 females) of mean age 34 (range 19-72) with various mandibular fractures were studied. Descriptive statistics (mean \pm standard deviation) were obtained for height (172 \pm 8 cm) and weight (73 \pm 14 kg). Both nares were studied via sniff and AR tests. For the sniff test, the patient occluded one naris and breathed through the other, and then did so vice versa. The patient was asked through which naris air flowed easier. AR profiles were generated with a single-microphone rhinometer, with use of a calibrated nosepiece attached to the AR device. The AR area-distance profile allowed calculation of the minimum cross-sectional area (MCA-1) at the anterior nasal valve and that for the middle turbinate (MCA-2). The nares with the larger MCA-1 were chosen for nasotracheal intubation.

RESULTS: The sniff test correctly predicted the nares in 93 % of cases (25 out of 27). For 96 % of all AR cases (26 out of 27), the naris with the larger MCA-1 was evident, and was selected for intubation. One interpretive error occurred in a patient who claimed no nasal side preference. In another case, examination of the AR profile revealed a reversal at MCA-2, that is, the nares on the opposite showed a value significantly greater than the original MCA-1, which altered the choice of chosen nares.

DISCUSSION: Acoustic rhinometry, as well as the simple and fast sniff test, have prognostic value in determining the site for nasotracheal intubation and especially for fiberoptic intubation. In the bedside setting, the patient's statement as to naris preference should be accorded careful attention.

ACKNOWLEDGMENT: We acknowledge the loan of a single-microphone reflectometer from Sleep Group Solutions.

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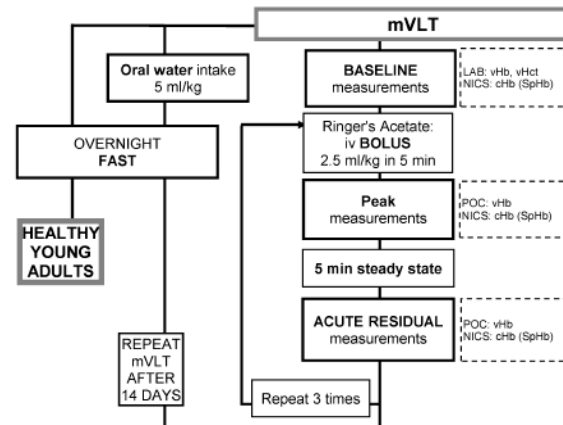
Acoustic rhinometry: recommendations for technical specifications and standard operating procedures, *Rhinology Suppl* 16:3-17; Dec 2000

Acoustic rhinometry in the evaluation of nasal obstruction, *The Laryngoscope*, V 105, Issue 3: 275-281,1995

Rhinologic diagnosis and treatment, Ch 6: 128-141, 1997

S-234.**MINIMUM VOLUME LOADING TEST TO EVALUATE HYDRATION IN HEALTHY VOLUNTEERS****AUTHORS:** A. Andrijauskas,¹ C. Svensen,² J. Ivaskevicius¹**AFFILIATION:** ¹Vilnius University Clinic of Anaesthesiology and Intensive Care, Vilnius, Lithuania; ²Department of Clinical Science and Education, Karolinska Institutet/Södersjukhuset, Section of Anaesthesiology and Intensive Care, Stockholm, Sweden**INTRODUCTION:** Evaluation of hydration status remains challenging. Minimum Volume Loading Test (mVLT) for evaluation of body hydration is a development of the Volume Loading Test VLT.¹ Crystalloid challenges are given and hemodilution is evaluated by a mathematical model (Bolus Induced Response of Deviations mathematics, BIRD-math). The aim is to discriminate between presumably dehydrated and euhydrated healthy volunteers.**METHODS:** After approval by the Ethic Committee, 12 healthy volunteers were, after informed consent was given, randomized for a crossover study. They were presumably dehydrated after an overnight fast before mVLT in one experiment, and euhydrated after drinking 5 ml/kg of water after an overnight fast in another. Subjects went through 2 mVLTs (FIG.1). Invasive venous hemoglobin and noninvasive total hemoglobin (SpHb™, Radical 7, Masimo, USA) were recorded (FIG.2). Hemodilution and its deviations were evaluated by BIRD-math (FIG.3). Deviations of dilution (BIRDS) between peak and acute residual checkpoints (PRD), also between residual and baseline (RBD) were put into BIRD-trends. They were compared to standardized trends (matrix BIRD-trends, BIRD-matrix) aiming to determine the corresponding hydration shifts that allow definition of preexisting status (FIG.4). That required statistical analysis to determine the differences between BIRDS (TAB.2).**RESULTS:** The mVLT failed to identify difference between baseline hydration of volunteers since normohydration was determined in both groups. Also, mVLT induced a similar shift of hydration since differences of BIRDS' means ($p < 0.682$) and variances ($p < 0.759$) were not significant between experiments. There were also no differences of vHb means ($p < 0.88$) and variances ($p < 0.342$). Capillary BIRD-trends were not informative.**DISCUSSION:** Similar preexisting hydration of volunteers was determined in both occasions based on venous dilution. Failure to identify the presumed difference may be due to physiologic hydration reserve that compensated deficit induced by fasting. Also, arterial rather than venous plasmahydration is a reflection of the whole-body hydration.² Aside from minor lack of statistical significance, capillary BIRDS showed reasonable potential to discriminate between dehydrated and hydrated (FIG.5).**REFERENCES:**

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vHb - invasively obtained venous haemoglobin concentration.

vHct - invasively obtained venous hematocrit.

cHb - non-invasively obtained capillary total haemoglobin (SpHb).

LAB - laboratory analysis of vHb and vHct.

POC - invasive point of care Hb measurement (HemoCue, Sweden).

NICS - Non-Invasive Continuous Scan of capillary total Hb (Radical 7, Masimo, USA).

Fig.1. Protocol of the prospective randomized crossover volunteer study.

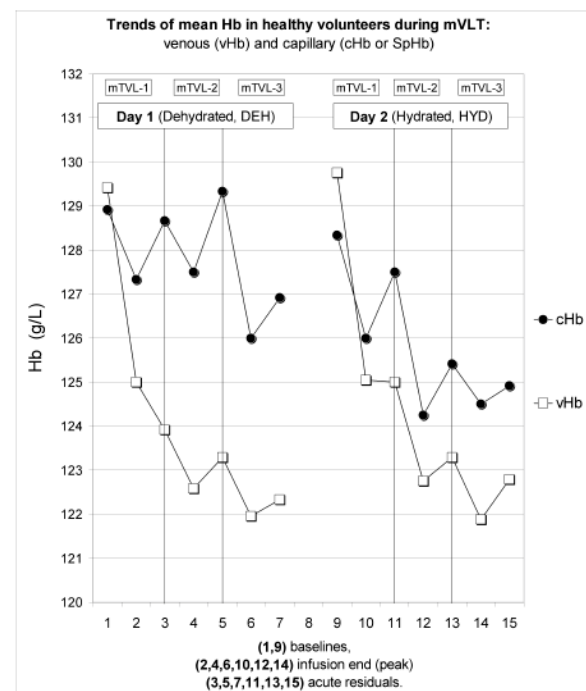


Fig.2. Venous (vHb) and capillary (cHb or SpHb®) hemoglobin concentration trends of healthy volunteers during three mini test volume loads (mTVL): at baseline before each infusion, at the end of bolus (peak) and following 5 min steady state (acute residual).

BIRD-matrix trends (RBD and PRD)

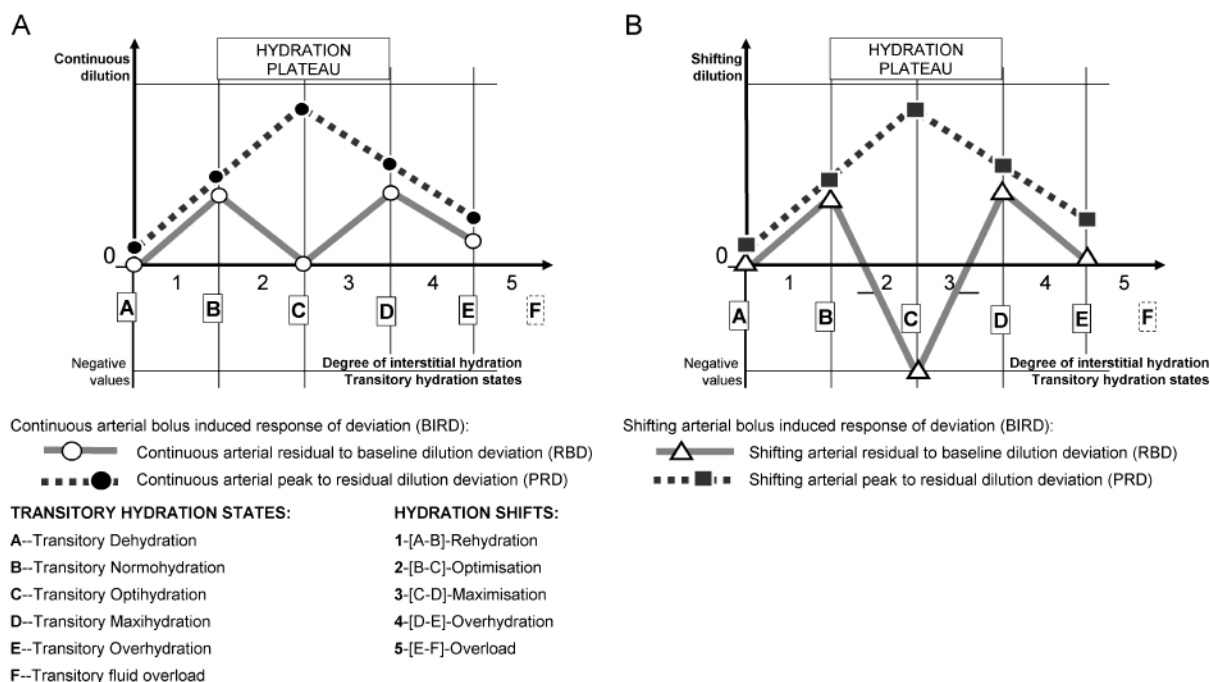


Fig.4. Identification of preexisting hydration status and mVLT induced hydration shifts. The BIRD-matrix trends are used for identification of hydration shifts by determining the corresponding parts of the BIRD-matrix and actual plasmodilution derived BIRD-trends. Hydration states reached by test fluid loads during mVLT are transitory since 5 min steady state after the fluid load is too short for complete intercompartment fluid equilibration. Maintenance infusion can transform transitory hydration state into permanent. A. Matrix trends of continuous residual to baseline deviation of dilution (RBD), and peak to residual deviation (PRD). B. Matrix trends of shifting RBD and PRD.

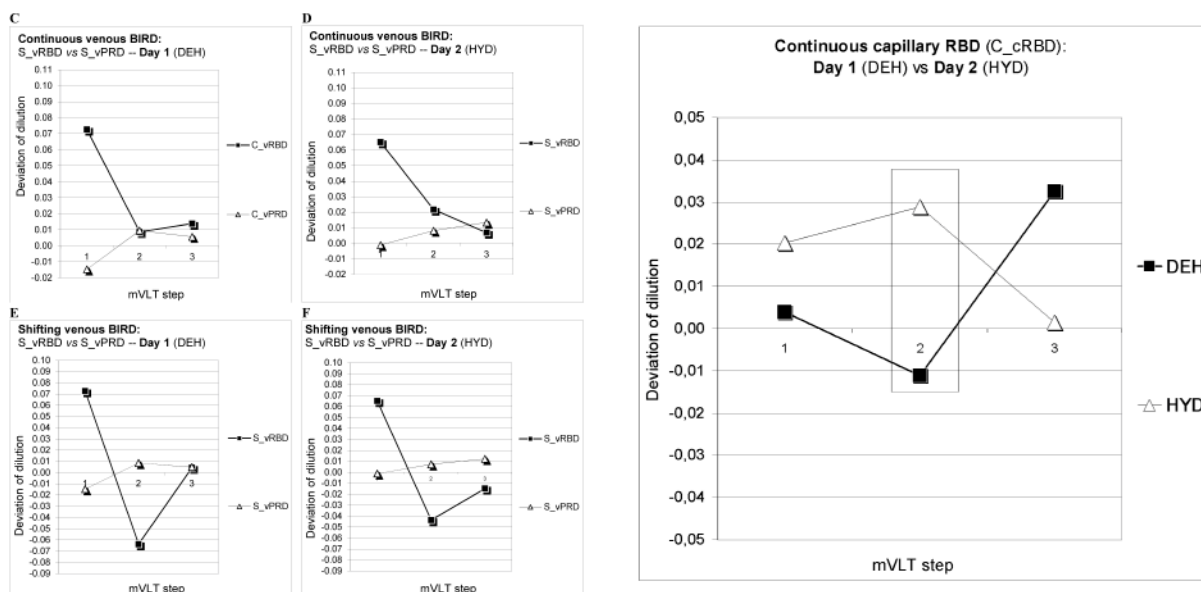


Fig.4 C-F. Identification of preexisting hydration status and mVLT induced hydration shifts. (C) Venous trends of continuous RBD and PRD in presumed dehydration (DEH), and (D) presumed normohydration (HYD). (E) Venous trends of shifting RBD and PRD in presumed DEH, and (F) presumed HYD. In accordance to statistics (TAB.2), in both occasions mVLT induced transitory optimisation with a shift towards maximisation.

Fig.5. Continuous capillary BIRDS in healthy volunteers (means): dehydrated (DEH), hydrated (HYD). Shift from checkpoint 1 to 2 was positive in HYD, and negative in DEH, and difference of residual to baseline deviation of dilution (RBD) and its variance were close to significant ($p < 0.085$ and $p < 0.764$, accordingly). The RBD turning into negative shows capillary hemoconcentration during second fluid challenge (mVLT step) with an increase of filtration-absorption ratio. Thus, aside of minor lack of statistical significance, capillary RBD shows potential to discriminate between HYD and DEH volunteers while venous RBD trends failed. Continuous noninvasive total hemoglobin (SpHb™) was recorded with a device (Radical 7, Masimo, USA) set to "short" (1 min) averaging time and "arterial" mode.

S-235.**NONIN EQUANOX 8004CA ADVANCE CEREBRAL OXIMETER SENSOR PROVIDES VALID ASSESSMENT OF TRUE TISSUE OXYGEN SATURATION****AUTHORS:** D. MacLeod, K. Ikeda**AFFILIATION:** Duke University Medical Center, Durham, NC

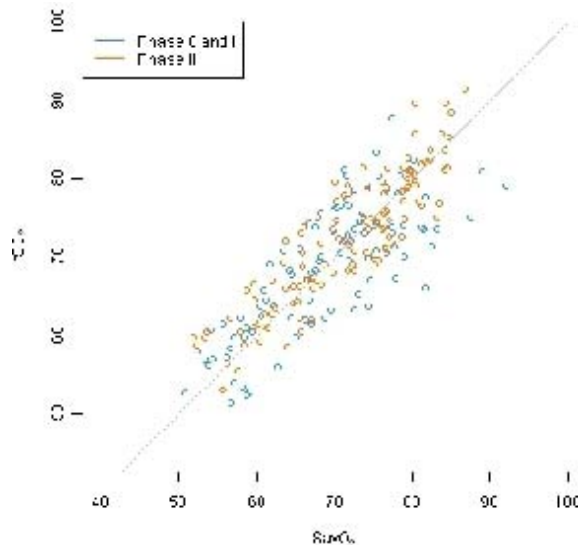
INTRODUCTION: Near infra-red spectroscopy (NIRS) regional oximeters have been developed to noninvasively estimate cerebral tissue oxygen saturation (rSO_2). Cerebral oxygen saturation represents the oxygen level within brain tissue and is a composite value based on the relative proportions of arterial and venous blood within brain tissue. Nonin has developed a regional oximeter technology (Equanox) with dual emitter and dual detector sensor architecture to eliminate the influence of variations in non-cerebral tissue (eg:scalp). The aim of this study was to calibrate and validate a new four wavelength Equanox cerebral oximeter sensor.

METHODS: Healthy adult ASA 1 volunteers were enrolled into the study. An internal jugular venous bulb catheter and a radial artery catheter were placed. Equanox cerebral sensors were placed bilaterally on the forehead and a pulse oximeter was placed on the ear. NIRS-derived rSO_2 and pulse oximeter saturation (SpO_2) were recorded continuously at 1Hz. Hypoxia was induced and managed via a dedicated facemask and breathing apparatus (Respiract, Thornhill Research, Toronto) and monitor continuous end-tidal CO_2 and O_2 . Subjects underwent two standardized breath-down protocols in sequence: (1) decrease of SpO_2 in approximately 5% increments from 100 to 70% and (2) decrease of SpO_2 in single step from 100 to 70%. Each incremental stage was maintained for 6 minutes to establish steady-state end-tidal CO_2 and O_2 tensions during which a single jugular bulb blood sample and two arterial blood samples were drawn simultaneously. Co-oximetry was used to determine the jugular venous saturation ($SjvO_2$) and arterial saturation (SaO_2). The arterial samples were averaged to provide one SaO_2 value per plateau. The arteriovenous ($SavO_2$) saturation was then calculated as a 70:30 ratio of venous to arterial blood: $SavO_2 = [0.70 \times SjvO_2] + [0.30 \times SaO_2]$

Accuracy was determined by ARMS, a common statistic for oximetry devices to estimate the agreement between the test device and an accepted reference value (rSO_2 vs $SavO_2$), using the data derived from the validation phase. A predetermined ARMS value of 5% was set as the criterion for accuracy.

RESULTS: 24 subjects completed the study (calibration=13; validation=11). Readings were obtained in all subjects and no subjects were excluded from the analysis. Absolute accuracy of rSO_2 compared to calculated $SavO_2$ as measured by ARMS was 4.1% [figure1].

DISCUSSION: This study confirms that Nonin's cerebral oximeter with Equanox technology and 8004CA sensor provides an accurate measure of the calculated cerebral tissue oxygen saturation during deliberate oxygen desaturation in healthy volunteers.

REFERENCES: NA

S-236.**THE INCIDENCE AND SEVERITY OF RESPIRATORY COMPROMISE IN POSTCARDIAC SURGERY PATIENTS IN THE FIRST 24 HOURS FOLLOWING DISCHARGE FROM ICU**

AUTHORS: S. Pai, M. Ramsay, E. E. Lagow, L. Jennings, B. Leeper

AFFILIATION: Baylor University Medical Center, Dallas, TX

INTRODUCTION: This prospective observational study is designed to investigate the incidence and severity of respiratory insufficiency in post cardiac surgery patients in the first 24 hours after discharge from the ICU. This study was instigated because of a 15% early ICU readmission rate with the main diagnosis of respiratory failure. If the patients at risk could be identified by better monitoring, perhaps an earlier intervention could prevent the return to ICU.

METHODS: 26 patients were attached to a TOSCA® 500 (Radiometer Copenhagen, Basel, Switzerland) by a low pressure ear probe for continuous monitoring of transcutaneous carbon dioxide, oxygen saturation, and pulse rate. The TcPCO₂ from the TOSCA correlates well with Paco₂ from invasive ABG results.¹⁻² Hypercarbia was classified as mild (TcPCO₂ 40-49), moderate (TcPCO₂ 50-59), and severe (TcPCO₂ ≥60).

RESULTS: The TcPCO₂ sensor was functional for a mean of 74% of the study time. The SpO₂ sensor was functional for a mean of 93% of the time.

The total time duration of TcPCO₂ ≥60 mmHg was 22.5 ± 30.2 (mean ± SD) min, ranging from 0.1 to 94.1 min with a median of 11.2 min. The total time duration of TcPCO₂ 50-59 mmHg was 92.8 ± 96.7 min, ranging from 0.1 to 337.3 min with a median of 67.0 min.

The total time duration of SpO₂ <80% was 37.9 ± 36.3 min, ranging from 0.5 to 116.7 min with a median of 23.5 min.

The total time duration of pulse rate > 120 beats/min was 10.69 ± 20.3 min, ranging from 0.1 to 78.0 min with a median of 3.1 min. 46% of these tachycardic patients had history of atrial fibrillation.

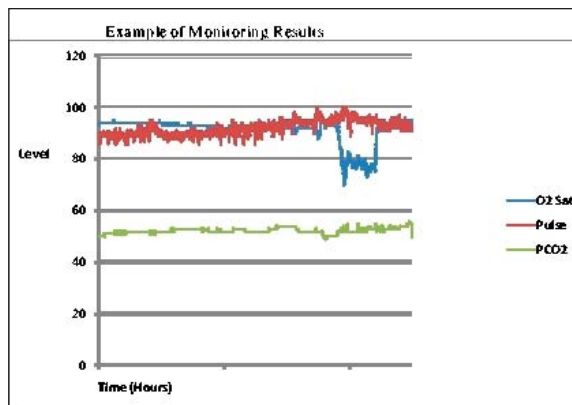
26% of the patients experienced all 3 symptoms of severe hypercarbia, hypoxia, and tachycardia in the first 24 hours after discharge from the ICU. Of the patients with severe parameters, 71% had history of COPD or obstructive sleep apnea. 3.8% of the 26 patients returned to ICU due to respiratory failure.

DISCUSSION: The incidence and severity of hypercarbia, hypoxia, and tachycardia in post cardiac surgery patients during the first 24 hours after ICU discharge was found to be high in this study. Monitoring TcPCO₂, SpO₂, and pulse rate provides an early identification of severe respiratory depression. This will lead to an earlier intervention that will prevent the return to ICU. This will be particularly important for patients with history of pulmonary diseases as it is recognized that COPD and OSA increase postoperative pulmonary complications and ICU stay.

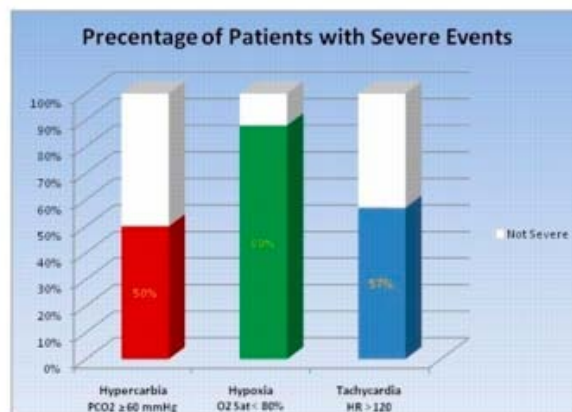
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J Clin Monit Comput. 2004;18:343-345



Transient Episode of Severe Hypoxia with Hypercarbia



S-237.**EXAMINATION OF THE EFFECT THAT FLULUBIPROFENAXCETYL USING THE MULTIPLATE PLATELET FUNCTION ANALYZER EFFECTS ON PLATELET AGGREGATION****AUTHOR:** S. Yuka**AFFILIATION:** Prefectural Hiroshima Hospital, Hiroshima-City, Japan

INTRODUCTION: Flulubiprofenaxcetyl is one of non-steroidal anti-inflammatory drugs (NSAIDs), and is often used for postoperative analgesia. However one of NSAIDs (aspirin) effects on hematological coagulation. We investigated the influence of flulubiprofenaxcetyl effect on platelet aggregation using Multiplate platelet function analyzer (Dynabyte GmbH). Multiplate allows for fast and sensitive detection using whole blood. The reagents induced platelet activation are Arachidone acid in ASPttest, and ADP in ADPttest. Platelet aggregation was measured Area Under the curve (AUC) of the platelet aggregation curve.

METHODS: Platelet aggregation were measured 13 adult patients undergoing general anesthesia. During surgery, flulubiprofenaxcetyl (50mg) was administered intravenous for a minute, and took blood as control after induction of general anesthesia and 30 minutes after the dosage.

Challenging Case Report (only complete if your submission falls into the "Challenging Case Report" category. If you select the "Challenging Case Report" category on the next step, this section must be completed.): N/A

RESULTS: The result of age was 62.9 ± 15.4 years, height was 157.9 ± 8.61 cm, body weight was 60.6 ± 17.7 kg. Control AUC in ADPttest was 591.6 ± 478.2 , ASPttest was 662.7 ± 334.3 . AUC 30 minute after dosage ADPttest was 416.6 ± 187.5 , ASPttest was 55.1 ± 54.9 . The platelet aggregation ability in ASPttest was significantly suppressed (Wilcoxon's signed rank sum test $p=0.0017$).

DISCUSSION: In ASPttest, multiplate is highly sensitive for the detection of aspirin with cyclooxygenase pathway. Platelet aggregation activity was specifically restrained by COX-1 inhibitor of the flulubiprofenaxcetyl. Our results suggest that flulubiprofenaxcetyl daily use effect on platelet aggregation and may cause perioperative bleeding.

REFERENCES: N/A

S-238.**USE OF CAPSULE TECHNOLOGY'S NEURON® TO INTERFACE WIRELESSLY TO THE EPIC™ ELECTRONIC ANESTHESIA RECORDS****AUTHORS:** A. Marian, F. Scamman, M. Todd**AFFILIATION:** University of Iowa Hospitals & Clinics, Iowa City, IA

INTRODUCTION: The Department of Anesthesia at the University of Iowa Hospitals recently went live with the Epic Electronic Anesthesia Records. For the interface between the anesthesia physiologic monitor and the anesthesia machine and Epic, we chose the Neuron, a relatively new product from Capsule. After extensive testing for the fixed locations, we hardwired the Neuron into our Ethernet backbone. Having many satellite locations where hard-wiring was impractical or impossible, we used the wireless feature of the Neuron to provide connectivity

METHODS: After verifying that the wireless strength (WiFi) in all of the satellite locations was satisfactory, we installed the Neuron on 4 roaming anesthesia machines. For our Epic workstations, we use a Dell Latitude laptop as the CPU with a slaved touch screen monitor and slide pad keyboard mounted on an articulated arm on the right-hand side of the machine. In the satellite locations, the Dell also operates wirelessly. The Neuron uses a digital interface module to identify the device it is connected to. All the electrical mains connections- machine, laptop, anesthesia machine, Neuron, and touch screen come to a common power strip. On arrival at a new location, the provider plugs the power strip into an electrical outlet and then turns on the Neuron and the laptop. To initiate electronic record keeping, the provider opens the Epic application, selects the patient, launches the intraoperative module and starts data collection. The provider enters drugs and events as necessary.

In more detail, we use the General Electric S/5 monitor and ADU anesthesia machine. The output of these is RS-232. The Neuron translates these data streams into TCP/IP and sends them over the hospital Ethernet backbone to the Capsule server. This server then translates the data streams to HL-7 and sends them through the Cloverleaf data switch to Epic. To ensure accuracy in patient data flow, Epic contains a look-up table that links the ID of the laptop with the ID of the Neuron.

RESULTS: Wireless transmission of physiological data from Anesthesia machines and S5 monitors to EPIC was successfully achieved with the use of Neurons in our satellite locations. Since going live, this wireless system has performed flawlessly

DISCUSSION: Anesthesiologists provide clinical service in multiple fixed and mobile locations in the current healthcare system. Wireless transfer of physiological data from patient monitors to electronic records will be the norm in future. We demonstrate the successful use of modern devices with wireless capability in optimal patient care and clinical documentation

REFERENCES: N/A

S-240.**COMPARISON OF STROKE VOLUME VARIATION OBTAINED FROM AN ARTERIAL PRESSURE TO ENDOTRACHEAL SENSOR SYSTEM**

AUTHORS: J. E. Bairamian, J. E. Rook, M. E. Allard, S. Brauer, R. L. Applegate

AFFILIATION: Department of Anesthesiology, Loma Linda University School of Medicine, Loma Linda, CA

INTRODUCTION: Stroke volume variation (SVV) can be used to assess fluid responsiveness based on changes in venous return induced by mechanical ventilation which thus alter left ventricular stroke volume, pulse pressure and cardiac output. This effect is greater in hypovolemia, thus SVV >12% during abdominal surgery is a reliable threshold value for predicting an increase in stroke volume index in response to fluid. A number of devices is available for use during anesthesia care. Several authors have published results indicating improved perioperative outcome when fluid administration is guided by SVV derived from an arterial pressure based cardiac output system. This study was designed to assess the correspondence of SVV determined by an arterial pressure based system (FloTrac, Edwards Lifesciences, Irvine, CA; A) to that determined by an endotracheal tube sensor system (ECOM, Conmed, Utica, NY; E).

METHODS: IRB approved prospective convenience sample data collection study in consenting adult patients undergoing scheduled major abdominal or pelvic surgery. Surgery was considered major if

expected blood loss was at least 15% of the patient's estimated blood volume. Exclusion criteria included coagulopathy, existing cardiac arrhythmia and significant renal or hepatic dysfunction. Data for SVV and cardiac output (CO) from each device was collected and analyzed at one-minute intervals for agreement of measurements and changes in measurements. Statistical analysis was done with $p < 0.05$ considered significant using JMP 8.0.2.

RESULTS: Data for the first 120 minutes of surgery following surgical incision from 15 patients was analyzed. Table 1 provides descriptive statistics. Transfused volume averaged over one liter in these surgical procedures. Figures 1 represents analysis for data across the entire range of SVV. As shown, there is a wide range of E compared to paired A values, with fair agreement ($r = 0.73$). The agreement between monitors does not appear to be better in the SVV ranges of <5% ($r = 0.31$), 6-12% ($r = 0.39$), or >12% ($r = 0.54$) when compared to the entire SVV range.

DISCUSSION: This preliminary analysis indicates potentially acceptable agreement of SVV between these technologies. However, further analysis is ongoing to determine if results obtained from clinical studies based on SVV determined by A can be used to guide clinical decisions when monitoring SVV by E.

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Anesthesiology 2005; 103: 419-428.
Crit Care 2010; 14: R18.
Intensive Care Med 2010; 36: 1327-1332.

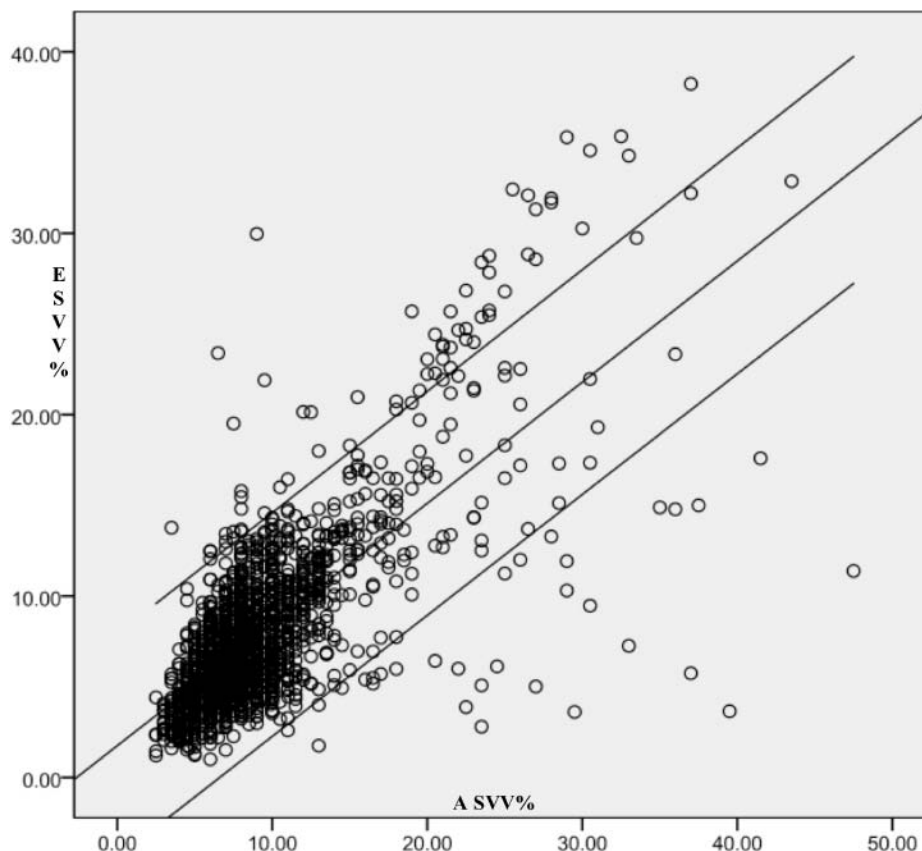


Figure 1: Comparison of paired SVV measurements from arterial pressure (A) and endotracheal sensor (E) based monitoring systems

Geriatric Anesthesia

S-241.**A COMPARISON OF VARIABILITY OF RECOVERY FROM NEUROMUSCULAR BLOCKAGE OF CISATRACURIUM VS. ROCURONIUM IN ELDERLY PATIENTS****AUTHORS:** Y. E. Jaller, C. M. Santacruz**AFFILIATION:** Fundación Cardioinfantil, Bogotá, Colombia

INTRODUCTION: Residual neuromuscular weakness in the post anesthetic care unit (PACU) secondary to neuromuscular blocking drugs (NBDs) is common and may contribute to morbidity in patients recovering from general anesthesia.¹ The physiological changes that occur with aging have significant effects on the pharmacokinetics of NBDs and may increase the risk of residual relaxation in elderly patients.² In this population residual paralysis can be avoided by using NBDs that exhibit a more predictable recovery pattern.³ The objective of this study is to compare the variability in duration of action and clinical recovery after rocuronium or cisatracurium in elderly patients.

METHODS: Following IRB approval and written informed consent, 64 patients over 65 years with normal renal and liver function were enrolled in this prospective, randomized, double-blind study. Anesthesia was induced with etomidate and maintained with sevoflurane and remifentanyl. Cisatracurium 0.15 mg/kg or rocuronium 0.6mg/kg were administered after induction. Neuromuscular blockade was monitored using acceleromyography (TOF-Watch SX[®] Organon, Dublin; Ireland). Onset time, clinical duration of action (return of T1 twitch height to 25% of control) and time to recovery (time from start of injection of NMBA until T4/T1 ratio of 0.8 and 0.9) were assessed. Levene test for equality of variances and coefficient of variation test were used as appropriate. $P < 0.05$ was considered significant.

RESULTS: Demographic characteristics were similar between the groups. Rocuronium had a significantly lower onset time and duration of action compared to Cisatracurium (Table 1). Greater variability was seen for the duration of action and recovery from neuromuscular blockade with rocuronium (Figure 1).

DISCUSSION: The variability in offset is significantly lower in elderly patients receiving cisatracurium compared to rocuronium. This effect may be of particular clinical interest in reducing the incidence of residual paralysis in the PACU or intensive care unit.

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S-242.**HUMAN CSF ALZHEIMER AND INFLAMMATORY BIOMARKERS AFTER ANESTHESIA AND SURGERY****AUTHORS:** J. X. Tang, D. Baranov, M. Hammond, L. M. Shaw, M. F. Eckenhoff, R. G. Eckenhoff**AFFILIATION:** University of Pennsylvania School of Medicine, Philadelphia, PA

INTRODUCTION: The prevalence of post-operative cognitive disturbances in the elderly, coupled with a growing body of in vitro, cell and animal evidence suggesting anesthetic effects on Alzheimer-like pathways,¹ call for study of Alzheimer neuropathology and dementia after anesthesia and surgery. The smoldering neuroinflammatory progression of Alzheimer disease (AD) and improved biomarkers suggests the latter be deployed to help establish credibility of an interaction.

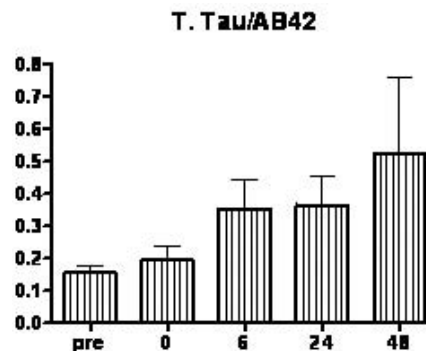
METHODS: Eleven patients scheduled for endoscopic surgery to correct idiopathic CSF leaks were enrolled in this IRB approved study. Lumbar subarachnoid catheters were placed immediately prior to the procedure, and "pre-op" samples taken. Anesthetics depended on provider choice. Further samples were taken at the end of the procedure (0 time), and then at 6, 24 and 48 hours later, or until the catheters were removed. Samples were frozen, and then analyzed as a batch with ELISA by the UPenn ADNI laboratory, or with bead-based Luminex assays for cytokines.

RESULTS: Patients were 53 ± 6 years old, 8 women and 3 men. About half the patients received TIVA and half received inhaled anesthetics. The procedures lasted 6.4 ± 2 hrs. Amyloid $\beta 1-42$, ($A\beta 42$) was unchanged, but showed a trend for increase after 24 hrs. Total tau was significantly increased after 6 hours, more than 200% after 24 hrs. Phospho-tau was not altered. S100b, IL-1b, and IL-6 followed a similar course, while no consistent change was observed in IL-10, VEGF, or TNF α . TIVA was only associated with lower post-op IL-6 and higher VEGF levels.

DISCUSSION: The CSF $A\beta 42$:total tau ratio is now used to assist a diagnosis of AD. The figure shows this ratio to be dramatically increased following anesthesia and surgery. In AD, the ratio is driven by lowered $A\beta 42$, but here it is driven by an elevated total tau. This likely reflects a less specific neuronal injury, consistent with the S100b and cytokine analysis. The impact of this significant insult on a vulnerable brain is not yet clear. Few serial CSF studies after an intervention have been conducted, so the time scale for AD-marker progression is unknown.

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Liver/Transplantation

S-243.**EARLY ALLOGRAFT DYSFUNCTION AFTER LIVER TRANSPLANTATION****AUTHORS:** B. Raffel, A. Young, M. Minhaz, J. C. Emond, G. Wagener**AFFILIATION:** Columbia University Medical Center, New York, NY

INTRODUCTION: Early allograft dysfunction (EAD) is a serious complication after liver transplantation that may lead to death or graft failure. There is no uniform definition of EAD and most definitions are based on arbitrarily chosen laboratory values. The goal of this study was to evaluate different postoperative (postOP) laboratory values and assess their ability to predict early graft failure (90-day mortality or reoperation).

METHODS: All liver transplants performed at Columbia University Medical Center from 1998 to 2009 were eligible for inclusion. We excluded pediatric transplants and patients with incomplete records. Peak INR, total bilirubin (tBili), AST, MELD score and nadir serum albumin on postOP days 5, 7 and peak values between days 2 and 7 and between days 2 and 5 were compared. We also compared these with two previously used definitions of EAD: peak tBili > 10 mg/dl between days 2 and 7¹ and either tBili > 10 mg/dl or INR > 1.6 on day 7 or AST or ALT > 2000 on any day between postOP days 2 and 7.²

RESULTS: 654 patients were studied. Peak INR, tBili, AST and MELD at any of the time-points but not nadir serum albumin were predictors of 90-day graft failure (see table 1). MELD on postOP day 5 was the best predictor with an area under the curve of the receiver operator curve = 0.801 (CI 95% = 0.725 to 0.878). Using as the best cutoff = 18.9 (the point on the ROC curve closest to sensitivity = specificity = 1) MELD on postOP day 5 had a sensitivity of 78%, a specificity = 68% and a likelihood ratio = 2.95, better than any the previously used definitions (table 2).

DISCUSSION: MELD score over 18.9 on postOP 5 was better able to predict 90-day mortality or graft failure than previously used definitions that chose arbitrary cut-off values. This study demonstrates that the MELD score is not only useful pre-transplant but also an excellent tool for postoperative risk stratification with very good discriminatory power.

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Table 1: Area under the curves of the receiver operator curves of each definition to predict graft failure (death or re-transplant within 90 days)

| | Area under the curve | p | 95% CI | |
|-------------------|----------------------|---------|--------|-------|
| | | | Lower | Upper |
| INR max day2-5 | 0.734 | < 0.001 | 0.654 | 0.813 |
| INR max day 2-7 | 0.738 | < 0.001 | 0.662 | 0.815 |
| INR max day 5 | 0.778 | < 0.001 | 0.706 | 0.851 |
| INR max day 7 | 0.759 | < 0.001 | 0.677 | 0.84 |
| AST max day2-5 | 0.645 | < 0.005 | 0.555 | 0.735 |
| AST max day 2-7 | 0.663 | < 0.001 | 0.572 | 0.754 |
| AST max day 5 | 0.629 | < 0.005 | 0.534 | 0.725 |
| AST max day 7 | 0.605 | < 0.05 | 0.508 | 0.702 |
| tBili max day2-5 | 0.788 | < 0.001 | 0.717 | 0.859 |
| tBili max day 2-7 | 0.781 | < 0.001 | 0.705 | 0.857 |
| tBili max day 5 | 0.787 | < 0.001 | 0.712 | 0.861 |
| tBili max day 7 | 0.749 | < 0.001 | 0.666 | 0.831 |
| MELD max day2-5 | 0.782 | < 0.001 | 0.702 | 0.862 |
| MELD max day 2-7 | 0.795 | < 0.001 | 0.716 | 0.875 |
| MELD max day 5 | 0.801 | < 0.001 | 0.725 | 0.878 |
| MELD max day 7 | 0.781 | < 0.001 | 0.697 | 0.864 |
| Alb min day2-5 | 0.481 | 0.688 | 0.378 | 0.585 |
| Alb min day 2-7 | 0.472 | 0.55 | 0.369 | 0.575 |
| Alb min day 5 | 0.494 | 0.891 | 0.39 | 0.597 |
| Alb min day 7 | 0.527 | 0.568 | 0.424 | 0.63 |

Table 2: MELD > 18.9 on day 5 as a predictor of 90 day mortality or reoperation compared to other definitions of early allograft dysfunction.

| | Sensitivity (95% CI) | Specificity (95% CI) | Likelihood ratio |
|--|---------------------------|---------------------------|------------------|
| - MELD > 18.9 on day 5 | 0.781 (0.624 to 0.894) | 0.736 (0.699 to 0.770) | 2.953 |
| - Bili > 10 POD 7 | 0.683 (0.519 to 0.819) | 0.721 (0.684 to 0.756) | 2.448 |
| - INR > 1.6 POD 7 or - Bili > 10 POD 7 or - AST > 2000 POD 2-7 | 0.707 (0.545 to 0.839) | 0.746 (0.709 to 0.780) | 2.779 |

S-244.**ADEQUATE EARLY GRAFT FUNCTION AFTER ORTHOTOPIC LIVER TRANSPLANTATION IS BEST PREDICTED BY INDOCYANINE GREEN PLASMA DISAPPEARANCE RATE**

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INTRODUCTION: The 1- and 5-year survival after orthotopic liver transplantation (OLT) increased the last decade above 85% and 75% respectively. Mortality and morbidity is mainly determined in the early post-operative period.¹ During this period, monitoring of initial graft function is highly mandatory. Physical examination or conventional laboratory findings, such as serum bilirubin measurements are not accurate predictors of graft and patient survival. However, point-of-care monitoring of the plasma disappearance rate (PDR) of Indocyanine Green dye (PDR-ICG) has been shown to predict early post-operative complications following OLT when measured during the first post-operative days.^{2,3} We evaluated the role of intraoperative PDR-ICG values in the prediction of adequate early graft function after full size adult OLT.

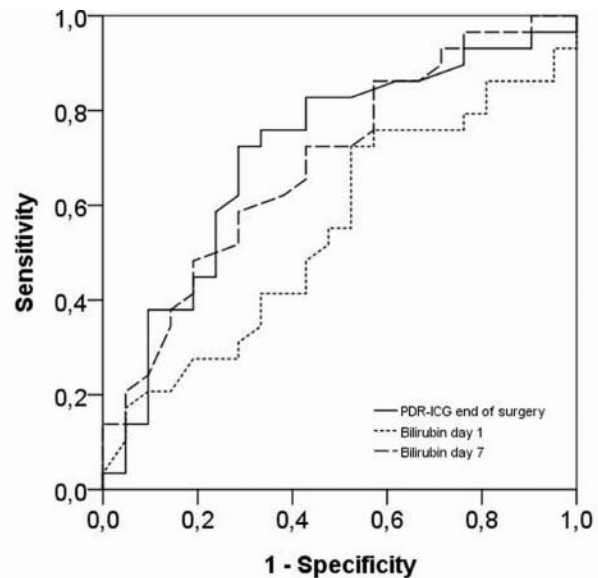
METHODS: We retrospectively analyzed data from 62 patients undergoing OLT. Early graft function was defined as adequate if there were no signs of primary non-function, hepatic artery or portal vein thrombosis, sepsis, need for surgical re-intervention, acute rejection or early ischemic biliary lesions. PDR-ICG was measured non-invasively by pulse dye densitometry at the end of surgery and was correlated with early graft function. ROC analysis was performed to compare the predictive ability for adequate early graft function of both PDR-ICG and post-operative serum bilirubin measurements.

RESULTS: PDR-ICG at the end of surgery was significantly higher in patients with adequate early graft function compared to patients with early post-operative complications (27.2 ± 8.2 %/min versus 23.0 ± 6.9 %/min; $p < 0.05$). ROC analysis (fig.1) revealed an area under the curve (AUC) of 0.71 and a cut-off PDR-ICG value for predicting adequate early graft function was determined to be 23.9%/min with a sensitivity of 72.4% and a specificity of 72.7% while serum bilirubin measurement at day 1 and day 7 after transplantation revealed an AUC of 0.54 and 0.69 respectively. A further subgroup analysis could not determine specific complications to be predicted by intra-operative PDR-ICG measurements.

DISCUSSION: We demonstrate for the first time that already intraoperative measurement of PDR-ICG during full size adult OLT provides a useful clinical tool that is more sensitive than postoperative measurements of serum bilirubin within the first week to predict adequate early graft function after liver transplantation.

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S-245.**RISK FACTOR ANALYSIS FOR MASSIVE RED BLOOD CELL TRANSFUSION IN LIVER TRANSPLANTATION (LT)****AUTHORS:** K. Naguit, K. Fukazawa, E. A. Pretto, Jr**AFFILIATION:** University of Miami, Miami, FL

INTRODUCTION: Liver transplantation is associated with large amounts of blood loss. In this study, we investigated independent risk factors that have been reported in previous studies¹, as well as other potential contributing factors that have not, using a larger patient population.

METHODS: Primary retrospective data collection was from patient records in our institution. After institutional review board approval, 603 consecutive cadaveric whole LT cases performed from January 2002 to March 2008 were reviewed. Demographic data for donor and recipient, preoperative labs, history of prior abdominal surgery, prior abdominal infection, TIPS, hemodialysis for kidney failure, use of antiplatelet medications, splenomegaly, portal vein thrombosis, varicose veins and collateral veins, were collected from electronic anesthesia record database. We correlated the amount of packed cell transfusion given during transplant with each of the aforementioned variables using univariate/multivariate logistic regression analysis for binominal variables, as well as linear regression analysis for continuous variables. P value < 0.05 was considered to be statistically significant.

RESULTS: In our cohort, the median pRBC and cell saver units transfused, was 11 and 6 units respectively. Based on our analysis, major risk factors that contributed to packed cell transfusion during LT are shown in Figure 1. Dialysis prior to LT (coefficient 15.21, p=0.005), and presence of portal vein thrombosis (coefficient 8.72, p<0.0001) were the most significant predictors of the quantity of pRBC transfusion required during LT. Other risk factors included preoperative creatinine (p=0.0001), PT (p=0.001), total bilirubin (p<0.0001), BUN (p<0.0001), sodium (p=0.006), Hb (p<0.0001), MELD score (p=0.012), cold ischemia time (p=0.020), warm ischemia time (p=0.014), and CVA (as a cause of donor death) (p=0.038).

DISCUSSION: Prior renal dialysis and portal vein thrombosis were the most statistically significant independent risk factors for massive pRBC transfusion in our study. Knowledge of risk factors may permit more rational preparation with better utilization of blood components and improved perioperative management.

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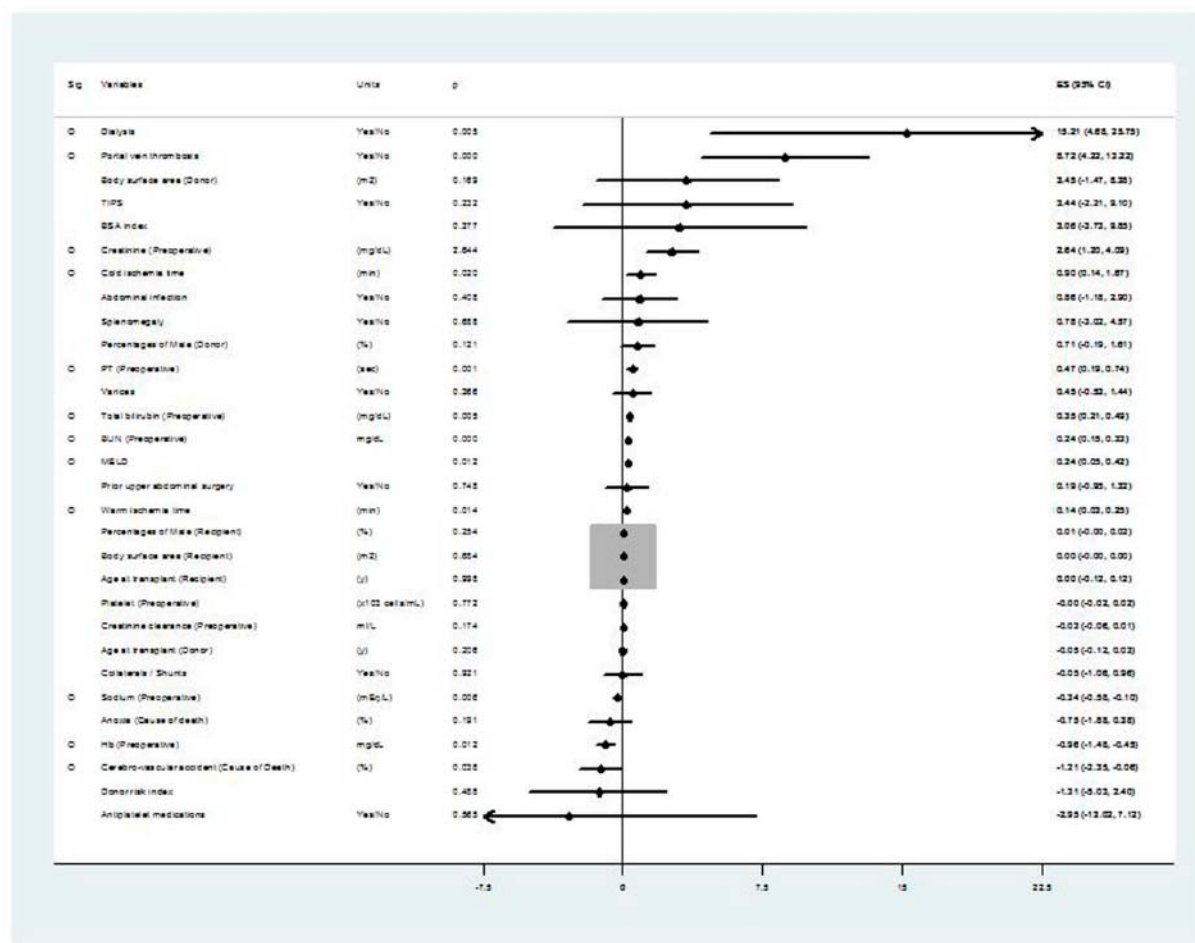


Figure 1:

S-246.**SERUM ALBUMIN AND OUTCOMES IN DIALYSIS-DEPENDENT KIDNEY FAILURE FOLLOWING LIVER TRANSPLANTATION**

AUTHORS: F. Saner,¹ A. Geis,² R. Schumann,³ T. Feldkamp,² J. W. Treckmann,¹ A. Paul¹

AFFILIATION: ¹Department of General- Visceral- and Transplant Surgery, University Essen, Essen, Germany; ²Department of Nephrology, University Essen, Essen, Germany; ³Department of Anesthesiology, Tufts Medical Center, Boston, MA

INTRODUCTION: Following liver transplantation (LT), recipients, and particularly those with a high MELD score, are at risk to develop dialysis dependent acute kidney injury (AKI). Albumin replacement in cirrhotic patients to avoid kidney failure has been advocated by some.

The aim of our study was to evaluate the impact of serum albumin level on morbidity and mortality in short-term dialysis dependent liver transplant recipients.

METHODS: In this retrospective study, we analyzed records of 68 consecutive liver transplant recipients from 01/2004-10/2007, who required postoperative renal replacement therapy (RRT). Patients were stratified according to survival of > 1 year (group 1) or ≤ 3 months (group 2). In addition we recorded liver function tests, total protein and albumin at start and end of the RRT period. Albumin was not replaced in either group. Data are reported as means ± SD (normal distribution) or as median and range.

RESULTS: There were no differences between groups in age, MELD score, cold- and warm ischemia time. Mean ALT, AST, INR, bilirubin, and albumin did not differ at RRT start. Liver function at the end of the RRT period was significantly better in group 1 compared to group 2. The albumin and total serum protein level in both groups were not different at RRT end between groups (table 1).

The one-year-survival of patients who required RRT was 38.8%.

Patients who survived at least 1 year did not require dialysis treatment at hospital discharge.

DISCUSSION: The need for postoperative RRT following liver transplantation is associated with a high mortality rate. In our study serum albumin levels were relatively low during RRT without prognostic significance for survival. However, the recovery of liver function while on RRT was significantly better in patients who survived > 1 year compared to those with early mortality.

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Table 1

| | Group 1 (n=26) | Group 2 (n=42) |
|-----------------------------------|----------------|-----------------|
| Age(years) | 43.2 ± 12 | 49.5 ± 11.1 |
| MELD | 23 ± 8 | 23 ± 9 |
| Cold ischemia time (minutes) | 488 ± 207 | 478 ± 240 |
| Warm ischemia time (minutes) | 38 ± 11 | 40 ± 17 |
| Bilirubin (mg/dl) (end of RRT) | 2.6 (0.4-16.2) | 4.7 (0.5-35.6)* |
| INR (end of RRT) | 1.2 (0.8-1.8) | 1.5 (1-3.7)* |
| AST (U/L) (end of RRT) | 56 (17-564) | 172 (21-17987)* |
| ALT (U/L) (end of RRT) | 105 (6-1906) | 254 (23-11151)* |
| Total protein (g/dl) (end of RRT) | 3.6 ± 0.7 | 3.6 ± 0.9 |
| Albumin (g/dl) (end of RRT) | 2 ± 0.3 | 1.8 ± 0.5 |

*p<0.05

S-247.**THE EFFECT OF OCTREOTIDE ON MYOCARDIAL INJURY AFTER HEPATIC ISCHEMIA-REPERFUSION IN A RABBIT MODEL****AUTHORS:** J. Yang, H. Sun, M. Wang, J. Liu**AFFILIATION:** Hunan Tumor Hospital, Changsha, China

INTRODUCTION: Hepatic ischemic-reperfusion injury (HIRI) is of concern in the field of liver surgery and the concept of pharmacologic preconditioning to prevent it has recently been investigated. Octreotide (Oct) has been reported to reduce HIRI in the rabbit^{1,2} and lung injury after Hepatic ischemic-reperfusion in the rabbit.³ This study was designed to investigate the effects of Octreotide on myocardial injury after Hepatic Ischemia-reperfusion (HIR) in a rabbit model.

METHODS: 24 adult New Zealand rabbits were randomly divided into sham operated group (Control), Ischemia/reperfusion group (I/R) and Ischemia/reperfusion+Oct pretreatment group (I/R+Oct). At 30min prior to laparotomy, rabbits in I/R+Oct group received an injection of Oct 20 ug/kg intraperitoneally and 30 ug/kg subcutaneously.⁴ Control and I/R groups rabbits received same volume of isotonic saline. HIRI models were set up in I/R and I/R+Oct groups using Pringle's maneuver method⁵ with 30 min ischemia and 120 min reperfusion. We checked the CK-MB, LDH, SOD and malondialdehyde (MDA) in the serum in every group at the time before ischemia (T1), 30min (T2) after ischemia, and 60min (T3), 120min (T4), 240min (T5) after reperfusion, the SOD and MDA in myocardial tissue in every group at T5. We observed myocardial cell ultrastructure in the myocardial cell under electromicroscope at T5.

The CK-MB, LDH, MDA, SOD at different time point between 3 groups

RESULTS:

1. The CK-MB, LDH in group I/R, I/R+Oct were higher than that of Control ($P<0.05$) from T2, and they were lower in group I/R compared with group I/R+Oct in this period ($P<0.05$).

2. The MDA in group I/R and I/R+Oct were higher than that in Control from T2 in serum and at T5 in myocardial tissue ($P<0.05$), and it was lower in group I/R+Oct than that in group I/R ($P<0.05$). The SOD in group I/R and I/R+Oct were lower than that in Control from T2 in serum and at T5 in myocardial tissue ($P<0.05$), and it was higher in group I/R+Oct than that in group I/R ($P<0.05$).

3. Under electromicroscope, we could see myocardial cell myofilament edema, mitochondria ambiguity, vacuolar degeneration, chromatin gathered in border in I/R, but it was slighter in group I/R+Oct.

DISCUSSION: The current study demonstrated that Octreotide could decrease CK-MB, LDH release in serum, decrease MDA and increase SOD level in serum and myocardial tissue, alleviated the changes of myocardial cell ultrastructure after hepatic ischemia-reperfusion. Octreotide appears to protect myocardial injury after hepatic ischemic-reperfusion in a rabbit model.

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The CK-MB, LDH, MDA, SOD at different time point between 3 groups

| Group | Time | CK-MB(μ L) | LDH(μ L) | MDA(μ mol/L) | SOD(μ mol/L) |
|---------|------|------------------------|------------------------|--------------------|----------------------|
| Control | T1 | 178.12 \pm 68.59 | 125.18 \pm 23.61 | 5.64 \pm 2.31 | 318.01 \pm 39.18 |
| | T2 | 184.59 \pm 77.45 | 133.66 \pm 41.27 | 6.23 \pm 2.97 | 309.96 \pm 40.21 |
| | T3 | 199.85 \pm 74.42 | 139.88 \pm 48.62 | 6.31 \pm 2.76 | 311.74 \pm 41.89 |
| | T4 | 205.64 \pm 71.64 | 141.43 \pm 47.25 | 5.98 \pm 2.81 | 319.78 \pm 43.06 |
| | T5 | 214.98 \pm 70.63 | 138.65 \pm 34.13 | 6.18 \pm 2.64 | 314.55 \pm 44.67 |
| I/R | T1 | 164.89 \pm 72.36 | 118.43 \pm 22.48 | 6.08 \pm 2.86 | 323.43 \pm 41.47 |
| | T2 | 828.5 \pm 100.31* | 583.69 \pm 120.43* | 9.13 \pm 4.22* | 252.79 \pm 30.07* |
| | T3 | 1473.94 \pm 189.56* | 1359.89 \pm 223.58* | 12.83 \pm 4.69* | 210.86 \pm 31.74* |
| | T4 | 1682.33 \pm 219.74 | 2001.45 \pm 206.84* | 15.92 \pm 5.07* | 195.79 \pm 30.82* |
| | T5 | 2319.81 \pm 312.37* | 1286.69 \pm 267.42* | 20.04 \pm 7.16* | 172.43 \pm 32.66* |
| I/R+Oct | T1 | 171.43 \pm 69.55 | 114.97 \pm 25.57 | 5.94 \pm 2.09 | 317.68 \pm 37.98 |
| | T2 | 698.92 \pm 94.63*+ | 374.69 \pm 78.47*+ | 7.08 \pm 3.65*+ | 270.32 \pm 33.79*+ |
| | T3 | 823.03 \pm 101.97*+ | 948.30 \pm 139.46*+ | 9.23 \pm 3.70*+ | 240.36 \pm 30.78*+ |
| | T4 | 889.62 \pm 138.99*+ | 1402.19 \pm 180.23*+ | 11.12 \pm 4.72*+ | 226.31 \pm 39.28*+ |
| | T5 | 1090.29 \pm 192.04*+ | 680.48 \pm 145.95*+ | 14.36 \pm 4.73*+ | 204.32 \pm 35.71*+ |

*compared with Control $p<0.05$ + compared with Group I/R $P<0.05$

S-248.**SEX BIAS IN EXPERIMENTAL IMMUNE-MEDIATED DRUG-INDUCED LIVER INJURY IN BALB/C MICE: ROLES FOR ESTROGEN AND ESTROGEN RECEPTOR ALPHA****AUTHORS:** Z. Li, D. Njoku**AFFILIATION:** Johns Hopkins University, Baltimore, MD

INTRODUCTION: Immune-mediated drug-induced liver injury (DILI) from anesthetics, antibiotics or anti-epileptics is more prevalent in women. In anesthetic DILI we previously showed that regulatory T cells (Tregs) have a critical role in sex bias. We did this by demonstrating increased hepatitis, autoantibodies, proinflammatory IL-6 responses and lower Tregs in female BALB/c mice using our model of experimental anesthetic DILI,¹ where mice were immunized with haptenated liver proteins emulsified in complete Freund's adjuvant (TFA-S100/CFA).² Then we alleviated hepatitis, autoantibodies and proinflammatory responses following adoptive transfer of additional Tregs to these mice. We now hypothesize that sex bias in anesthetic DILI is not caused by qualitative differences in Tregs but by estrogen (E2) - induced proinflammatory responses in immune cells as well as E2-induced unresponsiveness of alpha subunit of the E2 receptor (E2R α).

METHODS: To first assure that sex bias in anesthetic DILI was caused by quantitative but not qualitative differences in Tregs between sexes, we measured Treg responses to anti-IL-10 blocking antibodies and IL-6 supplementation as well as inhibitory molecule expression of programmed death receptor 1 (PD-1) and CTLA-4. To directly address the role of E2 we measured IL-6 following E2 treatment as well as and E2R α expression in naïve splenocytes and in splenocytes from TFA-S100/CFA - immunized mice.

RESULTS: We found that anti-IL-10 and IL-6 diminished Tregs in both sexes. We also found no sex bias in PD-1 and CTLA-4 expression. We then found that naïve female splenocytes treated with E2 produced significantly elevated levels of IL-6 ($p < 0.05$), which in turn could diminish Treg levels. Next we found diminished E2R α levels in naïve female when compared to male BALB/c mice, which was most likely induced by E2 and could prevent Treg expansion ($p < 0.05$). When we measured E2R α levels following immunizations with TFA-S100/CFA, we found that these levels remained significantly lower in females confirming our hypotheses.

DISCUSSION: E2 and E2R α are currently being investigated as potential targets of pain pathways as well as some cancers. E2R α upregulation is required for Treg expansion.³ We show for the first time that E2R α unresponsiveness could be one mechanism that explains sex bias in experimental immune-mediated DILI. We also show a therapeutic role for Treg expansion which is in sharp contrast to cancer pathogenesis. Future studies will confirm whether these mechanisms have a critical role in sex bias in patients with DILI following anesthetics or other DILI-inducing drugs.

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S-249.**COMPARAISON OF VOLATILE ANESTHETIC AGENTS IN RENAL TRANSPLANTATION: A RETROSPECTIVE STUDY OF 802 CONSECUTIVE RENAL TRANSPLANTS****AUTHORS:** P. Lahsaei, S. B. Kinsella, R. Mangus, W. Goggins**AFFILIATION:** Indiana University School of Medicine, Indianapolis, IN

INTRODUCTION: There is an increasing body of evidence that volatile anesthetic agents may have a protective role in ischemia-reperfusion injury via a phenomenon known as "anesthetic preconditioning". Previous research at our center has found a protective effect for Desflurane (Des) and Sevoflurane (Sevo) when compared to Isoflurane (Iso) in liver and pancreas transplantation. This study compares the three agents in kidney transplantation. Primary outcomes include early graft function and graft survival in living and deceased donor grafts.

METHODS: Data was extracted using a retrospective single center review of all kidney transplants between 2003 and 2009. Only single organ kidney transplants were included. Choice of volatile anesthetic agent was at the discretion of the anesthesiologist. Delayed graft function (DGF) is the standard measure for early post-transplant function and is based on the need for dialysis within 7 days, urine production in 24 hours and a 25% decrease in serum creatinine within 48 hours. The glomerular filtration rate (GFR) was calculated using the Cockcroft and Gault equation and was compared using the difference between the admission and day 30 values. An intention to treat analysis was employed for graft failure.

RESULTS: There were a total of 802 transplants, 297 living donor (LD) and 505 deceased donor (DD). The LD group included 12% Iso, 62% Des and 16% Sevo, while the DD group had 11% Iso, 65% Des and 12% Sevo. There was no statistical difference among the three study groups with regard to DGF or graft survival in either LDs or DDs. Furthermore, we were not able to appreciate any statistically significant group differences in change in 30 day GFR for LDs or DDs.

DISCUSSION: There is a large body of evidence that shows the protective properties of volatile anesthetic agents in organ ischemia-reperfusion injury. Our clinical research in liver and pancreas transplantation confirms these findings. Results from this study in kidney transplants does not show any difference among the three inhaled anesthetic agents in early and later graft function, nor in graft survival.

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S-250.**THE OXIDATIVE STRESS AND THE PLASMA ANTIOXIDANT BIOLOGICAL POTENTIAL OF DONORS AND RECIPIENTS IN LIVING DONOR LIVER TRANSPLANTATION**

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INTRODUCTION: A high level of reactive oxygen species (ROS) due to an increased production of oxidant species and/or a decreased efficacy of antioxidant system can lead to oxidative stress. It would affect course of various diseases, including inflammatory, infectious and degenerative disorders either in humans or in animals.

The liver is the front line of defense and a target organ for many toxicants. Therefore, liver dysfunction would influence plasma redox state. However, it is unknown that exact relationship between liver dysfunction and plasma redox state in humans. Here, we measured and compared oxidative stress and antioxidant capacity of the recipients of living donor liver transplantation (LDLT) to the donors after induction of anesthesia.

METHODS: We identified 19 adult patients underwent elective LDLT and 19 donors at Okayama University Hospital between November 2009 and November 2010.

The metabolites by reactive oxygen species (d-ROMs) and the plasma biological antioxidant potential (BAP) were measured after induction of general anesthesia using the free radical specific evaluator.

The d-ROMs test provides a measure of the whole oxidant capacity of plasma against the N,N-diethylparaphenyldiamine in acidic buffer. Such oxidant capacity is mainly due to hydroperoxides with the contribution of other minor oxidant factors. The BAP test allows evaluating the plasma antioxidant biological potential as the capacity of the plasma sample to reduce ferric ions to ferrous ions.

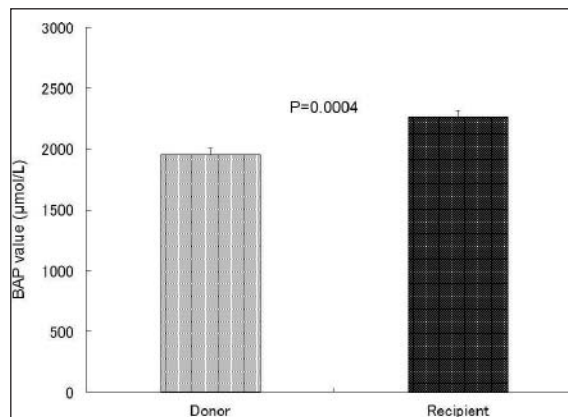
The data were reported as mean±SD.

RESULTS: There was no difference in the sex ratio between the recipient group (n=19) and the donor group (n=19). As for the age, the recipient group was older (50.5 ± 13.7 vs 37.2 ± 12.2 , $p=0.0033$) than the donor group. There was no significant difference of the d-ROM values (242.58 ± 88.70 vs 234.79 ± 56.51 , $p=0.7487$) between two groups, though the BAP values were significantly higher (2265.07 ± 245.93 vs 1956.17 ± 239.45 , $p=0.0004$) in the recipient group than in the donor group after induction of anesthesia. (Figure)

DISCUSSION: The biological antioxidant potential was significantly higher in the recipient group than in the donor group, though there was no significant difference in the oxidative stress. Plasma redox state seems to be quite complex, but our results highlight influence of liver dysfunction on these complex oxidative status.

REFERENCES:

Acta Med. Okayama 5: 323-330, 2010



Plasma antioxidant capacity (BAP test) in the donor and the recipient groups

S-251.**PH TREATMENT AND INTRAOPERATIVE SODIUM CONCENTRATION IN LIVER TRANSPLANTATION****AUTHORS:** J. Hudcova,^{1,2} R. Ruthazer,² J. B. Kane,¹ I. Bonney,² R. Schumann²**AFFILIATION:** ¹Lahey Clinic Medical Center, Burlington, MA; ²Tufts Medical Center, Boston, MA**INTRODUCTION:** The treatment of intraoperative metabolic acidosis varies among anesthesia clinicians. We examined this practice and compared the effect of treatment with bicarbonate (NaHCO₃) or Tromethamine (THAM) on serum sodium (Na) concentration.**METHODS:** Following IRB approval we conducted a retrospective study of all consecutive patients undergoing liver transplantation (LT) during a 3.5 year period. Combined liver/kidney, fulminant hepatic failure and retransplantation cases were excluded. Data collection included demographics, operating room (OR) time, delta serum sodium (ΔNa) defined as postoperative minus preoperative serum Na ($\text{Na}_{\text{post}} - \text{Na}_{\text{pre}}$) stratified according to pH treatment: none, NaHCO₃, THAM, or both agents. NaHCO₃ was administered either as boluses, an infusion or a combination of both. The 2-way analysis of variance (ANOVA) with interaction and the Spearman correlation were used for statistical analysis. Data are in means \pm SD, $P < .05$ is significant.**Challenging Case Report (only complete if your submission falls into the “Challenging Case Report” category. If you select the “Challenging Case Report” category on the next step, this section must be completed.):** N/A**RESULTS:** Data of 165 patients were analyzed.Demographics, Na levels and ΔNa are shown in Table 1.Relationships between ΔNa and various alkalinizing regimens as well as different forms of NaHCO₃ administration are displayed in Table 2.Comparisons of different alkalinizing regimens in relation to ΔNa are outlined in Table 3.Serum Na increased in all patients. All NaHCO₃ treated patients had significantly higher ΔNa ($p = 0.0001$)*. The mean of ΔNa was least in THAM only treated group. The ΔNa mean value did not differ between THAM only treated patients and no treatment ($p = 0.55$). There was no significant difference in ΔNa between form of NaHCO₃ administration (bolus, infusion or both, $p = 0.88$).The mean of OR time was 6.7h (SD 1.2h) for all patients and there was no correlation between ΔNa and OR time ($p > .2$).**DISCUSSION:** Serum sodium rises during liver transplantation. The increase is significantly greater in NaHCO₃ treated patients (alone or in combination with THAM) when compared to no bicarbonate treatment regardless of form of administration and OR time. The rate of Na increase is worrisome because it exceeds the accepted limit of 0.5mEq/L/h (0.8mEq/L/h in all patients and ≥ 1.0 mEq/L/h in bicarbonate treated group).The rise in ΔNa is similar in patients not treated and treated with THAM only. We suggest THAM as the agent of the choice if intraoperative treatment of metabolic acidosis is required. A prospective controlled trial is needed to confirm these initial results and relate clinical outcomes to intraoperative sodium homeostasis.**REFERENCES:** N/A

| Age | Male gender | BMI | MELD | Type of transplant | | Na _{pre} | Na _{post} | ΔNa |
|----------------|-------------|----------------|-----------------|--------------------|-------------|-------------------|--------------------|-------------------|
| 52.6 \pm 9.9 | 76.1% | 28.7 \pm 5.4 | 20.4 \pm 15.1 | DD 44.2% | LD 55.8% | 135.8 \pm 4.6 | 141.0 \pm 3.5 | 5.2 \pm 4.8 |

Table 1. Patients' characteristics, serum Na levels, and ΔNa .

| | | N | Mean | SD |
|---------------------------------|---|----|------|-----|
| NaHCO ₃ free regimen | No agent | 20 | 3.5 | 3.3 |
| | THAM only | 47 | 2.8 | 4.7 |
| | No agent or THAM alone | 67 | 3.0 | 4.3 |
| NaHCO ₃ regimen | NaHCO ₃ only | 62 | 6.8 | 4.3 |
| | NaHCO ₃ + THAM | 34 | 6.5 | 5.0 |
| | Any NaHCO ₃ (alone or with THAM) * | 96 | 6.7 | 4.5 |
| NaHCO ₃ forms | Bolus | 43 | 6.5 | 4.9 |
| | Infusion | 49 | 6.8 | 4.2 |
| | Both | 4 | 7.5 | 4.4 |

Table 2. Comparisons of ΔNa in different alkalinizing regimens and forms of bicarbonate administration

| Agent/s 1 | N | Agent/s 2 | N | P value |
|--|----|---|----|---------|
| No agent | 20 | THAM alone | 47 | 0.55 |
| No agent | 20 | Any NaHCO ₃ (alone or with THAM) | 96 | <.005 |
| THAM alone | 47 | Any NaHCO ₃ (alone or with THAM) | 96 | <.0001 |
| No NaHCO ₃ (no agent or THAM alone) | 67 | Any NaHCO ₃ (alone or with THAM) | 96 | <.0001 |

Table 3. Comparisons of different alkalinizing regimens in relation to ΔNa .

S-252.**INTRAOPERATIVE ANESTHETIC MANAGEMENT AND EFFECT ON SERUM SODIUM CONCENTRATION IN LIVER TRANSPLANTATION**

AUTHORS: J. Hudcova,^{1,2} R. Ruthazer,² I. Bonney,² J. B. Kane,² R. Schumann²

AFFILIATIONS: ¹Lahey Clinic Medical Center, Burlington, MA; ²Tufts Medical Center, Boston, MA

INTRODUCTION: Intraoperative changes in serum sodium (Na) can affect outcomes following liver transplantation (LT).¹ We investigated intraoperative factors that may influence Na homeostasis perioperatively including fluid and pharmacologic management.

METHODS: Following IRB approval we conducted a retrospective study of all consecutive patients undergoing liver transplantation (LT) during a 3.5 year period. Combined liver/kidney, fulminant hepatic failure and retransplantation cases were excluded. The Spearman correlation was used to examine associations between delta serum sodium (ΔNa), defined as postoperative minus preoperative serum Na ($\text{Na}_{\text{post}} - \text{Na}_{\text{pre}}$) and bicarbonate (NaHCO_3) administration, preoperative serum Na, volume of crystalloids, fresh frozen plasma (FFP), colloids, intraoperative hyperglycemia (BS_{max}), vasopressin, diuretics and dopamine (DOPA) use. We also examined relationship between BS_{max} and intraoperative urine output (UOP). Data are presented in means \pm SD, a $p < .05$ is significant.

Challenging Case Report (only complete if your submission falls into the “Challenging Case Report” category. If you select the “Challenging Case Report” category on the next step, this section must be completed.): N/A

RESULTS: Data of 165 recipients were included.

Patients characteristics are summarized in Table 1.

Summary of intraoperative BS_{max} levels, volume of administered crystalloids and FFP and correlations of ΔNa with those parameters are outlined in Table 2.

Comparisons of ΔNa and intra-operative interventions are presented in Table 3.

The mean ΔNa was significantly higher in patients treated with NaHCO_3 and when no colloid (albumin or Hespan) was administered. No difference in ΔNa was identified in patients treated with vasopressin, diuretics and dopamine. ΔNa was significantly larger in patients with lower Na_{pre} ($p < .0001$). There was no association between BS_{max} and UOP.

DISCUSSION: Serum Na increased during LT. Patients with lower preoperative serum Na experienced significantly greater ΔNa increase. This is important since rapid correction of serum sodium has been associated with poor neurologic outcomes.² Hyperglycemia, higher FFP volume, NaHCO_3 administration and lack of intraoperative colloid substitution were all significantly associated with greater ΔNa . The link between hyperglycemia and greater ΔNa is unclear; no association between peak intraoperative blood sugar and urine output existed. Interestingly the amount of crystalloid volume infused did not appear to affect ΔNa , and neither did the use of vasopressin, diuretics and dopamine. A prospective validation of these findings and correlation with outcomes is warranted.

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2. Anaesthesia 2008, 63: 92-5

| Age | Male gender | BMI | MELD | Type of transplant | | Na_{pre} | Na_{post} | ΔNa |
|----------------|-------------|----------------|-----------------|--------------------|-------------|--------------------------|---------------------------|-------------------|
| 52.6 \pm 9.9 | 76.1% | 28.7 \pm 5.4 | 20.4 \pm 15.1 | DD 44.2% | LD 55.8% | 135.8 \pm 4.6 | 141.0 \pm 3.5 | 5.2 \pm 4.8 |

Table 1. Patients' characteristics, serum Na levels, and ΔNa

| | Summary | | | Correlations of ΔNa with outcomes | | |
|----------------------------------|---------|------|------|---|-------------|---------|
| | N | Mean | SD | N | Coefficient | P value |
| BS_{max} [mg/dL] | 165 | 267 | 130 | 163 | .34 | <.0001 |
| Crystalloids [mL] | 164 | 3523 | 1531 | 162 | .12 | 0.14 |
| FFP [units] | 165 | 16 | 12 | 163 | .47 | <.0001 |

Table 2. Intraoperative parameters and correlations to ΔNa

| Intervention | ΔNa – intervention present (N) | ΔNa – intervention absent (N) | P value |
|------------------|--|---|---------|
| NaHCO_3 | 6.7 \pm 4.5 (96) | 3.0 \pm 4.7 (67) | <.0001 |
| Vasopressin | 5.2 \pm 4.8 (152) | 5.1 \pm 4.1 (11) | 0.95 |
| Diuretics | 5.6 \pm 4.9 (19) | 5.1 \pm 4.8 (142) | 0.65 |
| DOPA | 5.0 \pm 4.9 (88) | 5.3 \pm 4.6 (74) | 0.68 |
| Colloids | 3.5 \pm 4.1 (26) | 5.8 \pm 4.5 (130) | 0.02 |

Table 3. Comparisons of ΔNa and intra-operative interventions

S-253.**INTRAOPERATIVE CHANGES IN SERUM SODIUM CONCENTRATION AND CRITICAL OUTCOMES BEYOND NEUROLOGIC FUNCTION****AUTHORS:** J. Hudcova,^{1,2} R. Ruthazer,² I. Bonney,² J. B. Kane,² R. Schumann²**AFFILIATION:** ¹Lahey Clinic Medical Center, Burlington, MA; ²Tufts Medical Center, Boston, MA**INTRODUCTION:** Outcomes beyond neurologic function may be affected by small but rapid alterations in serum sodium (Na) homeostasis encountered during liver transplantation (LT). To test this hypothesis, we correlated intraoperative Na changes with outcomes following LT.**METHODS:** This IRB approved retrospective study included LT patients during a 3.5 year period. Postoperative PACU intubation was standard. Combined liver/kidney, fulminant hepatic failure and retransplantation cases were excluded. We recorded demographics, delta serum sodium (ΔNa = post- minus preoperative Na [$\text{Na}_{\text{post}} - \text{Na}_{\text{pre}}$]), need for SICU admission (from PACU or at any time during hospitalization), time to extubation (Tex), length of stay: PACU (LOS_{PACU}), PACU+SICU ($\text{LOS}_{\text{PACU+SICU}}$), PACU or SICU ($\text{LOS}_{\text{PACUorSICU}}$), hospital (LOS_{HOS}), and complications (encephalopathy, seizures, mortality). The Spearman correlation was used for statistics. Multivariate analysis examined associations between ΔNa , age, BMI, preoperative serum albumin (Alb) and type of transplant and a subset of outcomes: SICU admission at any time ($\text{SICU}_{\text{need}}$) during hospitalization, length of intubation (Tint) and 30-day mortality ($\text{M}_{30\text{D}}$). Data are in means \pm SD, $p < .05$ is significant.**Challenging Case Report (only complete if your submission falls into the “Challenging Case Report” category. If you select the “Challenging Case Report” category on the next step, this section must be completed.):** N/A**RESULTS:** 165 patients (LD 55.8%, DD 44.2%, 76.4% males) were included. The mean age, BMI and MELD scores were 52.6 ± 9.9 years, 28.8 ± 5.5 kg/m² and 20.4 ± 15 respectively. The mean Na_{pre} and Na_{post} was 135.8 ± 4.6 and 141 ± 3.5 mEq/L, with a mean ΔNa 5.2 ± 4.8 .Correlation of ΔNa to need of SICU admission is in Table 1.Correlations of ΔNa with temporal outcomes are in Table 2.In-hospital and 30 day mortality were 9.2% and 20.2% respectively. Seizures occurred in 3.7%, encephalopathy in 1.8%, and 4.9 % of recipients had both. Neither these complications nor mortality were significantly related to ΔNa , but the study was underpowered for these outcomes.

Multivariate analysis results are shown in Table 3.

A one unit increase in the ΔNa is associated with increased odds of SICU admission and an intubation time of ≥ 2 days. Age is the only additional variable significant for increased SICU need. Mortality did not seem to be affected by any of the variables.**DISCUSSION:** Among several variables, intraoperative serum Na seems to be an important parameter affecting morbidity and possibly mortality following LT. A greater change in serum Na rise is associated with a greater chance of SICU admission and longer intubation time in either uni- or multivariate analysis with age, BMI, albumin and transplant type. More attention to intraoperative Na management is warranted. Maintenance of intraoperative Na concentration within relatively narrow limits appears to be more important than previously recognized.**REFERENCES:** N/A

| Outcome | Yes (N) | No (N) | p-value |
|----------------------------|--------------------|---------------------|---------|
| Transfer from PACU to SICU | 7.5 ± 4.4 (28) | 4.7 ± 4.7 (135) | .005 |
| Need SICU any time | 6.8 ± 4.5 (40) | 4.7 ± 4.7 (123) | .014 |

Table 1. Correlation of ΔNa to need of SICU admission

| Outcome | Yes (N) | No (N) | p-value |
|----------------------------|--------------------|---------------------|---------|
| Transfer from PACU to SICU | 7.5 ± 4.4 (28) | 4.7 ± 4.7 (135) | .005 |
| Need SICU any time | 6.8 ± 4.5 (40) | 4.7 ± 4.7 (123) | .014 |

Table 2. Correlation of ΔNa with temporal outcomes

| | $\text{SICU}_{\text{need}}$ | | Tint ≥ 2 days | | $\text{M}_{30\text{D}}$ | |
|--------------------|-----------------------------|-------|--------------------|--------|-------------------------|-----|
| | OR | p | OR | P | OR | p |
| ΔNa | 1.13 | <.02 | 1.22 | <.0001 | 1 | 0.4 |
| Age | 1.0 | 0.007 | 0.99 | 0.3 | 1 | 0.9 |
| BMI | 1.0 | 0.4 | 1 | 0.9 | 1 | 0.6 |
| Albumin | 1.1 | 0.3 | 0.8 | 0.6 | 0.8 | 0.4 |
| Type of transplant | 2.3 | 0.9 | 1.9 | 0.2 | 1.8 | 0.1 |

Table 3. Results of multivariate analysis

S-255.**SEVERE PRE-LIVER TRANSPLANT CORONARY ARTERY DISEASE ASSOCIATED WITH SIGNIFICANT WORSENING OF LATE POST-TRANSPLANT SURVIVAL**

AUTHORS: S. B. Kinsella, N. Simon, A. Tector, R. Vianna, R. Mangus

AFFILIATION: Indiana University School of Medicine, Indianapolis, IN

INTRODUCTION: Patients with coronary artery disease (CAD) are at increased risk for worse outcomes post-liver transplant. This risk may be incrementally increased in patients with severe CAD. This study evaluates liver transplant outcomes for a large number of patients who have previously undergone coronary artery intervention including either operative revascularization or stenting.

METHODS: This is a retrospective review of liver transplants from 2001 to 2010. Cardiac interventions were categorized as “remote” for more than 1 year pre-transplant and “recent” within 12 months of transplant. Median follow up for this cohort was 62 months. All patients were required to have a negative stress test prior to transplant, regardless of cardiac history or previous interventions.

RESULTS: There were 1122 patients included in this analysis, including 59 with a previous cardiac intervention (5%). A Cox proportional hazards model was constructed to evaluate long term post-transplant patient survival. Controlling for patient and donor age, model for end-stage liver disease score and HCV infection, there was a significantly worse survival for recipients with any history of cardiac intervention with survival at 5 years being 75% for patients with no cardiac disease, 60% for patients with immediately pre-transplant intervention and 56% for patients with remote intervention. The two CAD disease groups had a higher risk of cardiac related death post-transplant.

DISCUSSION: Patients with previous cardiac intervention had no increased risk of perioperative post-transplant complications, but had significantly worse survival at 90 days, 1 year and 5 years.

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Plotkin JS, Scott VL, Pinna A, Dobsch BP, DeWolf AM, Kang Y: Morbidity and mortality in patients with coronary artery disease undergoing orthotopic liver transplantation. *Liver Transplantation & Surgery* 1996; 2: 426-30.

Neuroanesthesia

S-256.**EFFECTS OF PHENYLEPHRINE AND EPHEDRINE BOLUS TREATMENTS ON CEREBRAL OXYGENATION IN ANESTHETIZED PATIENTS: PHYSIOLOGICAL MECHANISMS AND CLINICAL IMPLICATIONS**

AUTHORS: B. S. Alexander,^{1,2} Z. Yu,³ Z. Kain,¹ M. Cannesson,¹ W. Mantulin,² L. Meng¹

AFFILIATION: ¹Department of Anesthesiology & Perioperative Care, University of California, Irvine Medical Center, Orange, CA; ²Beckman Laser Institute, University of California, Irvine School of Medicine, Irvine, CA; ³Statistical Department, University of California, Irvine, Irvine, CA

INTRODUCTION: The knowledge of how phenylephrine and ephedrine bolus treatments affect cerebral perfusion and oxygenation has both physiological significance and clinical relevance. The recent findings that cerebral tissue oxygen saturation (SctO₂) is decreased after phenylephrine treatment and preserved after ephedrine treatment deserve further study using validated clinical tools. The physiological variable(s), which associates with and thus can predict changes in SctO₂, is poorly investigated in anesthetized patients.

METHODS: A randomized two-treatment crossover trial was conducted: both phenylephrine and ephedrine bolus treatments (order randomized) were given to 29 anesthetized patients with SctO₂, mean arterial pressure (MAP), cardiac output (CO), and other physiological variables recorded before and after pressor treatments. Linear mixed models were used to investigate the associations between SctO₂ and various physiological parameters.

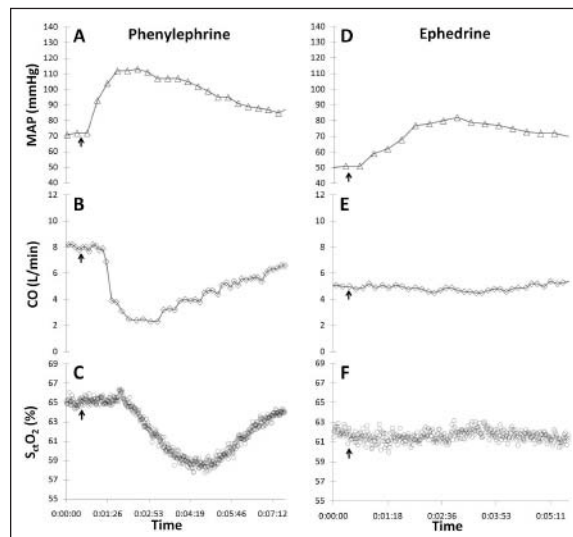
RESULTS: After adjusting the effects of drug treatment, period, and carryover on SctO₂, CO was identified to have the highest significant association with SctO₂ ($p < 0.001$). After taking CO into consideration, the other variables were not significantly associated with SctO₂. CO was significantly decreased after phenylephrine treatment ($p < 0.001$) but preserved after ephedrine treatment ($p > 0.05$). Concordantly, SctO₂ was significantly decreased after phenylephrine treatment ($p < 0.01$) but preserved after ephedrine treatment ($p > 0.05$).

DISCUSSION: CO has better predictive value on changes in cerebral oxygenation than MAP and other commonly monitored variables after phenylephrine and ephedrine administration in anesthetized patients. Whether ephedrine is a better option and whether the observed changes relate to clinical outcome remain to be proven.

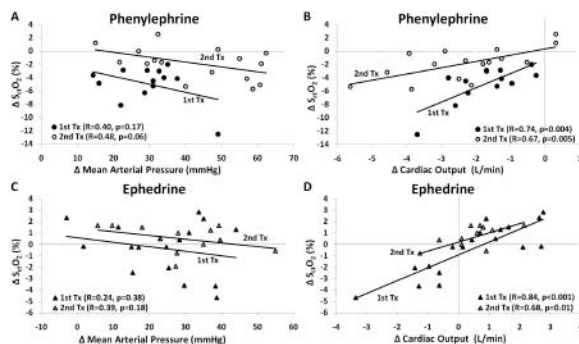
REFERENCES:

Nissen P, Brassard P, Jørgensen TB, Secher NH. Phenylephrine but not ephedrine reduces frontal lobe oxygenation following anesthesia-induced hypotension. *Neurocrit Care* 2010;12:17-23.

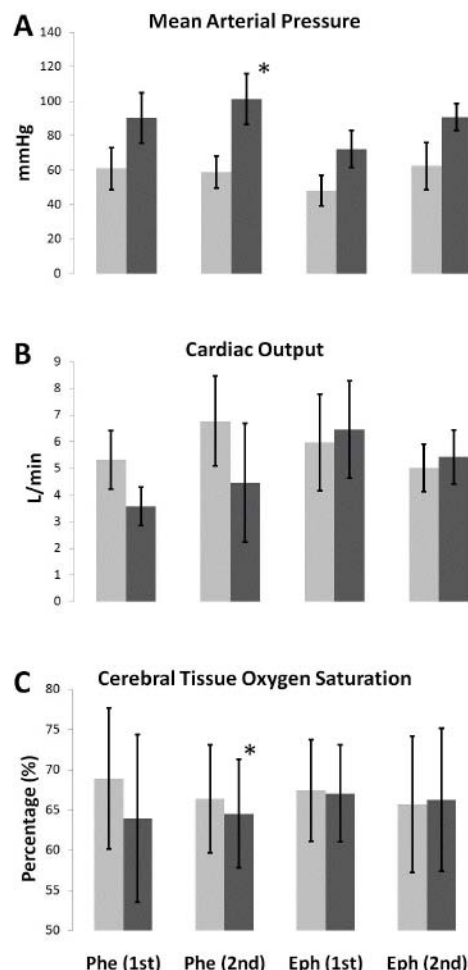
Brassard P, Seifert T, Wissenberg M, Jensen PM, Hansen CK, Secher NH. Phenylephrine decreases frontal lobe oxygenation at rest but not during moderately intense exercise. *J Appl Physiol* 2010;108:1472-8



Continuous mean arterial pressure, cardiac output, and cerebral tissue oxygen saturation change after phenylephrine and ephedrine bolus treatment.



Correlations between cerebral tissue oxygen saturation and system hemodynamics (mean arterial pressure and cardiac output).



Grouped responses in mean arterial pressure, cardiac output, and cerebral tissue oxygen saturation after the first and second phenylephrine and the first and second ephedrine treatments.

S-257.**EFFECTS OF HEAD UP POSITION, HYPERVENTILATION, AND INCREASED MEAN ARTERIAL PRESSURE ON CEREBRAL BLOOD VOLUME: A QUANTIFICATION STUDY USING FREQUENCY DOMAIN NEAR-INFRARED SPECTROSCOPY**

AUTHORS: B. S. Alexander,^{1,2} Z. Yu,³ Z. Kain,¹ M. Cannesson,¹ A. Cerussi,² L. Meng¹

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INTRODUCTION: Cerebral blood volume (CBV) is one of the key contributing factors to intracranial pressure (ICP). Head up position and hyperventilation are routinely used to decrease CBV in patients with dangerously elevated ICP. The use of phenylephrine and ephedrine to maintain an “acceptable” mean arterial pressure (MAP), thus presumably cerebral perfusion pressure, has the potential to affect CBV. Because recommendations for managing intracranial hypertension are often based on clinical experience, quantitative studies are needed to substantiate these common practices.

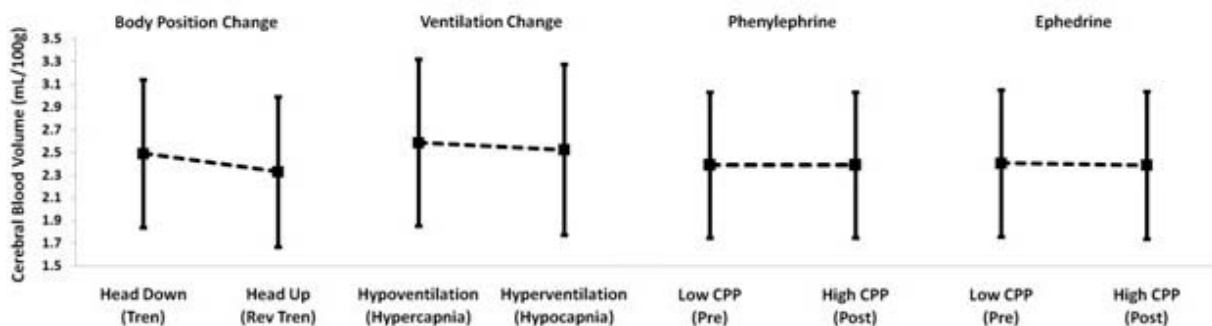
METHODS: Using frequency domain near-infrared spectroscopy (FD-NIRS), the extent to which head up position (28 patients), hyperventilation (30 patients), phenylephrine treatment (31 patients), and ephedrine treatment (31 patients) affected CBV in 33 anesthetized patients was studied. Cerebral tissue total hemoglobin concentration (THC) measured by FD-NIRS was used to calculate CBV. Linear mixed models and paired student’s t-test were used for analysis.

RESULTS: CBV was significantly decreased from head down (Trendelenburg) to head up (reverse Trendelenburg) position ($6.6 \pm 4.3\%$, mean \pm SD, $P < 0.001$) and from mild hypoventilation to hyperventilation ($2.3 \pm 1.6\%$, mean \pm SD, $P < 0.001$). CBV was not affected by increased MAP after both phenylephrine ($0.11 \pm 2.5\%$, mean \pm SD, $P = 0.86$) and ephedrine ($0.8 \pm 1.7\%$, mean \pm SD, $P = 0.04$) treatments.

DISCUSSION: The decreasing effect of head up position and hyperventilation on CBV is substantiated. The insignificant change in CBV after phenylephrine and ephedrine administration is proven. Still, how those effects occur and relate to clinical outcome remains to be defined.

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Effects of head up position, hyperventilation, and increased mean arterial pressure cause by phenylephrine and ephedrine treatments on cerebral blood volume.

S-258.**EFFECT OF PHENYLEPHRINE BOLUS TREATMENT ON CEREBRAL OXYGENATION DURING HYPOCAPNIA, NORMOCAPNIA, AND HYPERCAPNIA IN ANESTHETIZED PATIENTS**

AUTHORS: B. S. Alexander,^{1,2} G. Chen,¹ Z. Kain,¹ B. Tromberg,² W. Mantulin,² L. Meng¹

AFFILIATION: ¹Department of Anesthesiology & Perioperative Care, University of California, Irvine Medical Center, Orange, CA; ²Beckman Laser Institute, University of California, Irvine School of Medicine, Irvine, CA

INTRODUCTION: It has recently been discovered that phenylephrine bolus and infusion administration causes a decrease in cerebral tissue oxygen saturation (SctO₂) measured with near infrared spectroscopy (NIRS). A direct action of phenylephrine on cerebral vessel resistance is unlikely because vasoactive amines do not cross the blood brain barrier. The mechanism might be related to increased sympathetic nerve activity to the brain secondary to either a large and rapid rise in blood pressure or a reduction in stroke volume and/or cardiac output (CO). Taking together the knowledge that CO₂ is a well known cerebral vasodilator, we are interested in investigating if the decreases in SctO₂ caused by phenylephrine bolus treatment differ at varying arterial blood CO₂ tensions (PaCO₂).

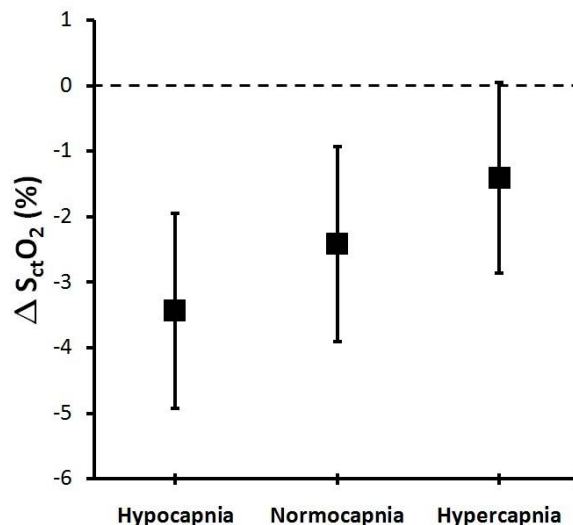
METHODS: In 14 anesthetized patients, intraoperative minute ventilation (tidal volume, VT ≈ 7-10 mL/kg; respiratory rate, RR ≈ 8-12 breaths/minute) was first adjusted to achieve normocapnia (end-tidal CO₂, ETCO₂ ≈ 38-40 mmHg). Then minute ventilation was adjusted to achieve both hypocapnia (ETCO₂ ≈ 24-26 mmHg) and hypercapnia (ETCO₂ ≈ 54-56 mmHg) via decreasing or increasing VT and RR approximately 40-60%. PaCO₂ was determined via blood gas analysis. The order of hypocapnia and hypercapnia was randomized. Once the target ETCO₂ level was achieved and remained stable, phenylephrine bolus administration was performed to increase mean arterial pressure (MAP) 20-40%. Physiological variables (SctO₂, MAP, CO, ETCO₂, and PaCO₂) were recorded before and after each treatment. The interval between phenylephrine treatments was at least 15 minutes. Linear mixed models for repeated measurements were used in analysis.

RESULTS: Phenylephrine bolus treatment significantly decreased SctO₂ at hypocapnia, normocapnia, and hypercapnia (P < 0.01). The decreases in SctO₂ were 3.44 ± 1.5% at hypocapnia, 2.42 ± 1.5% at normocapnia, 1.41 ± 1.5% at hypercapnia (mean ± SD). The differences of changes in SctO₂ among hypocapnia, normocapnia, and hypercapnia are significant (P < 0.01).

DISCUSSION: Phenylephrine bolus treatment is able to decrease SctO₂ during hypocapnia, normocapnia, and hypercapnia. However, the decremental effect of phenylephrine on SctO₂ depends on the PaCO₂ level. The decrease in SctO₂ at a high PaCO₂ level is less than that at a low PaCO₂ level. We speculate that CO₂-mediated cerebral vasodilation is able to mitigate phenylephrine-caused decreases in cerebral perfusion and oxygenation.

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Nissen P, Brassard P, Jørgensen TB, Secher NH: Phenylephrine but not ephedrine reduces frontal lobe oxygenation following anesthesia-induced hypotension. *Neurocrit Care* 2010; 12:17-23



Change in cerebral tissue oxygen saturation (ΔSctO₂) during hypocapnia, normocapnia, and hypercapnia.

S-259.**PALANOSETRON AS PART OF A TRIPLE THERAPY COMBINATION WITH DEXAMETHASONE, AND PROMETHAZINE FOR PROPHYLAXIS OF PONV IN HIGH-RISK PATIENTS UNDERGOING NEUROLOGICAL SURGERY AND GENERAL ANESTHESIA**

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INTRODUCTION: Post-operative nausea and vomiting (PONV) occurs in as many as 70%-80% of high risk surgical patients. The incidence is 50% for nausea and 39% for vomiting in neurosurgical patients. According to the simplified risk score model from Apfel et al, the greater the number of independent predictors, the higher the risk for PONV. The Society of Ambulatory anesthesia recommends that patients at high risk should receive two or more prophylactic drugs from different classes to prevent PONV. Previous triple-therapy combinations have been suggested in the literature. Palonosetron is unique among 5-HT₃ receptors antagonists because it has a three times longer half-life and a higher affinity to the 5-HT₃ receptors. We evaluated the use of this novel drug in a triple therapy combination with Dexamethasone and Promethazine for the prevention of PONV in patients at a high risk undergoing neurosurgery under general anesthesia.

METHODS: With IRB approval and informed consent, we conducted a prospective, non randomized, open label, single-arm, single-center study on 44 patients undergoing craniotomy under general anesthesia for more than one hour at OSUMC. Patients aged between 18 and 85, which had not received prior medications with antiemetic properties 24 hrs before surgery, were included in this study. All patients received triple therapy consisting of palonosetron 0.075 mg IV, dexamethasone 10 mg IV and promethazine 25 mg IV as single doses at induction of general.

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RESULTS: A total of 29 patients completed the study. The most frequent risk factor observed was 1 (0-4). The incidence of vomiting was 2%, 12% and 15% at day 1, delayed period (day 2-5) and overall period (day 1-5) after surgery. During the first 24 hours, complete response (CR) was observed in 49% (no emesis and no rescue medication) and complete control (CC) in 54% (no more than mild nausea, no emesis and no rescue medication). Overall, in the period between 0 and 120 hr after surgery, 34% of patients had CR and 49% had CC.

DISCUSSION: The evaluated triple-therapy with palonosetron showed to be an effective regimen for the prevention of PONV for up to 120 hours in patients undergoing neurological surgery under general anesthesia.

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S-260.**CIRCULATING ENDOTHELIAL PROGENITOR CELLS (EPCs) AND BRAIN ARTERIOVENOUS MALFORMATION (AVM) POSTOPERATIVE NEUROLOGICAL OUTCOME**

AUTHORS: N. Ma, M. Lawton, W. Young, C. Lee

AFFILIATION: University of California, San Francisco, San Francisco, CA

INTRODUCTION: Surgical resection can be curative for brain arteriovenous malformations (AVMs), but it entails considerable risk of postoperative neurological deficits. Circulating endothelial progenitor cells (EPCs) are adult stem cells found in the bone marrow and peripheral circulation. They appear to protect against cardiovascular and neurological injuries through differentiation into new vessels and production of angiogenic and neurotrophic factors, which may have importance in patients undergoing AVM surgery, in that vascular and/or neurological injury is a precipitant of neurological deficits. Our objective of this pilot study is to explore the association of EPCs with patients' surgical outcome assessed by change in modified Rankin's Scale (mRS) after AVM resection, using the new developments in EPC studies from cardiovascular research to study the potential functional contributions from EPC subsets in vascular- and neuro-regeneration.

METHODS: This study has been conducted in an actively followed unruptured AVM surgical case cohort from the UCSF Brain AVM Study Project. The assessments of patient neurological function using the mRS were recorded preoperatively and at 3 months follow-up postoperatively. Blood samples were collected preoperatively. The concentrations of angiogenic and neurotrophic factors in early EPC culture supernatants were measured by ELISA. The outgrowth of late EPC colonies was also examined.

RESULTS: Concentration of VEGF in early EPC culture supernatants, representing a major factor delivered by early EPCs in vascular and neurological repairs, showed a trend of 3-fold higher levels (17.65 ± 19.66 vs. 4.85 ± 2.83 , $p=0.24$) in AVM patients ($n=10$) with good surgical outcome (no change or better in mRS) than inpatients ($n=4$) with poor outcome (worse in mRS) at 3-months postoperative follow-up compared to preoperative baseline. Outgrowth colonies, representing a major endothelial type of functions of late EPCs, were present in 44% of AVM patients with good surgical outcome ($n=13$), which was more than that of 25% in those with poor surgical outcome ($n=4$).

DISCUSSION: Our project will help understand how EPCs may be used to aid risk stratification and the pathophysiology of recovery following AVM surgery, and guide development of future trials, including modifications of perioperative anesthesia care, using perioperative EPCs as a therapeutic modality. Promising results from this pilot study further support the feasibility of our research proposal.

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1. Science 1997;275:964-7;
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3. Stroke 2004;35:2390-5; 4. Circulation 2009;119:699-708

S-261.**DOES REMIFENTANIL REDUCE SEVOFLURANE REQUIREMENTS TO BLOCK AUTONOMIC HYPERREFLEXIA IN PATIENTS WITH COMPLETE SPINAL CORD INJURY?****AUTHORS:** K. Y. Yoo, C. W. Jeong**AFFILIATION:** Chonnam National University Medical School, Gwangju, Republic of Korea**INTRODUCTION:** An inhaled anesthetic concentration required to block autonomic hyperreflexia (AHR) is high enough to cause severe hypotension in patients with high spinal cord injury (SCI).¹ We determined the effects of remifentanil on the sevoflurane requirement to block AHR in SCI.**METHODS:** The study involved 96 patients with chronic, complete SCI scheduled to undergo transurethral litholapaxy during general anesthesia. Anesthesia was induced with thiopental, and sevoflurane concentrations in 50% nitrous oxide were adjusted to maintain a bispectral index of 40 to 50. Whether the patient develops an AHR [Δ systolic blood pressure (SBP) >20-40 mmHg] was first examined by distending the bladder with glycine solution (the first trial). Patients who developed AHR were then allocated to receive no remifentanil infusion (control, n = 31), a target-controlled plasma concentration of 1 ng/mL (n = 25), or 3 ng/mL remifentanil (n = 24). After baseline hemodynamics had recovered, the target sevoflurane and remifentanil concentrations were maintained for at least 20 minutes and the procedure was resumed (the second trial). Each target sevoflurane concentration was determined by the up-and-down method based on changes (15% increase or more) of SBP in response to the bladder distension. SBP, heart rate, and bispectral index were measured before and during the bladder distension during the trials, and plasma concentrations of catecholamines during the first trial.**Challenging Case Report (only complete if your submission falls into the “Challenging Case Report” category. If you select the “Challenging Case Report” category on the next step, this section must be completed.):** N/A**RESULTS:** Eighty-two (85.4%) of 96 patients developed AHR during the first trial. During the second trial, the end-tidal concentrations of sevoflurane to prevent AHR were reduced to 2.6% (95% confidence interval 2.5% to 2.8%, $P < 0.01$) and 2.2% (2.1% to 2.4%, $P < 0.0001$) in the groups receiving 1 and 3 ng/mL remifentanil, respectively, in comparison with 3.1% (2.9% to 3.3%) in the control. When considering minimum anesthetic concentration (MAC) values and the contribution of 50% nitrous oxide (0.48 MAC), the combined MAC values, expressed as multiples of MAC, were 2.27, 1.98, and 1.75 in the control, 1 ng/mL remifentanil, and 3 ng/mL remifentanil groups, respectively.**DISCUSSION:** Target-controlled concentrations of 1 and 3 ng/mL remifentanil would reduce the requirement of sevoflurane combined with 50% nitrous oxide to block AHR by 16% and 29%, respectively, in SCI patients undergoing transurethral litholapaxy.**REFERENCES:**

1. Yoo et al. Anesthesiology 2008;108:858-63

S-262.**HYPERGLYCEMIA DURING CRANIOTOMY FOR ADULT TRAUMATIC BRAIN INJURY**

AUTHORS: D. Sharma, T. Pecha, N. Hoffman, P. Sookplung, P. Curry, M. S. Vavilala

AFFILIATION: University of Washington, Seattle, WA

INTRODUCTION: Hyperglycemia after traumatic brain injury (TBI) is associated with poor outcome but previous studies have not addressed intraoperative hyperglycemia in adult TBI.¹⁻³ In this study, we examined glycemic patterns and risk factors for hyperglycemia during craniotomy in adults with TBI.

METHODS: A retrospective cohort study of patients ≥ 18 years who underwent urgent or emergent craniotomy for TBI at our level 1 Adult and Pediatric Trauma Center between October 2007 and May 2010 was performed. Preoperative (within 24 h of anesthesia start) and intraoperative (during anesthesia) glucose values for each patient were retrieved. The prevalence of intraoperative hyperglycemia (glucose ≥ 200 mg/dL), hypoglycemia (glucose < 60 mg/dL), and glycemic trends were determined. Generalized Estimating Equations was used to determine the independent predictors of intraoperative hyperglycemia. Data are presented as adjusted odds ratio (AOR) (95% CI) and $p < 0.05$ reflects significance.

RESULTS: Data from 185 patients were included in the final analysis. Intraoperative hyperglycemia was common ($n=26$ [15%]) and intraoperative hypoglycemia was not observed. Independent risk factors of intraoperative hyperglycemia were age ≥ 65 years (AOR 95% CI 3.9 (1.4 - 10.3); $p = 0.007$), Glasgow Coma Scale score < 9 (AOR 95% CI 4.9 (1.6 - 15.1); $p = 0.006$), preoperative hyperglycemia (AOR 95% CI 4.4 (1.7- 11.6); $p = 0.003$) and subdural hematoma (AOR 95% CI 5.6 (1.4 - 22.2); $p = 0.02$). Mean intraoperative glucose was highest in severe TBI patients ($p = 0.02$). There was both between ($p < 0.001$) and within ($p < 0.001$) patient variability in intraoperative glucose. Patients with intraoperative hyperglycemia had higher in-hospital mortality (8 [31%] $p < 0.02$).

DISCUSSION: Intraoperative hyperglycemia was common in adults undergoing urgent/emergent craniotomy for TBI and was predicted by severe TBI, the presence of SDH, preoperative hyperglycemia and age ≥ 65 years. However, there was significant variability in intraoperative glycemic patterns. Anesthesiologists may anticipate intraoperative hyperglycemia based on above clinical and radiological characteristics of TBI.

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3. The Influence of Hyperglycemia on Neurological Outcome in Patients with Severe Head Injury. Neurosurgery. 2000 46(2):335

| Variable | Hyperglycemia (any glucose ≥ 200 mg/dL) (n = 26) | No Hyperglycemia (all glucose < 200 mg/dL) (n = 159) | P |
|--|---|--|----------|
| Age (mean \pm SD, range) | 57 \pm 19 (18-86) | 50 \pm 20 (18-93) | 0.09 |
| Age ≥ 65 years (n = 49) | 16 | 33 | < 0.0001 |
| Male Gender (n = 129) | 16 | 113 | 0.26 |
| Admission Glasgow Coma Scale Score ≤ 8 (n=85) | 29 | 65 | 0.002 |
| Isolated Subdural Hematoma (n = 111) | 21 | 89 | 0.005 |
| Any SDH (n = 136) | 24 | 112 | 0.02 |
| Isolated Extra-axial Hematomas (n = 36) | 1 | 25 | 0.10 |
| Isolated Intra-axial Hematomas (n = 9) | 6 | 9 | 0.21 |
| Multiple Lesions (n = 23) | 2 | 21 | 0.42 |
| In-hospital mortality (n = 28) | 8 | 20 | 0.02 |
| Mortality (n = 68) | 9 | 59 | 0.75 |
| Median anesthesia duration | 201 (130-317) | 200 (93-457) | 0.95 |
| Preoperative HG (n = 31) | 11 | 20 | < 0.0001 |
| Median discharge GCE | 13 (5-15) | 15 (6-15) | 0.09 |

Univariate Factors Associated with Intraoperative Hyperglycemia in 176 Adult Patients with Traumatic Brain Injury

| Risk Factors | Adjusted odds ratio (95% CI) | P |
|---|---------------------------------|-------|
| Age ≥ 65 years | 3.9 (1.4 – 10.3) | 0.007 |
| Admission Glasgow Coma Scale Score ≤ 9 | 4.9 (1.6 – 15.1) | 0.006 |
| Preoperative Hyperglycemia | 4.4 (1.7– 11.6) | 0.003 |
| Isolated Subdural Hematoma | 5.6 (1.4– 22.2) | 0.02 |

Independent Predictors of Intraoperative Hyperglycemia. Data from 176/185 Adults (9 patients with no intraoperative glucose values). Data are adjusted for age and gender.

S-263.**RELATIONSHIP BETWEEN END-TIDAL CO₂ AND CEREBRAL OXYGENATION IN ANESTHETIZED PATIENTS**

AUTHORS: B. S. Alexander,^{1,2} G. Chen,¹ M. Cannesson,¹ A. Cerussi,² B. Tromberg,² L. Meng¹

AFFILIATION: ¹Department of Anesthesiology & Perioperative Care, University of California, Irvine Medical Center, Orange, CA; ²Beckman Laser Institute, University of California, Irvine School of Medicine, Irvine, CA

INTRODUCTION: The plot of the relationship between cerebral blood flow (CBF) and arterial blood CO₂ tension (PaCO₂) has been previously defined. While cerebral perfusion (CBF) and cerebral oxygenation (cerebral tissue oxygen saturation, SctO₂) are related, as well as PaCO₂ and end-tidal CO₂ (ETCO₂), this should not be used to directly imply a relationship between SctO₂ and ETCO₂. In addition, the common practice of using minute ventilation (MV) adjustment to regulate ETCO₂ can potentially cause changes in the other physiological variables, such as mean arterial pressure (MAP), cardiac output (CO), and arterial blood oxygen saturation measured using pulse oximetry (SpO₂), etc. Those associated changes can confound the relationship between SctO₂ and ETCO₂ and need to be considered.

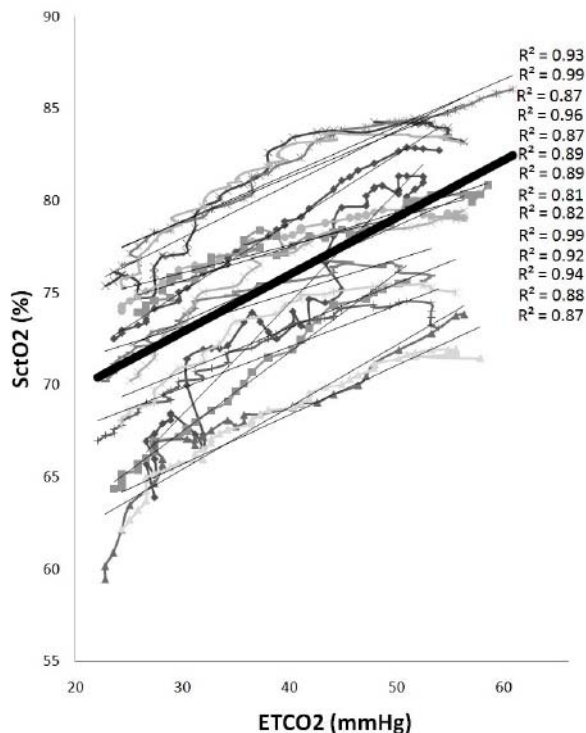
METHODS: Intraoperative MV adjustments were performed in 15 anesthetized patients (9 maintained with propofol and remifentanyl, 6 maintained with sevoflurane) undergoing elective surgery. Pressure controlled mechanical ventilation was used. The protocol began with ventilation pressure set between 8-12cmH₂O, respiratory rate (RR) between 4-6 breaths per minute in order to achieve a starting ETCO₂ of ~55mmHg. Once this point of hypoventilation was achieved and maintained for 5 minutes, we made the first MV adjustment (increasing ventilation pressure by 2cmH₂O and RR by 1) and repeated the same incremental changes every 5 minutes. MV adjustments were stopped once the end point ETCO₂ of ~25mmHg was reached. Throughout MV adjustments, SctO₂ (using Frequency Domain Near-infrared Spectroscopy), MV, ETCO₂, MAP (using arterial line), CO (using esophageal Doppler), SpO₂, and Bispectral index (BIS) were continuously recorded.

RESULTS: All variables were recorded continuously and all data points were considered during analysis. The systematic MV adjustment caused gradual changes in ETCO₂ from ~55mmHg to ~25mmHg. MV and ETCO₂ were significantly associated with each other ($P < 0.001$). ETCO₂ significantly associated with SctO₂ in a linear fashion ($p < 0.001$). After taking ETCO₂ into consideration in linear mixed models, the other covariates did not significantly associate with SctO₂ ($P > 0.05$). The results were not affected by anesthesia maintenance techniques (propofol/remifentanyl vs. sevoflurane).

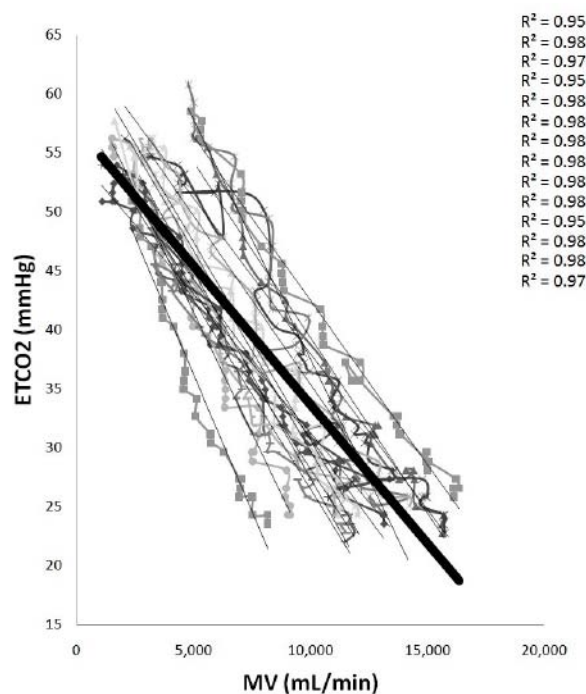
DISCUSSION: There is a linear relationship between SctO₂ and ETCO₂ within the common clinical range of ETCO₂ (~25-55 mmHg) in anesthetized patients. The confounding variables including MAP, CO, SpO₂, and BIS are not the causes of the observed changes in SctO₂ following MV adjustments. This finding is clinically relevant, especially in patients with a high risk of cerebral hypoxia.

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Harper AM, Glass HI. J Neurol Neurosurg Psychiatry 1965; 28:449-52



Relationship between end-tidal carbon dioxide and cerebral tissue oxygen saturation.



Relationship between minute ventilation and end-tidal carbon dioxide.

S-264.**THE USE OF METHOHEXITAL DURING GENERAL ANESTHESIA PREVENTS PROGRESSIVE DETERIORATION OF MOTOR EVOKED POTENTIALS****AUTHORS:** R. T. O'Bannon, S. Dubin**AFFILIATION:** Medical College of Georgia, Augusta, GA

INTRODUCTION: The effectiveness of SSEP's and MEP's to detect cord ischemia and thereby aid in limiting and/or preventing iatrogenic injuries during spinal column corrective procedures has been well established.

The routine use of evoked potential's (EP's) necessitates anesthetic regimens that provide analgesia, hypnosis, anesthesia and immobility, while preserving signal quality.

At our institution EP's for spinal column corrective procedures have been conducted via TIVA or TIVA with 0.4 MAC or less of a volatile agent.

The recent shortage of propofol has pushed the exploration of alternative agents to replace propofol due to its limited supply. Dose response studies have shown that the preservation of MEP's was significantly with a methohexital compared to a propofol infusion (53% vs 14%). Thus we hypothesized that methohexital would be an adequate if not superior alternative to propofol.

METHODS: We report the use of the anesthetic regimen of 0.3-0.4 MAC of volatile agent (sevo or desflurane) with a remifentanyl (0.15 - 0.3 mcg/kg/min) and methohexital infusion (35-75 mcg/kg/min) instead of propofol due to the national shortage of the drug.

RESULTS: Our observations in more than 50 patients, who underwent anterior and/or posterior cervical, thoracic or lumbar spinal corrective procedures, showed a lack of anesthetic deterioration effects. The voltage stimulus needed to effect a 100microV amplitude cMAP response did not increase throughout anesthetic administration.

DISCUSSION: General anesthesia causing "anesthetic fade" of evoked potential signals has been described and quantified. The preservation of MEP's using a methohexital compared to a propofol infusion was shown to be significant. Our results suggests that MEP quality was maintained via our anesthetic regimen.

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S-265.**TRENDS IN POSTOPERATIVE CEREBROVASCULAR EVENTS; A SURVEY OF THE NATIONAL INPATIENT SAMPLE****AUTHORS:** M. Dauber, S. Roth**AFFILIATION:** University of Chicago Dept of Anesthesia and Critical Care, Chicago, IL

INTRODUCTION: Perioperative cerebrovascular events account for significant disability and have a major impact on perioperative financial costs. We surveyed the trends in this diagnosis over the 10 year period from 1995-2008.

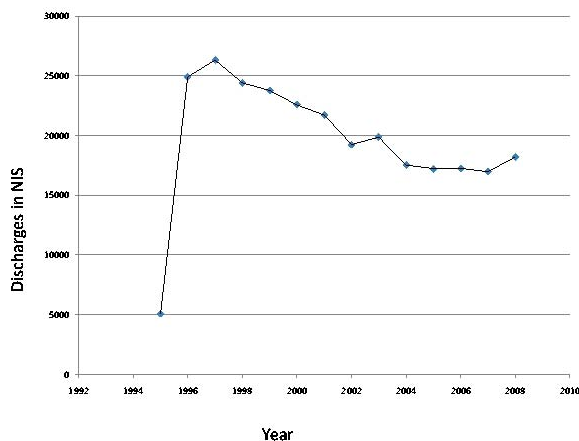
METHODS: Data from the Nationwide Inpatient Sample (NIS, hcupnet.ahrq.gov) were compiled. The NIS is the largest hospital discharge database for all payors in the US containing approximately 40 million records per year, and representing an approximately 20% random sampling of US hospitals. The number of cases where perioperative cerebrovascular infarction or hemorrhage was a discharge diagnosis was compiled for the NIS using ICD-9-CM code 997.02. Data were collected and tabulated for 1995-2008.

RESULTS: Since 1995, the number of discharges with perioperative cerebral hemorrhage increased dramatically, and then has stabilized (Fig. 1). Segregated by age, the 65-84 year old group accounts for the overwhelming majority of the improvement.

DISCUSSION: Postoperative stroke has major physical and financial impact. Stabilizing trends in this morbid event are promising. Especially noteworthy is the decrease in the incidence in the 65-84 year olds, with a recent upward trend in the extreme elderly. As the elderly are submitted to surgery more frequently in the future these trends will be important to follow.

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AHRQ database: hcupnet.gov/hcupnet.jsp (accessed 1/10/2011)



S-266.**A11, AN ANTI-PLATELET ANTIBODY, PREVENTS DELAYED TRANSIENT COGNITIVE DYSFUNCTION CAUSED BY ACUTE NITROGLYCERIN INDUCED HYPOTENSION IN MICE**

AUTHORS: A. Zekan, M. M. Haile, R. P. Kline, A. Y. Bekker, Y. Li, T. Wisniewski

AFFILIATION: NYU Langone Medical Center, New York, NY

INTRODUCTION: Acute nitroglycerin induced hypotension (NTG-IH) in mice to below the level of cerebral blood flow (CBF) auto-regulation causes a delayed transient dysfunction of short term memory (STM) that may have an inflammatory etiology.¹ Patients with HIV-1 immune-related thrombocytopenia have a unique antibody, called A11, against integrin GPIIb/IIIa that induces fragmentation of activated platelets.² We hypothesize that treatment with A11 may ameliorate cognitive dysfunction caused by acute NTG-IH.

METHODS: After IACUC approval, 79 Swiss-Webster mice, in 3 groups were given Day 0 NTG (60 mg/kg) i.p. and A11 (25 µg), i.v. then tested on Day 5: 1) A11 with NTG injection; 2) A11 on return of righting reflex; 3) A11 2 hr after the righting reflex. Three groups were given Day 0 NTG with testing on Day 1, 5, 9. The object recognition test (ORT) measures STM by exploiting the tendency of mice to explore novel objects when familiar object is present. During training, two identical objects were placed in a circular arena with mice for 15 mins. Testing was 1 hour later for 3 mins after a novel object was introduced. Time exploring each object was recorded (SMART system, San Diego Insts). Mice with intact memory spend about 65% of the time exploring the novel object. Mice with impaired memory devote equal time to each object. Recognition Index (RI) is defined as the ratio of time spent exploring the novel object to time spent exploring both objects and was the measure of memory. We tested the specific hypotheses that Day 5 NTG was less than both Day 1 and Day 9 NTG using 1-tailed t-tests ($p < 0.05$). Day 5 ORT scores were less than the Day 5 scores for the A11 treated mice (t-test, $p < 0.05$; the two groups examined where A11 was administered within 2 hours of reflex righting were pooled).

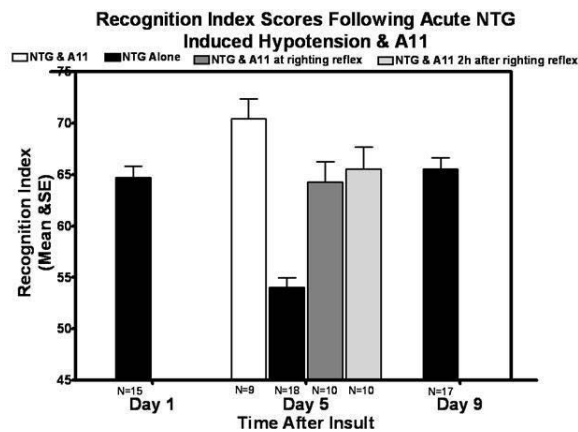
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RESULTS: Mice subjected to 60 mg/kg IP NTG injection exhibited normal RI on Day 1; poor RI on Day 5; and normal RI by Day 9. Mice treated with A11 at the point of NTG administration or within two hours of reflex righting after NTG-IH showed significantly improved scores on Day 5 compared to NTG alone.

DISCUSSION: A11 treatment in all groups prevented the delayed transient loss of SMT 5 days later. Platelet activation is involved in both the coagulation cascade and inflammation. A11 effects only activated platelets with no measurable effect on platelet aggregation, adhesion and bleeding time. It offers a treatment option within a reasonable therapeutic window for acute low CBF states and deserves further investigation.

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1. Journal of Neurosurgical Anesthesiology: Oct 2009-Vol 21-Issue 4-pp 367-426 (Abstract).
2. Blood: 2010 Jun 4.



Recognition index scores following acute NTG induced hypotension and A11 treatment.

S-267.**THE RELATIONSHIP OF CRANIOTOMY TYPE AND POSTOPERATIVE NAUSEA AND VOMITING: A MATCHED CASE-CONTROL STUDY**

AUTHORS: A. Gharapetian, C. Tan, C. R. Ries, K. V. Mayson, D. Griesdale

AFFILIATION: University of British Columbia, Vancouver, BC, Canada

INTRODUCTION: The role of surgical risk factors for postoperative nausea and vomiting (PONV) following elective craniotomy are uncertain. Evidence examining surgical location (infra vs. supratentorial) is conflicting.^{1,2} However, the indication for craniotomy may be more discriminative than its location. To test this hypothesis, and to reduce confounding by known patient and anesthetic risk factors, we designed a matched case-control study of neurosurgical PONV.

METHODS: With institutional ethics approval, a perioperative database was used to identify PONV cases occurring in PAR as well as controls following elective craniotomy between 2003-2008 at Vancouver General Hospital. Wherever possible, cases were matched in a 2:1 fashion with controls on the following confounders: gender, age (\leq or >50), and anesthetic time period (before or after adoption of routine PONV prophylaxis in 2005). Hospital charts were reviewed and data collected on smoking status, craniotomy type (tumor, epilepsy, vascular, microvascular decompression [MVD], and acoustic neuroma [AN]), craniotomy location (infra vs. supratentorial) and anesthetic type (balanced vs. total intravenous anesthesia [TIVA]). We then performed conditional logistic regression adjusting for additional confounders (smoking status, surgical location, PONV prophylaxis, as well as anesthetic type and duration) to evaluate the relationship between craniotomy type and PONV.

RESULTS: One hundred and seventeen cases were matched to 185 controls. Patients had a mean age of 50 (SD 13) and 65% were female. Matching factors were balanced between cases and controls. The majority of craniotomies were supratentorial (70%) with MVD and AN surgery being each performed in 9% of patients. TIVA and PONV prophylaxis were used in 22% and 80% of procedures, respectively. Compared to controls, cases were more likely to be non-smokers (86 vs. 74%, $p=0.01$). On multivariable analysis, MVD (OR 5.8, 95%CI: 1.8-18.4, $p=0.003$) and AN surgery (OR 3.8, 95% CI: 1.2-12.2, $p=0.02$) were associated with increased odds of PONV compared to tumor surgery. Infratentorial location (OR 1.01, 95% CI: 0.47-2.3, $p=0.90$), adequate prophylaxis (OR 0.70, 95% CI: 0.35-1.4, $p=0.31$) and TIVA (OR 0.77, 95% CI: 0.40 -1.5, $p=0.42$) were not independently associated with PONV.

DISCUSSION: Compared to tumor resection, MVD and AN surgery were associated with increased odds of PONV in the PAR. Strategies to reduce PONV, including increased prophylaxis, should be examined in this high-risk population.

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1. J Neurosurg Anesthesiol 1997;9;308-312
2. J Anesth 2003;17;227-31

S-268.**WITHDRAWN.**

S-269.**A SUPERADDITIVE INTERACTION BETWEEN
INFLAMMATION AND ETOMIDATE FOR MEMORY
BLOCKADE IN MICE****AUTHORS:** W. To,¹ D. Wang,¹ B. Orser^{2,3}**AFFILIATION:** ¹Department of Physiology, University of Toronto, Toronto, ON, Canada; ²Department of Anesthesia, University of Toronto, Toronto, ON, Canada; ³Sunnybrook Health Sciences Centre, Toronto, ON, Canada**INTRODUCTION:** Seriously ill patients typically require lower doses of general anesthetics;¹ however, the underlying reasons for the reduced anesthetic requirements have not been clearly elucidated. A major concern associated with the use of lower doses of general anesthetics is that patients will experience the explicit recall of surgical events and “intraoperative awareness”.² It is suspected that general anesthetics and systemic inflammation may cause memory deficits in animal models.³ The goal of the present study was to determine whether systemic inflammation and etomidate interact in a sub-additive, additive or supra-additive manner to modify learning and memory.**METHODS:** All experiments were approved by local ethics committee. Memory performance in 3-4 month old, male 129/Sv × C57BL/6 mice was assessed with contextual fear conditioning assay. The endotoxin lipopolysaccharide (LPS; 125 µg/kg, i.p.) was used to trigger systemic inflammation. Three hours prior to contextual conditioning, each mouse received an injection of either vehicle (saline) or LPS. Additionally, 30 min before training, the mice received either vehicle or etomidate (2, 6, or 10 mg/kg, i.p.). Twenty-four hours after the training session, learning and memory performance was assessed by measuring the percent of time spent freezing in response to the conditioned context. The experimenters were blinded to the drug treatment groups.**RESULTS:** Etomidate caused a concentration-dependent impairment of contextual fear memory as evidenced by a decrease in the freezing scores, $F(2,42) = 24$, $p < 0.0001$. LPS further impaired contextual fear memory in a supra-additive manner, as demonstrated by the markedly lower freezing scores of the LPS-treated groups at all three concentrations of etomidate, $F(1,42) = 42$ ($p = 0.025$).**DISCUSSION:** Inflammation induced by LPS intensified the memory blocking properties of etomidate. Specifically, LPS and etomidate interact in a supra-additive manner to reduce freezing scores in a contextual fear conditioning assay. The results suggest that memory-blocking doses of general anesthetics might be reduced in patients who experience systemic inflammation.**REFERENCES:**

1. Clin Pharm, 1987; 7:533-37.
2. Anesth Analg, 2010; 3:816-22.
3. Ann Neurol, 2010; 3:360-8.

S-270.**KETAMINE ENHANCES MIDDLE LATENCY RESPONSES IN GUINEA PIGS DURING MULT-RATE CLICK STIMULATION****AUTHORS:** J. Bohorquez,¹ R. McNeer,^{2,1} O. Ozdamar¹**AFFILIATION:** ¹University of Miami College of Engineering, Coral Gables, FL; ²University of Miami Miller School of Medicine, Miami, FL

INTRODUCTION: Middle latency responses (MLR) have been extensively studied in the guinea pig model at click stimulation rates up to 40 Hz.^{1,2} High-rate recordings are technically challenging,³ and it has been assumed that high-rate MLR are not significant.¹ We recorded MLR at the inferior colliculus (IC) and cortex in guinea pigs during ketamine anesthesia using multi-rate click stimulation from 5 to 80 Hz.

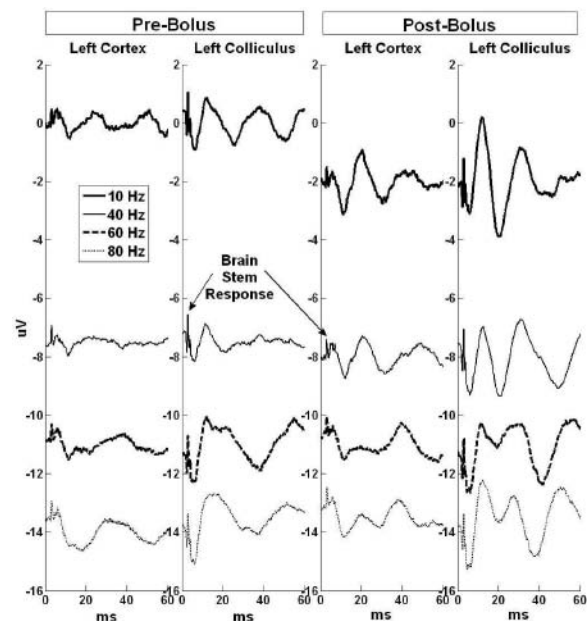
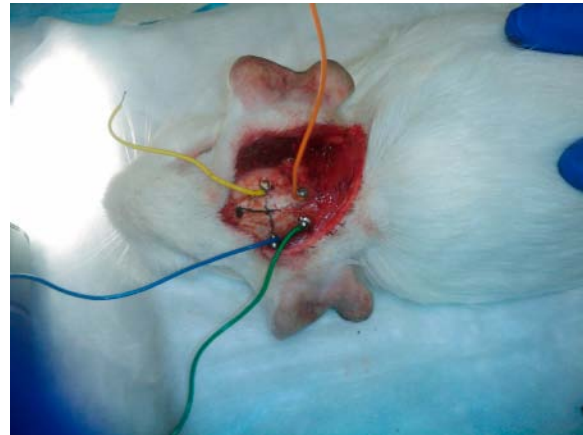
METHODS: With Institutional Animal Care and Use Committee approval, guinea pigs were implanted with dural electrodes at the cortical (5 mm posterior and 7 mm lateral to the bregma) and IC (3 mm lateral to the lambda) regions (Fig 1). Monaural clicks at 80 dB SPL were delivered to the right ear of the animal following a multi-rate stimulation approach: when 10 KHz sampling rate was used jittered rates of 10, 40, 60 and 80 Hz used, and when the sampling rate was set to 5 KHz the rates were: 5, 20, 30 and 40 Hz. EEG recordings (1024 samples/sweep) were deconvolved using continuous loop averaging deconvolution to obtain the MLR.³ Recordings were obtained during “light” levels of anesthesia about 1.5 hours after a bolus of ketamine (pre-bolus) and during “deep” anesthesia immediately after a bolus of ketamine (post-bolus).

RESULTS: All MLR recordings are associated with brain stem responses and share the same voltage scale (Fig 2). Pre-bolus recordings show a diminishment in MLR amplitude as stimulation rate is increased from 5 to 40 Hz (10 and 40 Hz are shown in the figure). Then at as stimulation rates increase from 40 to 80 Hz, MLR amplitude also increases (Fig 2, pre-bolus). Comparing pre- and post-bolus conditions, MLR amplitudes are greater (especially at 5 and 40 Hz) immediately after the ketamine bolus.

DISCUSSION: This preliminary report is the first to investigate the generation of MLR as a function of auditory click stimulation rates greater than 40 Hz in the guinea pig. The first important finding that MLR generation actually is enhanced at unconventionally higher rates was unexpected. We will develop methods to record MLR at even higher rates in order to determine the rate ceiling. A second preliminary finding suggests that ketamine enhances MLR generation in the IC and cortex, not dissimilar to human findings in which ketamine increases the amplitude of the steady-state response.⁴ These effects are opposite of what is observed for other anesthetic agents. The present results and the rodent model described here will be extended to investigations of the effects of anesthesia on auditory information processing.

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3. J Acoust Soc Am 2004;115:1242-51
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S-271.**SCOPOLAMINE USED IN COMBINATION WITH
DEXAMETHASONE AND ONDANSETRON AS AN
EFFECTIVE TRIPLE THERAPY REGIMEN FOR THE
PREVENTION OF PONV IN HIGH-RISK PATIENTS**

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J. Werner, S. D. Bergese

AFFILIATION: The Ohio State University, Department of
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INTRODUCTION: Nausea and vomiting is one of the most common complaints concerning both patients and clinicians in the perioperative setting. Post operative nausea and vomiting (PONV) occurs in as many as 70%-80% of high risk surgical patients. In neurosurgical patients alone, the incidence is 50% for nausea and 39% for vomiting. SAMBA Guidelines recommend the use of a combination of one or two antiemetic drugs in adults at moderate risk, and two or more in adults at high risk. In an effort to find a multimodal treatment for PONV, scopolamine may be used as an effective option. Scopolamine is a belladonna alkaloid, acting as a nonselective muscarinic antagonist with both peripheral antimuscarinic properties and central sedative, antiemetic and amnesic effects. Scopolamine is the first drug of this class commercially available with a transdermal therapeutic system (TTS) delivery, allowing for 72 hours of continuous release of the drug. Therefore, we sought to evaluate the efficacy of a triple therapy combination with scopolamine, dexamethasone and ondansetron, for the prevention of PONV in patients undergoing neurological surgery under general anesthesia.

METHODS: After IRB approval and informed consent, we conducted a prospective, non randomized, open label, single-arm, single-center study on 18 patients that underwent craniotomies under general anesthesia for more than one hour at OSUMC. Patients aged between 18 and 85, which had not received prior medications with antiemetic properties 24 hrs before surgery, and had no history of increased intraocular pressure, were included in this study. All patients received triple therapy consisting of a transdermal scopolamine patch (1.5 mg), placed over the mastoid area within 2 hours prior to surgery, IV dexamethasone (10 mg) and IV ondansetron (4mg), administered as single doses immediately before induction.

Challenging Case Report (only complete if your submission falls into the “Challenging Case Report” category. If you select the “Challenging Case Report” category on the next step, this section must be completed.): N/A

RESULTS: A total of 18 patients were treated with triple-therapy. The most frequent number of PONV risk factors was 1 (0-4). During the first 24 hours, complete response (CR) was observed in 72.22% (no emesis and no rescue medication) and complete control (CC) in 66.66% (no more than mild nausea, no emesis and no rescue medication). Of those, 3 had both nausea and vomiting, 2 had nausea only and 13 had no symptoms. Overall, in the period between 0 and 120 hr after surgery, 80.02% of patients had CR and 78.91% had CC. Only one patient had an episode of mydriasis. No other adverse events were noted in the patients.

DISCUSSION: The evaluated triple-therapy showed to be an effective regimen for the prevention of PONV for up to 120 hours in patients undergoing neurological surgery under general anesthesia.

REFERENCES: N/A

S-272.**A COMPARISON OF DESFLURANE INHALATION AND PROPOFOL TCI REGIMEN FOR TEMPORAL LOBECTOMY: EARLY RECOVERY, COGNITIVE FUNCTIONS AND COST**

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AFFILIATION: Department of Anesthesiology, Faculty of medicine, Chulalongkorn University, Bangkok, Thailand

INTRODUCTION: Despite the varieties of the anesthesia regimen practicing for craniotomy, rapid emergence is one of the important goals of Neuroanesthesia. In this study, we compared desflurane inhalation (Group D) and propofol TCI (Group P) regimen in patients undergoing craniotomy for temporal lobectomy in the context of recovery profiles including time of recovery, cognitive function, postoperative pain, post-operative nausea and vomiting (PONV). In addition, we compared the costs between the regimens.

METHODS: This study was a prospective randomized trial. Forty-two patients were randomly assigned into group D with desflurane inhalation and group P with propofol TCI. Anesthetic depth was controlled by bispectral index (BIS). Time to awakening, cognitive function using Mini-Mental Status Exam (MMSE-Thai version), pain score and PONV were documented. All patients were followed clinical symptoms and recovery profiles until 24 hours postoperatively.

RESULTS: Time from discontinuing anesthesia to eye opening and obey command was faster in group D than group P (5.20 ± 2.91 vs. 8.90 ± 4.64 min). However, times to extubation and orientation were similar. There were no statistical significant differences in PACU recovery scores, discharge times or MMSE scores between both groups. Significantly more patients suffered PONV in group D than group P (45% vs. 4%). Pain scores, shivering needed to be treated, 24 hour MMSE scores were not different. Overall costs were significant higher in group P than group D (2924.88 vs. 1474.34 Thai Baht).

DISCUSSION: Both anesthetic regimens proved successful in terms of fast recovery in all patients undergoing craniotomy for temporal lobectomy with absence of serious complication. Even though group D tends to have faster recovery time, the clinical relevant had not yet been demonstrated. Apart from drug delivery system, manpower and adverse event related costs, Group D has a significant lower cost in comparison to Group P.

In conclusion, with similar emergence and recovery profiles, desflurane inhalation regimen (Group D) has a significant lower cost than propofol TCI regimen (Group P) in Anesthesia for temporal lobectomy.

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5. Anesth Analg 2004;98: 632-41.
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Average cost per case in Thai Baht

| | Desflurane (n=20) | | Propofol (n=21) | |
|----------------|----------------------|------------|----------------------|------------|
| | Mean \pm SD | Percentage | Mean \pm SD | Percentage |
| Desflurane | 917.45 \pm 299.07 | 48.35 | 0 | 0 |
| Propofol | 348 | 18 | 2618.29 \pm 849.71 | 83.37 |
| Cis-atracurium | 427.2 \pm 89.50 | 22.51 | 457.71 \pm 90.26 | 14.57 |
| Fentanyl | 42.35 \pm 12 | 2.23 | 42.17 \pm 11.58 | 1.34 |
| Antiemetics | 157 \pm 178 | 8.27 | 16.62 \pm 76.158 | 0.53 |
| Analgesics | 5.2 \pm 2.62 | 0.27 | 5.26 \pm 2.62 | 0.17 |
| Anti-Shivering | 0.33 \pm 1.45 | 0.02 | 0.62 \pm 1.96 | 0.02 |
| Overall Costs | 1897.57 \pm 237.78 | 100 | 3124.09 \pm 884.69 | 100 |

1 US Dollar = 30 Thai Baht

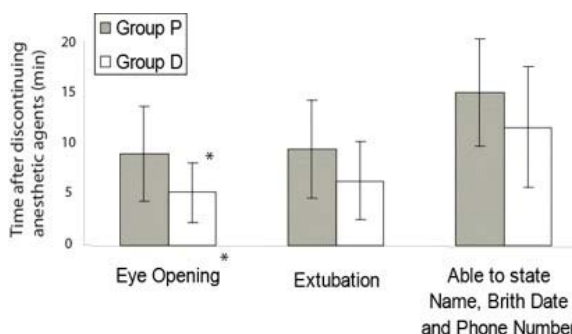


Figure 1: Time after discontinuing anesthetic agent to eye opening, extubation and able to state name, birthdate and phone number (min).

S-273.**IL-1 β INCREASES α 5GABA $_A$ RECEPTOR ACTIVITY IN VITRO AND CAUSES MEMORY DEFICITS IN WILD TYPE BUT NOT GABRA5-/- MICE IN VIVO****AUTHORS:** D. Wang,^{1,2} B. Orser^{1,3}**AFFILIATION:** ¹Department of Anesthesia, University of Toronto, Toronto, ON, Canada; ²Department of Physiology, University of Toronto, Toronto, ON, Canada; ³Department of Anesthesia, Sunnybrook Health Sciences Centre, Toronto, ON, Canada**INTRODUCTION:** Postoperative cognitive dysfunction (POCD) is a common and serious problem associated with surgery and anesthesia. Memory deficits are a prominent and persistent symptom. There is no specific treatment for POCD as the underlying mechanisms remain poorly understood. Surgical injury increases the release of pro-inflammatory cytokines, such as IL-1 β . These pro-inflammatory cytokines interfere with cognitive function. A tonic inhibitory conductance generated by α 5 subunit containing GABA $_A$ receptors (α 5GABA $_A$ Rs) is known to play a critical role in learning and memory. Here we test the hypothesis that the cytokine IL-1 β enhances a tonic conductance generated by α 5GABA $_A$ Rs, which contributes to memory deficits.**Methods:** Experiments were approved by the local animal care committee. Whole-cell currents were recorded from cultured murine hippocampal neurons. The tonic current was studied by adding a low concentration of GABA (0.5 μ M) to the extracellular solution and then measuring the change in the holding current during an application of the competitive GABA $_A$ antagonist bicuculline (100 μ M). Memory behavior was studied in wild type and α 5GABA $_A$ null mutant (*Gabra5*^{-/-}) mice with a fear conditioning assay. Systemic inflammation was induced by either the administration of endotoxin lipopolysaccharide (LPS) or IL-1 β by intraperitoneal injection. Data are presented as mean \pm SEM.**RESULTS:** IL-1 β caused a concentration-dependent increase in the tonic current with the maximal effect observed at 20 ng/ml (control: 1.06 ± 0.08 pA/pF, $n = 21$ versus 1.57 ± 0.10 pA/pF, $n = 22$; $P < 0.05$). IL-1 β increased the tonic current by activating the IL-1 receptor as the enhancement was blocked by an IL-1 receptor antagonist. The IL-1 β -enhanced tonic current was primarily generated by α 5GABA $_A$ Rs as the increase was blocked by a α 5GABA $_A$ -selective antagonist. Systemic administration of LPS and IL-1 β decreased the freezing scores for contextual fear conditioning in wild type mice but not *Gabra5*^{-/-} mice.**Discussion:** IL-1 β acts via the IL-1 receptor to enhance the tonic conductance mediated by α 5GABA $_A$ Rs in hippocampal neurons. This increase in α 5GABA $_A$ activity likely contributes to memory deficits associated with systemic inflammation. Given that IL-1 β levels increase dramatically after surgery, our data suggest that surgical inflammation causes an increase in α 5GABA $_A$ activity which contributes to postoperative memory loss.**REFERENCES:**

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4. J Neurosci 2006 26: 3713-3720.
5. J Neurosci 2010 30: 5269-5282.

S-275.**THE USE OF ASPIRIN ASSAYS IN THE MANAGEMENT OF IATROGENIC CAROTID ARTERY DISSECTION****AUTHORS:** M. Cordova, P. brous, J. Lesser, J. Kim**AFFILIATION:** St. Luke's-Roosevelt, New York, NY**INTRODUCTION:** N/A**METHODS:** N/A**Challenging Case Report (only complete if your submission falls into the "Challenging Case Report" category. If you select the "Challenging Case Report" category on the next step, this section must be completed.):** A 49 year old woman underwent elective embolization of an intracranial arteriovenous malformation (AVM). Post -embolization angiography revealed an iatrogenic carotid artery dissection. A general consensus determined the risk of thrombus formation in the dissection outweighed the risk of post-embolization AVM rupture, and the decision was made to immediately administer anti-platelet therapy prior to stenting. A heparin bolus and infusion were administered and the patient was given a 325 mg aspirin suppository. Heparin infusion rates were titrated to ACT and aspirin effect was monitored using the VerifyNowTM (Accumetric, San Diego, CA) assay. Blood samples for the aspirin assay were collected at times of 0, 30, and 60 minutes with results of 626, 611, and 612 aspirin reaction units (ARU). An adequate response to aspirin is defined as <550 ARUs.^{1,2} Given the lack of response to the aspirin, the decision was made to delay the carotid stenting until the patient developed a therapeutic response. The patient was awakened, extubated and transferred to the neurosurgical ICU with a heparin infusion. An aspirin assay 2.5 hours later was therapeutic (423 ARUs) and remained therapeutic until post-op day 2 when the patient underwent successful carotid stenting.**RESULTS:** N/A**DISCUSSION:** Complications of endovascular embolization of intracranial AVMs can be devastating.³ In this case, the risk of post-embolization AVM rupture had to be balanced with the risk of thromboembolism related to the carotid dissection. The post-embolization angiogram demonstrated good venous outflow from the remaining AVM which predicted a lower risk of hemorrhage. Accordingly, the decision was made to initiate anti-platelet therapy to treat the carotid dissection and prepare the patient for carotid stenting.The benefits of preop aspirin and clopidogrel for carotid artery stents have been extensively studied³ and they are the standard of care for elective carotid stenting. Recent studies have shown aspirin resistance to be relatively uncommon while clopidogrel resistance is 50-66%.^{1,2} Dual anti-platelet therapy was believed to be too great of a risk in this patient, and therefore, aspirin and heparin were given with intraoperative monitoring of ACT and ARU. Rectal administration of aspirin has the same bioavailability as oral, but with a slower onset of absorption.⁴ To our knowledge, we present the first case in which aspirin assays were used intraoperatively after an iatrogenic carotid artery dissection.**REFERENCES:**

1. J Neuroimaging 2010; 20:64-69.
2. Am J Neuroradiol 29:281-85. Feb 2008.
3. Eur J Vasc Endovasc Surg, 522-527. May 2005.
4. Acta Anaesthesiol Scand 25-6, Feb 1981.

S-276.**APREPITANT VS ONDANSETRON AS TRIPLE-THERAPY FOR THE PROPHYLAXIS OF POSTOPERATIVE NAUSEA AND VOMITING**

AUTHORS: A. A. Uribe,¹ E. G. Puente,¹ A. Vilorio,¹ A. S. Schultz,¹ G. Zisman,² S. D. Bergese¹

AFFILIATION: ¹The Ohio State University, Department of Anesthesiology, Columbus, OH; ²University of Buffalo, Department of Anesthesiology, Buffalo, NY

INTRODUCTION: The incidence of post-operative nausea and vomiting (PONV) is 50% to 80% postoperatively after craniotomy. The common prophylactically administered treatment for PONV is a triple therapy combination of Droperidol, Promethazine and Dexamethasone. Preliminary studies have shown a decreased incidence in PONV when using NK-1 antagonists. Of further interest, the NK-1 antagonist Aprepitant may have antiemetic effects as far out from surgery as 48 hours, important with post-discharge nausea and vomiting and opioid induced emesis. We hypothesized that the triple therapy with Aprepitant will decrease the incidence of PONV when compared to Ondansetron.

METHODS: Under IRB approval we conducted a prospective, randomized, double blind, single-center study on 41 patients that underwent craniotomies under general anesthesia for more than one hour at OSUMC. Patients aged between 18 and 85, which had not received prior medications with antiemetic properties 24 hr before surgery, were included in this study. Patients were randomized to receive oral aprepitant 40 mg (or placebo) within 2 hr from induction of anesthesia. All patients received ondansetron 4 mg IV (or placebo), dexamethasone 10 mg IV and promethazine 25 mg IV at induction of anesthesia. Patients were followed for episodes of nausea and vomiting, rescue medications, opioid consumption and safety for 5 days postoperatively.

Challenging Case Report (only complete if your submission falls into the “Challenging Case Report” category. If you select the “Challenging Case Report” category on the next step, this section must be completed.): N/A

RESULTS: A total of 41 patients completed the study. The most frequent number of patient related PONV risk factors with Apfel's scale was 1 (0-4). The cumulative incidence of vomiting was 7%, 12% and 12% at 2, 24 and 72 hours after surgery. During the first 24 hours, complete response (CR) was observed in 68% (no emesis and no rescue medication) and complete control (CC) in 73% (no more than mild nausea, no emesis and no rescue medication). Overall, in the period between 0 and 120 hr after surgery, CR was 51% and CC was 61%.

DISCUSSION: Both triple-therapy regimens evaluate, with aprepitant or ondansetron, showed to be an effective regimen for PONV prophylaxis for up to 120 hours in high-risk adult patients undergoing neurological surgery under general anesthesia.

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2. Annals of French Anesth and Reanim 2004; 23(4): 422-27
3. Anesth 2000; 93(1): 48-54.
4. Anesth 2006; 104(5): 906-09

S-277.**HIPPOCAMPUS CYTOKINE EXPRESSION FOLLOWING ACUTE HYPOTENSION AND ANTI-INFLAMMATORY TREATMENT IN ADULT MICE**

AUTHORS: E. A. Garcia, M. M. Haile, S. Galoyan, R. P. Kline, A. Y. Bekker

AFFILIATION: New York University Medical Center, Department of Anesthesiology, New York, NY

INTRODUCTION: Hypotension has been implicated in the development of cognitive dysfunction (CD). Nitroglycerin induced hypotension (NTG-IH) to below the range of cerebral autoregulation causes a transient impairment of short-term memory in mice that is ameliorated by NSAID Meloxicam (MEL) given at 24h.¹ Memory was found intact on Day 1, impaired on Day 5, and intact on Day 9. We tested the hypothesis that changes in hippocampal cytokine levels would be associated with CD.

METHODS: After IACUC approval, 45 Swiss-Webster, 30-40g mice (6-8 weeks) were randomized into 9 groups: 1) no treatment; 2) i.p. NTG(60 mg/kg) tested at 8h; 3) at 24h; 4) at 72h; 5) on D5; 6) on D7; 7) on D9; 8) NTG then i.p. MEL (60mg/kg) at 24h tested at 72h ; 9) NTG then MEL at 24h tested on D5. Under ketamine/xylazine anesthesia, hippocampi were isolated and prepared for analysis.² Hippocampal saturation of TNF- α , INF- γ , IL-1 α , IL-1 β , IL-2, IL-6, & IL-10 was determined by ELISA with MILLIPLEX Multi-Analyte Profiling. Data was analyzed using Kruskal-Wallis One-Way ANOVA and Mann-Whitney post-hoc tests with Bonferonni correction.

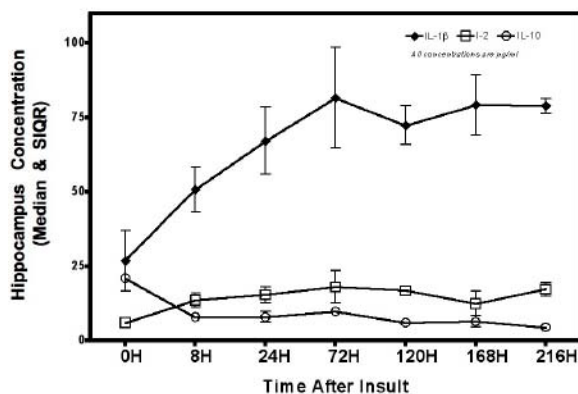
RESULTS: After adjustment for outliers, 1 sample each from groups 4, 5, and 7 were excluded. A time course analysis of cytokine expression after NTG-IH showed a steady, progressive increase of IL-1 β & IL-2 expression in the first 72h after which cytokines stabilize and remain elevated through D9. All IL-1 β & IL-2 points were significant against baseline ($p < .0167$) except for IL-1 β at 8h and 72h, and IL-2 at 72h (Fig 1). No significant changes were observed in TNF- α , INF- γ , IL-1 α , or IL-6 at any time. The MEL group showed elevated expression of IL-1 β & IL-2 at 120h vs. baseline ($p < .0167$) but did not differ from NTG at 120h (Fig 2). At 72h the MEL group exhibited an attenuation of IL-1 β that did not differ from baseline, but was significantly different from NTG at 72h ($p < .0167$). IL-2 also showed trends of attenuation although no statistical significance was observed (Fig 3).

DISCUSSION: CNS inflammation and cytokine expression have been implicated in the development of CD.³ NTG-IH exacerbates the expression of IL-1 β & IL-2 in murine hippocampus, which peaks at 72h and stabilizes thereafter. Intervention with NSAID Meloxicam at 24h attenuates this response at 72h, but does not significantly alter expression on D5 when compared to NTG. This suggests that short-term memory function is not cytokine-dependent, but rather that there are secondary mechanisms sensitive to cytokine modulation which may be involved with cognition in the setting of inflammation.

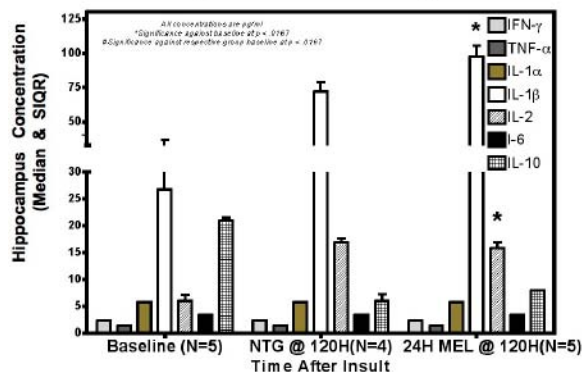
REFERENCES:

1. J Neurosurg Anesthesiol: Vol. 21(4), 367-426. 2009.
2. J Neurosci Meth: Vol. 175, 119-124. 2008.
3. Psychoneuroimmunology, AP: 337-377. 2007.

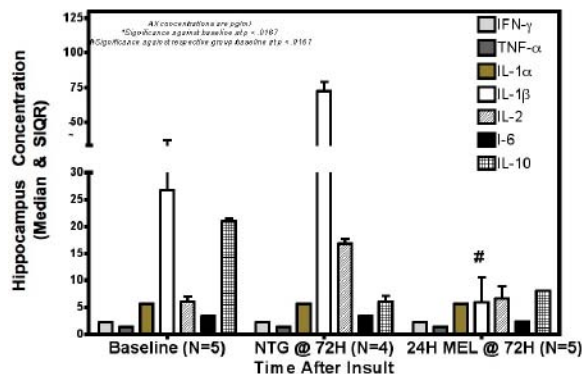
Time Course Cytokine Expression Following Acute NTG-Induced Hypotension



Cytokine Expression On Day 5 Following Acute NTG-Induced Hypotension



Cytokine Expression On Day 3 Following Acute NTG-Induced Hypotension



S-282.

FROM A STRICTLY ASEPTIC TO A CLEAN PROCEDURE: EXPLORING THE EVIDENCE FOR SPINAL ANESTHESIA

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AFFILIATION: Dept. of Anesthesia, Yasin Memorial Hospital, Faisalabad, Pakistan

INTRODUCTION: Regional anesthesia is preferred for cesarean sections (c-sections). In case of emergency c-sections, application of spinal anesthesia (SA) is usually outpaced by the desired rapid speed of fetal delivery. An idea of rapid sequence spinal anesthesia (RSSA) was introduced in 2003 to speed up SA for emergency c-sections.¹ Most of the components of the proposed RSSA revolve around human factors except one; to convert SA from an aseptic to a clean procedure, and requires further scientific validation.^{1,2} The objective of this study was to determine the incidence of infective complications in a group of patients who required SA and then SA was performed as a clean and not as a strictly aseptic procedure.

METHODS: After ethical approval, a retrospective observational study was performed to determine the incidence of infective complications during an eight year period from November 1991 to October 1999 in a group of patients who required SA and then SA was performed as a clean and not a strictly aseptic procedure. Patients who had inadequate or failed SA were excluded from the study. To perform SA, an anesthesiologist cleaned his hands with a methylated alcohol soaked cotton swab. A patient's back was also cleaned with methylated alcohol in the same way. The anesthesiologist did not gown or glove and no drape was used on the patient's back. Local anesthetic for intrathecal injection was drawn in a sterilized syringe in a clean manner. An assistant opened the wrapper of a cutting spinal needle and handed it over to the anesthesiologist in a non-touch manner. No dressing was ever applied on a patient's puncture wound after finishing the procedure. All the study patients received antibiotics in their perioperative period.

RESULTS: During the eight year SA was given to 3690 patients in the manner described. Considering gender distribution, 2960 of those patients were women and 730 of those were men. They ranged in age from 16-75 year. Applying American Society of Anesthesiologists' anesthesia risk scale, 3100 of those patients were graded as ASA-I and 569 of those were assessed as ASA-II. Distribution of study patients according to surgical specialty is shown in Table 1. No study patient (0/3690) had any complication e.g. meningitis, abscess formation, etc. due to SA even though SA was performed in a barely clean manner.

DISCUSSION: Converting SA from a strictly aseptic to a clean procedure does not enhance the risk of infective complications. As obstetric patients are relatively further low risk for such complications; RSSA is a scientific option for urgent c-sections³.

REFERENCES:

1. Int J Obstet Anesth 2003; 12: 143-144.
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Table 1: Specialty distribution of patients

| Specialty | WM (n=10) |
|-----------------|-----------|
| Obstetric | 2313 |
| General Surgery | 604 |
| Gynecology | 486 |
| Urology | 217 |
| Orthopedic | 67 |
| Plastic Surgery | 3 |

S-283.**COMBINED SPINAL EPIDURAL (CSE) FOR CESAREAN SECTION: GERTIE MARX VERSUS PENCAN SPINAL NEEDLES**

AUTHORS: S. Shah, S. Cohen, M. Negron-Gonzalez, G. Kiss, C. W. Hunter

AFFILIATION: UMDNJ-Robert Wood Johnson Medical School, New Brunswick, NJ

INTRODUCTION: PENCAN spinal needle along with ESPOCAN epidural needles are used routinely for CSE anesthesia for cesarean delivery. We encountered difficulty piercing the dura forcing us to switch to epidural block. We compared Gertie Marx spinal needle with PENCAN needle to determine which one is better for our obstetric patients.

METHODS: 124 ASA I-II parturients, who requested neuraxial block for C/S, were included. The epidural space was located with ESPOCAN 18 gauge epidural "Braun" needle (B. Braun Medical Inc.) at L4-5 or L3-4 interspace with loss of resistance to air tech using midline approach in lateral or sitting flexed position. Patients were then randomized to one of two groups. Group I: 59 had a 25 gauge PENCAN spinal needle placed in the subarachnoid space. Group II: 65 had a 26 gauge Gertie Marx spinal needle (IMD Inc. USA) placed in the subarachnoid space. Patients received intrathecally 10 mg isobaric bupivacaine with 25mcg fentanyl and 100 mcg epinephrine. When the dura could not be pierced by the spinal needle the epidural needle was rotated 45 degree at a time for further attempts. If still unsuccessful, the spinal needle removed and epidural block was applied. All pts had a 19g Arrow FlexTip plus (Arrow international Inc.) open-end tip catheter placed 4 cm in the epidural space. An investigator recorded patient's height, weight, parity, patient's position, the distance of epidural space from the skin, technical problems, paresthesia and pain upon insertion of the spinal needle, time to incision, difficulty with catheter insertion, post-dural-puncture-headache, transient radicular irritability, duration of procedure and overall satisfaction from the technique use. Values are mean±SD, p<0.05 considered significant

RESULTS: Groups did not differ in age, weight, height or parity, the distance of epidural space from the skin, duration of surgery, previous neuraxial block, the need to rotate or reinsert the epidural needle, the efficacy of the block, side effects from the block, difficulty with cath insertion, the sensory level overall satisfaction, or the APGAR score. Time to incision was 33 ± 8 and 24 ± 6 min for Group I and II respectively (p= 0.0001). Time to T6 was 6 ± 4 and 2.6 ± 2 min for Group I & II respectively (p= 0.0001).

DISCUSSION: Application of PENCAN spinal needle when compared to Gertie Marx needle for C/S had less success piercing the dura, caused more paresthesia and pain during insertion, prolonged time to incision and required switch to epidural block more often.

REFERENCES:

Does a pencil-shaped spinal needle offer advantages for spinal anesthesia? Reg Anesth 1990; 13: 124-128.

| | PENCAN n=59 N (%) | Gertie Marx n=65 N (%) | P-Value |
|------------------------------------|----------------------|---------------------------|---------|
| Lateral Position | 55(98) | 48 (80) | 0.002 |
| Spinal needle problem | 34(58) | 19 (29) | 0.001 |
| Leg jerk upon needle insertion | 24 (41) | 10 (16) | 0.001 |
| Paresthesia upon needle insertion | 3 ± 3.8 | 1.4 ± 3 | 0.02 |
| Pierced dura with successful block | 36(61) | 56 (88) | 0.001 |
| Switched to epidural | 23 (39) | 8 (13) | 0.001 |
| Sedation (0-10) | 0.1 ± 0.5 | 3.3 ± 3.9 | 0.0001 |
| Overall Satisfaction (0-10) | 9.3 ± 1.1 | 9.6 ± 1.0 | 0.09 |

S-285.**IMPLEMENTATION OF A NOVEL CA3 ASSISTANT COORDINATOR ROTATION THAT EMBRACES ACGME CORE COMPETENCIES WITH FOCUS ON PRACTICE-BASED LEARNING & IMPROVEMENT AND SYSTEMS-BASED PRACTICE**

AUTHORS: V. O. Busso, K. S. Mon, M. Mirrer, Y. J. Xie, D. Schwengel, L. J. Mark

AFFILIATION: Johns Hopkins Medicine, Baltimore, MD

INTRODUCTION: The CA3 Assistant Coordinator Rotation is a one month elective that targets ACGME core competencies with focus on practice-based learning & improvement and systems-based learning. CA3 anesthesia residents at our institution learned to manage a busy, academic surgical suite and perioperative services.

Methods: The program goals and objectives were created based on ACGME core competencies. Residents spent 3 days a week with administrative and supervisory clinical responsibilities and 2 days a week with academic time. Residents received didactic orientation to managing the surgical suite, case scheduling system and anesthesia manpower scheduling system, and finalized daily surgical schedules with anesthesia team assignments. With direct supervision, residents were empowered to coordinate the surgical suite with nursing colleagues and supervised CRNA and junior resident colleagues. Residents also participated in the weekly perioperative clinical services team meeting and were in-serviced to patient safety event reporting systems (University HealthSystem Patient Safety Net and Department of Anesthesiology and Critical Care Medicine Assurance Event Report).

RESULTS: 12 CA3 residents completed the rotation from August 2009 through June 2010. 9/12 residents completed evaluations with an average evaluation score of 5/5. 11/12 residents completed academic projects and 16 abstracts were presented at local and national meetings. 3 residents were inspired to pursue additional research time which has led to the creation of a comprehensive clinical practices compendium and the incorporation of some of their projects into the Residency Program Systems-Based Learning Course. These projects are ongoing with current classes of residents.

DISCUSSION: This novel rotation has been well received by CA3 residents and has been academically productive. Residents commented that participation facilitated their transition to an attending, and that they valued the clinical application of practice-based learning & improvement and systems-based practices they were learning.

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S-286.**AMNIOTIC FLUID INCREASES PLATELET LEUKOCYTE AGGREGATION AND LEUKOCYTE ACTIVATION****AUTHORS:** K. Chen,¹ Y. Liu,¹ V. Lee,² C. Li^{1,2}**AFFILIATION:** ¹Department of Anesthesiology, China Medical University Hospital, Taichung, Taiwan; ²Graduate Institute of Clinical Medical Sciences, China Medical University, Taichung, Taiwan

INTRODUCTION: Amniotic fluid embolism is a rare but devastating condition associated with a very high rate of morbidity and mortality. In a case of amniotic fluid embolism, massive platelet aggregations were confirmed in pulmonary capillaries.¹ In general, the postmortem histological diagnosis of amniotic fluid embolism consisted of demonstrating mucus, squamous, leukocytes, platelets, and fatty cells in the arteries of the lung. Nonetheless, the exact pathogenesis of this syndrome remains unknown and significant controversy exists whether platelet and leukocyte should always be activated. Therefore, we evaluated the effects of amniotic fluid on the interaction between the platelet and leukocyte in whole blood as measured by P selectin, MAC-1 expression and platelet leukocyte aggregation.

METHODS: This study was approved by the institutional review board of our hospital, and informed consent was obtained from ASA I-II full term pregnant women before cesarean section (n=20). Amniotic fluid collected before rupture of amniotic membrane and venous blood samples were collected from an antecubital vein. Amniotic fluid was centrifuged to obtain the upper clear fluid for the experiments. The whole blood, purified leukocyte and platelet rich plasma was preincubated with various concentrations of amniotic fluid (0.1-1.5 mg/mL) in vitro. Samples were stained with a saturating concentration of different fluorochrome-conjugated antibodies (CD62p, CD41a, CD11b), and were analyzed on a flow cytometer to measure platelet P selectin, leukocyte MAC-1 expression and platelet-leukocyte aggregation. Reactive oxygen species (ROS) and p38 activation were also detected.

RESULTS: Amniotic fluid significantly induced platelet-leukocyte aggregation in a concentration dependent manner. Amniotic fluid also induced minimal increase of platelet P selectin expression and significantly increased leukocyte MAC-1 expression at concentration of 0.25-1.5 mg/mL. Amniotic fluid had no effect on ROS production of platelet, but significantly induced ROS production and p38 activation of leukocyte at concentration of 0.25-1.5 mg/mL.

DISCUSSION: Platelet-leukocyte interactions may contribute to the development of several pathological conditions including coronary artery disease and stroke. We first demonstrated that amniotic fluid induced platelet-leukocyte aggregation via activating platelet P selectin expression as well as leukocyte MAC-1 expression. To stimulate leukocytes by amniotic fluid could induce activation of p38 and ROS production. Platelet-leukocyte aggregates may be an important player in the development of amniotic fluid embolism.

REFERENCES:

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S-287.**GENERAL ANESTHESIA FOR CESAREAN SECTIONS - ARE ANESTHESIOLOGISTS DEALING WITH EXAGGERATED FEAR?****AUTHOR:** M. Ajmal**AFFILIATION:** Dept. of Anesthesia, Yasin Memorial Hospital, Faisalabad, Pakistan

INTRODUCTION: General anesthesia (GA) for cesarean sections (c-sections) has significant reported incidence of regurgitation and failed intubation.¹ Inquest into finding the cause led the blame to physiological changes associated with pregnancy.² In the absence of additional risk, does pregnancy alone as such enhance that much the incidence of regurgitation and failed intubation? The objective of this study was to determine the incidence of regurgitation and failed intubation during an eight year period in women who had induction of GA for their c-sections using a gentle mask ventilation and no cricoid pressure.

METHODS: After ethical approval, a retrospective observational study was performed. All the parturients except those who received GA due to inadequate or failed spinal anesthesia from November 1991 to October 1999 were included. For induction of GA, patients were placed in slight reverse Trendelenburg position. Everyone received metoprolol 10mg i.v. followed by preoxygenation, a sleeping dose of thiopentone and a 100mg suxamethonium. No cricoid pressure was applied and lungs were gently mask ventilated till tracheal intubation was achieved. Incidence of regurgitation and failed intubation was determined.

RESULTS: During the eight year, 2114 parturients received GA. Of the 1030 emergency c-sections, those 98 patients who arrived a hospital immediately before being escorted to an operating room were not restricted for any solid or liquid oral intake. Thirty of the 2114 patients were predicted as relatively difficult to intubate. No study patient had any major additional risk factor for regurgitation e.g. morbid obesity, gastro-esophageal reflux. A blind nasotracheal intubation was accomplished in two elective cases those otherwise were difficult to intubate. Other parturient related characteristics are summarized in Table 1. No incidence of regurgitation and a failed intubation in study patients was observed (0/2114). No incidence with perioperative clinical features suggestive of aspiration e.g. fever, cough, chest pain, respiratory distress or pneumonia was recorded (0/2114).

DISCUSSION: In the absence of additional risk factors there is no extra risk of regurgitation during induction of GA for c-sections. Reported higher incidence of failed intubation in obstetric patients could be due to an inexperienced anesthesiologist and an application of a cricoid pressure. While there is no paucity of published data on upper airway changes during pregnancy and labour, further work on gastric pressure changes in pregnancy and at induction of GA for c-sections is required.³

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S-288.**THE EFFECTS OF PRE-EXPOSURE SEVOFLURANE WITH LOW CONCENTRATION ON BISPECTRAL INDEX IN CESAREAN DELIVERY PATIENTS UNDER GENERAL ANESTHESIA****AUTHORS:** E. SONG, W. Choi, J. Shin**AFFILIATION:** Asan Medical Center, Seoul, Republic of Korea

INTRODUCTION: Patients undergoing cesarean delivery under inhalation anesthesia are at a high risk of awareness, especially in the period prior to neonatal delivery. In the previous study, 1 vol% end-tidal sevoflurane with 50% nitrous oxide resulted in BIS > 60 during cesarean delivery. This study investigated the effects of pre-exposure sevoflurane on Bispectral index (BIS) in the early period of cesarean delivery.

METHODS: Sixty two parturients scheduled for elective cesarean delivery were randomly assigned to receive 1.0-1.1 vol% end-tidal sevoflurane (control 1), 1.2-1.3 vol% end-tidal sevoflurane (control 2), pre-exposure 1 vol% sevoflurane for last 1 minute of denitrogenation period and 1.0-1.1 vol% end-tidal sevoflurane (sevo 1) or pre-exposure 1 vol% sevoflurane for last 1 minute of denitrogenation period and 1.2-1.3 vol% end-tidal sevoflurane (sevo 2), in combination with 50% nitrous oxide. Each group was assessed for BIS value, noninvasive blood pressure, heart rate, and end-tidal sevoflurane concentration at the point of baseline, before intubation, after intubation and skin incision, uterine incision, delivery, and 5 minutes after delivery. Neonatal outcomes were assessed using Apgar scores at 1 and 5 minutes and umbilical vein blood gas analysis.

RESULTS: The BIS values were significantly lower in groups sevo 1 and 2 than in groups control 1 and 2 at skin incision ($P < 0.05$). At uterine incision and delivery, BIS values were significantly lower in groups sevo 1, 2 and control 2 than group control 1 ($P < 0.05$). Other parameters as well as neonatal outcomes were not different between groups. None of the patients had any recall of intraoperative events.

DISCUSSION: These data suggest that pre-exposure sevoflurane with low concentration reduced BIS values in the period prior to cesarean delivery. This method may reduce the risk of maternal awareness.

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| | PENCAN n=59 N (%) | Gertie Marx n=65 N (%) | P-Value |
|------------------------------------|----------------------|---------------------------|---------|
| Lateral Position | 55(98) | 48 (80) | 0.002 |
| Spinal needle problem | 34(58) | 19 (29) | 0.001 |
| Leg jerk upon needle insertion | 24 (41) | 10 (16) | 0.001 |
| Paresthesia upon needle insertion | 3 ± 3.8 | 1.4 ± 3 | 0.02 |
| Pierced dura with successful block | 36(61) | 56 (88) | 0.001 |
| Switched to epidural | 23 (39) | 8 (13) | 0.001 |
| Sedation (0-10) | 0.1 ± 0.5 | 3.3 ± 3.9 | 0.0001 |
| Overall Satisfaction (0-10) | 9.3 ± 1.1 | 9.6 ± 1.0 | 0.09 |

S-289.**EFFECTS OF EPHEDRINE AND PHENYLEPHRINE ON FETAL HEART RATE DURING SPINAL ANESTHESIA FOR CESAREAN DELIVERY****AUTHORS:** M. Wang, Y. Qian**AFFILIATION:** Dept. Anesthesiology, 1st Affiliated Hospital, Nanjing Med. University, Nanjing, China

INTRODUCTION: Phenylephrine can improve the fetal oxygen supply and demand balance when it is used to treat hypotension following spinal anesthesia for cesarean delivery because it can increase fetal pH and base excess compare with ephedrine.¹ but that was related to decreased fetal heart rate is not know. So in this study, we compared the effects of ephedrine and phenylephrine on fetal heart rate during spinal anesthesia in cesarean delivery when we maintain maternal blood pressure near the baseline.

METHODS: Ninety in-term parturient women with singleton scheduled for elective cesarean delivery under spinal anesthesia were randomly divided into three groups (A,B,C) with 30 cases each. Group A receiving ephedrine(4mg/ml), Group B: ephedrine combined phenylephrine (2mg/ml + 25µg/ml) and Group C: phenylephrine (50µg/ml). The blood pressure was maintained near baseline by adjusting the infusion vasopressor rate during anesthesia. The maternal blood pressure (MAP), heart rate and fetal heart rate were measured at 1 min, 3 min, 5 min, 10 min after anesthesia as well as skin incision and uterine incision. Immediately after delivery, maternal arterial, umbilical arterial and venous blood samples were taken for blood gases analysis and measuring plasma concentrations of lactate and glucose.

RESULTS: The fetal heart rates of group A and group B significantly increased after the infusion vasopressor compared with baselines ($P < 0.05$), there was no significant changes in group C ($P > 0.05$). The incidence of fetal tachycardia in group A or B was greater than that in group C ($P < 0.05$). Umbilical arterial and venous pH and base excess in group A were lower than those in group B and C ($P < 0.05$). Umbilical arterial PCO₂ and plasma concentrations of lactate and glucose in group A were greater than those in group C ($P < 0.05$). Umbilical arterial and venous plasma concentrations of lactate and glucose in group B were greater than those in group C ($P < 0.05$), but base excess was lower than that in group C ($P < 0.05$).

DISCUSSION: Ephedrine can induce the metabolic excitation in the fetus compared with phenylephrine because the fetal heart rate of group A or B is faster than that of group C, which was related to β-receptor activity. Phenylephrine may be more suitable for dealing with the hypotension following spinal anesthesia in cesarean delivery.

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S-290.**β-2 ADRENERGIC AND OXYTOCIN RECEPTOR POLYMORPHISMS AFFECT LABOR PROGRESS IN NULLIPAROUS SAUDI WOMEN**

AUTHORS: A. S. Terkawi,¹ W. Jackson,² S. Hansoti,¹ R. Tabassum,¹ P. Flood²

AFFILIATION: ¹King Fahad Medical City, Riyadh, Saudi Arabia; ²Columbia University College of Physicians and Surgeons, New York, NY

INTRODUCTION: Labor progress varies substantially between individual parturients. While demographic characteristics explain some of the variability between women in labor, the effect of genetic factors on the progress of labor are not known. β-2 adrenergic (B2AR) and oxytocin receptors (OXTR) are both G- protein linked receptors involved in the modulation of uterine contractility. Genes for both receptors are known to exhibit high genetic variability at many sites.^{1,2} We examined the effect of genotype at 2 common polymorphic sites in the B2AR (rs1042713, rs1042714) and three at the OXTR (rs2258485, rs2224298, rs53576) on the progress of the latent phase, active phase, and transition point of labor.

METHODS: With IRB approval and written informed consent, we prospectively enrolled 243 parturients. Demographic and obstetrical data were collected prospectively. Cervical dilation and labor management data were recorded with respect to time. Labor progress was modeled with a biexponential function, and analysis of the effect of covariates was tested with NONMEM using PLTTools using previously published methods.³

RESULTS: A CC genotype in the β-2AR polymorphism rs1042714 was associated with slower labor progress due to a longer latent phase of labor (Figure 1a, p<0.03) Genotype AA at OXTR rs2254298 was associated with faster active labor (Figure 1b, p<0.04).

DISCUSSION: Single nucleotide polymorphisms in both the B2AR and OXTR influence the progress of labor. Individual differences in uterine contractility and labor progress may be explained in part by inherited differences in uterine muscle proteins. We plan to use this data in order to further develop and validate a labor progress calculator that can accurately depict time before delivery given demographic, clinical, and genetic data. Better individual prediction of labor progress has the potential to reduce unnecessary intervention and improve patient satisfaction.

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S-291.**RESTRICTED FLUID THERAPY DECREASES SURGICAL BLOOD LOSS-A CLINICAL STUDY OF TWO FLUID REGIMENS DURING CESAREAN SECTION UNDER SPINAL ANESTHESIA**

AUTHORS: H. Li,¹ A. Afzal,¹ Q. Lian,² G. C. Kramer,¹ C. Svensen,¹ D. Prough¹

AFFILIATION: ¹Department of Anesthesiology, The University of Texas Medical Branch, Galveston, TX; ²Department of Anesthesiology, The Second Affiliated Hospital, Wenzhou Medical College, Wenzhou, China

INTRODUCTION: We hypothesized that restricted IV fluid therapy during cesarean sections (CS) will not have a negative impact on neonates and will improve the maternal clinical outcomes. Currently, an average of 20 to 48 ml/kg of Lactated Ringer's solution (LR) is administered for uncomplicated CS at our institution.¹ Clinical studies have shown that intraoperative fluid restriction, rather than the current "standard" fluid regimen, improves clinical outcome after intra-abdominal surgery.²⁻⁴ As part of an ongoing prospective study of fluid management and clinical outcomes during CS under spinal anesthesia, we are evaluating the impact of different volumes of intraoperative fluid therapy on the maternal hemodynamics, surgical blood loss, and on the physiological condition of newborns.

METHODS: Patients scheduled for CS are randomly assigned to one of two groups, a restricted volume of LR (RV: n=65) and a standard volume of LR (SV: n=55) group; receiving a total of either 10 ml/kg in RV or 40 ml/kg in SV during the procedure. LR is administered at a constant rate to patients over a period of 70 minutes (average) with 1/3 administered during induction of spinal anesthesia, 1/3 during section delivery, and 1/3 during closure of the abdomen. Successful fluid therapy is achieved when a patient has received $100 \pm 10\%$ of the targeted volume for her treatment group. APGAR, umbilical arterial and venous blood gases from neonates were obtained. Mothers' MBP, HR, EBL, pre and post-op RBC, Hb, Hct, WBC, Plt were collected and analyzed statistically. IRB approval and patient consent were received before the study

RESULTS: There was no change of neonatal APGAR, A/V blood gas analysis, or maternal hemodynamics, and doses of vasopressors used between the two groups. Post-operative RBC, Hb, and Hct were higher in the RV group, and WBC count was lower in this group. (Figure 1-10).

DISCUSSION: In the study, we have investigated whether restricted fluid infusion during CS has an impact on both neonatal conditions and maternal hemodynamics and hematological profiles. Our result has suggested that 1) The neonatal APGAR scores and blood gas analysis from both groups are almost identical, which suggests that restricted fluid therapy has no detrimental effects on fetal perfusion and general physiologic status; 2) LR infusion is not effective in treating or preventing spinal hypotension; 3) Restricted fluid decreases surgical blood loss (0.5g/dl); 4) It appears that more LR infusion increases WBC count but its clinical significance yet to be elucidated.

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S-292.**CHANGES IN PLACENTAL AND FETAL ORGAN PERFUSION DURING CHRONIC MATERNAL HYPOXIA IN MICE: ASSESSMENT BY BOLD MRI DURING BRIEF HYPERCAPNIC AND HYPEROXIC CHALLENGE****AUTHORS:** Y. Ginosar, N. Corchia, U. Elchalal, R. Abramovich**AFFILIATION:** Hadassah Hebrew University Medical Center, Jerusalem, Israel

INTRODUCTION: Reduced maternal uteroplacental blood flow (UPBF) leads to chronic intrauterine fetal asphyxia. Doppler ultrasound may assess uterine, umbilical and fetal vessels, but is unable to assess these simultaneously or to perform rapid repeat assessments for dynamic studies. We previously developed a blood oxygen level dependant functional MRI (BOLD-fMRI) method utilizing hypercapnia (5% CO₂) and hyperoxia (95% O₂) for monitoring dynamic changes in hepatic perfusion without contrast administration.^{1,2} In this study we describe the use of BOLD-fMRI with acute hypercapnic challenge to assess changes in UPBF and fetal organ perfusion and to assess whether these responses are affected by chronic maternal hypoxia, as a model of intrauterine fetal asphyxia.³

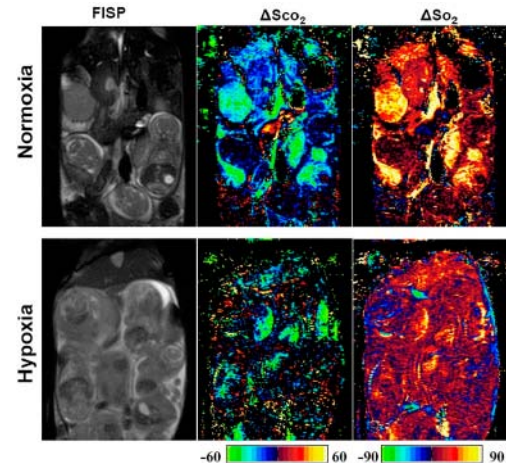
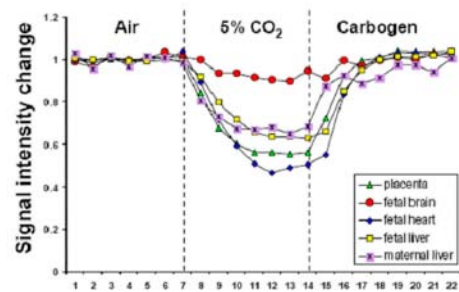
METHODS: Between days E13-17.5, pregnant female ICR mice were either exposed to chronic hypoxia (12% O₂) by placing them in a hypoxic chamber (Coy Laboratory Products) or kept under normoxic conditions; n=6 mice/group. On E17.5, all mice were anesthetized with pentobarbital and scanned in a 4.7-T Bruker Biospec spectrometer. Changes in placental and fetal perfusion were analyzed from T2*-weighted GE images (TR/TE=147/10 ms) acquired during breathing of air (4 min), air-carbon dioxide (5% CO₂) (4 min), and carbogen (95% O₂-5% CO₂) (4 min). Different regions of interest (placenta, fetal heart, fetal liver and fetal brain) were identified on True-FISP images using IDL software. Percentage change in signal intensity induced by hypercapnia (Δ SCO₂) and hyperoxia (Δ SO₂) was calculated and presented by color maps and time curves.

RESULTS: BOLD-fMRI provided simultaneous assessments of perfusion of placenta and fetal organs (brain, heart, liver) in pregnant mice. We observed that acute maternal hypercapnia caused reproducible and reversible reductions in placental perfusion, fetal hepatic perfusion and fetal cardiac perfusion. Fetal cerebral perfusion, however, was unchanged; suggestive of the described phenomenon of fetal “brain sparing”. The acute hypercapnia challenge using BOLD-fMRI was able to distinguish between chronic intrauterine asphyxia (induced by maternal hypoxia) and normal controls, with lower % change in UPBF and less fetal brain sparing.

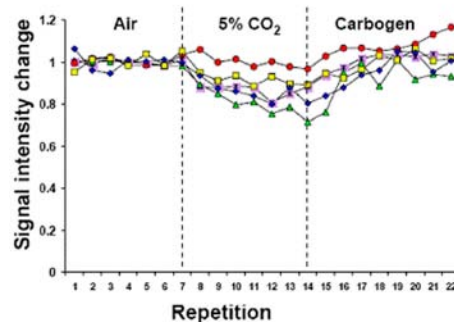
DISCUSSION: The BOLD-fMRI hypercapnic challenge test was able to differentiate between normal and chronically asphyxiated pregnancies. Further preclinical and clinical investigation is required to assess whether these observations may herald the use of this non-invasive diagnostic tool to determine if the severity of chronic intrauterine fetal asphyxia justifies interventional delivery.

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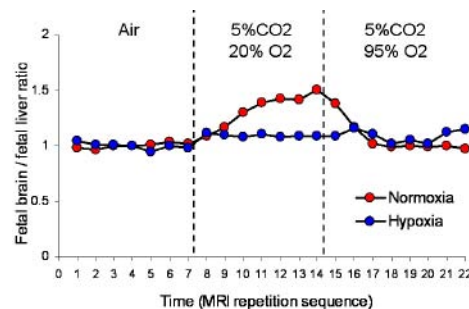
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**Normoxic controls**

Time courses of SI change from the different regions obtained from normoxic controls. Note fetal brain sparing with reduction in fetal hepatic perfusion.

Chronic hypoxia (FiO₂ 12%)

Time courses of SI change from the different regions obtained from chronically hypoxic mice (FiO₂ 12% E13-17.5). No fetal brain sparing with reduction in hepatic perfusion was observed.



Fetal brain - liver perfusion ratio following acute hypercapnic challenge in normoxic and chronically hypoxic dams. The brain-liver perfusion ratio was markedly increased in the normal controls; evidence for brain-sparing. This was absent in chronic hypoxia group.

S-293.**EFFECTS OF INTRATHECAL REPEAT MORPHINE ON POSTOPERATIVE HYPERALGESIA IN RATS****AUTHORS:** T. Nishiyama, Y. Kohno, K. Koishi**AFFILIATION:** Higashi Omiya General Hospital, Saitama, Japan

INTRODUCTION: In our previous studies with a post-surgical pain model of rat, intrathecal bolus morphine after surgery significantly decreased long-term thermal hyperalgesia, but did not have significant effects on mechanical hyperalgesia.¹ The present study further investigated the effects of morphine administered everyday on postoperative hyperalgesia in rats.

METHODS: After the approval of the institutional review board, male Sprague-Dawley rats were implanted with lumbar intrathecal catheters. One week later, rats were anesthetized with halothane. A 1 cm longitudinal incision was made through skin and fascia of the plantar aspect of the foot, starting 0.5 cm from the proximal edge of the heel. The plantaris muscle was elevated. The skin was apposed with 2 mattress sutures of 5-0 nylon. Ten minutes before each measurement, saline (control), morphine 1, 3, or 10 µg in 10 µl saline was administered intrathecally. Before surgery and 2, 24, 48, 72, 96, 120, 144, and 168 hours after surgery, withdrawal response to von Frey filament application, thermal withdrawal response to light beam and weight bearing were tested on both paws.

RESULTS: All the three tests did not show any changes on the non-operated paw. Von Frey filament withdrawal on the operated paw decreased in the control group for 168 hours, but returned with morphine 10 µg in 48 hours and 1 and 3 µg in 120 hours. Thermal paw withdrawal latency of the operated paw decreased in the control group for 168 hours, but returned with morphine 10 µg in 2 hours and 1 and 3 µg in 24 hours. Weight bearing did not change on the operated paw.

DISCUSSION: In a post-surgical pain model of rat, intrathecal repeat morphine decreased thermal hyperalgesia faster than mechanical hyperalgesia.

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S-294.**THE INVOLVEMENT OF ACTIVATED NF-κB AND CCL2 IN THE DEVELOPMENT OF DIABETIC NEUROPATHIC PAIN****AUTHORS:** Y. Zhang, Y. Rodriguez, M. C. Gitlin, K. Candiotti**AFFILIATION:** University of Miami, Department of Anesthesiology, School of Medicine, Miami, FL

INTRODUCTION: Nuclear factor-kappaB (NF-κB) is involved in the production of pro-inflammatory cytokines and the induction of reactive oxygen species (ROS). NF-κB activation is an emerging fundamental mechanism in the pathogenesis of neuropathic pain. Monocyte chemoattractant protein 1 (MCP-1/CCL2) is a chemokine that attracts monocytes and tissue macrophages; it is involved in chronic inflammatory disorders. In diabetes, hyperglycemia-induced ROS activates intracellular inflammatory signaling to upregulate NF-κB. Activation of NF-κB then induces the expression of pro-inflammatory genes. The resulting cycle of NF-κB and ROS may contribute to the establishment of a chronic inflammatory state and neuropathic pain in diabetes. This study investigated the expression of activated NF-κB and CCL2 in the dorsal root ganglion (DRG) at different levels of free radical stress in animals.

METHODS: Sample preparing: All experiments were carried out following the guidelines and protocols approved by the IACUC Committee of the University of Miami. Diabetes was induced by a single dose of 200 mg/kg streptozotocin (STZ) in C57 B/6 mice. Samples of dorsal root ganglia were from three types of mice: Normal mice as naïve control (n=6); diabetic mice (n=6) treated by vehicle; and diabetic mice (n=6) treated by 50 mg/kg of CoQ10, for 24 days started on the 2nd day of diabetes.

Immunohistological staining: Anti-p65 selectively binds to the activated form of NF-κB and anti-CCL2 antibodies; it was used in DRG cryostat sections to evaluate the expression level of activated NF-κB and CCL2 in the DRG. A positive cell count was done with an NIH image J.

Data Analysis: Data are presented as means ± SEMs. Statistical analyses were performed using a T-test. In all cases, p<0.05 was considered statistically significant.

Challenging Case Report (only complete if your submission falls into the “Challenging Case Report” category. If you select the “Challenging Case Report” category on the next step, this section must be completed.): N/A

RESULTS: There are few positive NF-κB and CCL2 cells in a normal mouse's DRG. Diabetes elevated the number of p65 and CCL2 positive cells in the DRG; p65 and CCL2 were also mostly co-localized in the same cells. CoQ10 treatment significantly decreased the number of positive NF-κB and CCL2 cells in the DRG. Data is shown in Figure 1.

DISCUSSION: NF-κB and CCL2 have low expression levels in the DRG of normal animals. High blood glucose induces NF-κB and CCL2 significantly. Treatment with CoQ10 can markedly decrease the activation and expression of NF-κB and CCL2 in the DRG of diabetic mice.

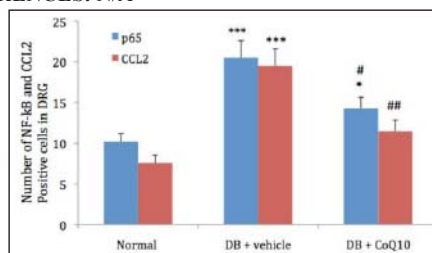
REFERENCES: N/A

Figure 1. Positive cells in DRG. DB: diabetic, ***p<0.001, *p<0.05 compared to normal control; ## p<0.01 and #p<0.05 compared to DB+vehicle.

Pain – Basic Science

S-295.

WITHDRAWN.

S-296.**UP-REGULATION OF HIGH MOBILITY GROUP BOX-1 IN SPINAL CORD FOLLOWING PERIPHERAL NERVE INJURY MODEL IN RATS****AUTHORS:** Y. Liu,¹ V. Lee,² K. Chen,¹ C. Li²¹Department of Anesthesiology, China Medical University Hospital, Taichung, Taiwan; ²Graduate Institute of Clinical Medical Sciences, China Medical University, Taichung, Taiwan

INTRODUCTION: Peripheral nerve injury induces neuropathic pain through the up-regulation of inflammatory mediators in the spinal cord and dorsal root ganglia. The novel inflammatory cytokine high mobility group box 1 (HMGB1) is released actively by activated macrophages/monocytes or passively by necrotic cells into the extracellular milieu; and is associated with the pathogenesis of many CNS diseases. Nonetheless, little is known about the biological effects of HMGB1 in the peripheral nerve injury. In an attempt to understand the potential role of HMGB1 in triggering spinal glia activation and its contribution to the development of neuropathic pain, we investigated the HMGB1 expression in the spinal cord using a rat model of the condition spared nerve injury (SNI).

METHODS: The protocol for this experiment was approved by our animal care and use committee. Under general anesthesia, 30 male Sprague-Dawley rats weighing 250-350 g were randomly divided into 5 groups to receive sham operation and 1, 4, 7 and 14 days after SNI. The development of mechanical hypersensitivity was measured by using von Frey hair filaments. HMGB1 and pERK expression in the spinal cord were assessed by western blotting or immunohistochemistry studies. Microglia activation was examined by OX-42 immunofluorescence staining. The results were analyzed by ANOVA with repeated measures followed by the Dunnett test. Differences were considered to be significant at $P < 0.05$.

RESULTS: A reduction in paw mechanical withdrawal threshold was observed and western blot analysis confirmed an increase in HMGB1 protein expression in the spinal cord after SNI. Immunohistochemistry for HMGB1 revealed that SNI-induced HMGB1 expression increased in the ipsilateral dorsal horns. Immunofluorescence staining for HMGB1 and neuron marker Neu-N indicates the most prominent increase was in the superficial laminae I-III neuron of the dorsal horn. Neuronal HMGB1 induction was associated with translocation from the nucleus to the cytoplasm, and was followed by surrounding microglia activation. The extracellular signal-regulated kinase (ERK) was significantly activated in ipsilateral dorsal horn after SNI surgery.

DISCUSSION: The present study demonstrated that HMGB1 was overexpression in the dorsal horn neurons and ventral horn motor neurons after spared nerve injury and might be related with microglia activation. Our results suggested that neuronal HMGB1 might serve a trigger for neuron-glia interaction, and provided evidence for a novel mechanism involved in neuropathic pain induced by nerve injury. Targeting HMGB1 signaling may be an important therapeutic strategy in peripheral nerve injury induced neuropathic pain.

REFERENCES: Nature Neuroscience 2007;10:1361-8.

S-297.**CAN INTRADERMAL ADRENOCEPTOR ADMINISTRATION REVERSE UV-INDUCED SENSITIZATION TO PAINFUL STIMULI?**

AUTHORS: H. Ruschulte1, M. Karst1, J. Knitsch1, M. Bernateck1, W. Koppert1, T. Hucho2

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INTRODUCTION: Tissue injuries may lead to pain by activating the signaling component protein kinase C epsilon to be activatable only once due to an downstream inhibitory pathway.¹ Preclinical data have been shown that this inhibitory memory can be activated pharmacologically.² We aimed to investigate if a beta agonist injection can reverse sensitization caused by UVB-induced erythema.

METHODS: The study was planned as a prospective controlled study and was approved by the IRB. We examined a sample size of n=17. Mechanical pain thresholds were measured by sharp pinpricks³ and blunt plastic projectiles applied to the skin via a pneumatically driven device.⁴

Each participant received an individual UVB dose (MED, i.e. medium erythema dose) (Multitester, Medlight, Herford, Germany) to cause a 0.25 cm² mild erythema on both forearms, 24 hours later the skin of each forearm was injected intradermally with 5 mcl (2.5 mcg) of terbutaline or pH-adjusted saline solution. Pain thresholds were examined before erythema induction, before injection and 15, 30, and 45 minutes after injection.

RESULTS: Compared to baseline, MED application led to a decreased pain threshold for pin prick ($p = .03$) and projectiles ($p = .01$) in both groups, demonstrating a successful sensitization. Interestingly, both solutions reversed the sensitization indicated by an increase of the pin prick pain threshold ($+60.33 \pm 111.71$ mN; $p .041$ for terbutaline vs $+30.96 \pm 51.30$ mN; $p .024$ for control) though no significant group differences were observed. However, terbutaline showed a more pronounced reduction of sensitization meeting the baseline values. Although neither group showed significant reduction of sensitization measured by projectile impact but, again, terbutaline showed a greater tendency towards increased thresholds ($+4$ mN ± 8 for terbutaline vs $+2$ mN ± 10 for control).

DISCUSSION: The experimental setting allowed for stable and reproducible conditions. It has been shown that context dependent beta receptor activation is able to reverse sensitization. The elevated pain thresholds in the vehicle arm may be caused by different mechanisms such as mechanical (needle) and chemical (low pH) stimuli in this experimental setting activating the same intracellular pathways.

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2. Hucho et al., 2010; *FENS Abstr* 5: 215.4
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S-298.**IMPAIRED OPIOID RESPONSIVENESS FOLLOWING DIABETIC NEUROPATHY IS DUE TO ENHANCED RAB7-MEDIATED LYSOSOMAL DEGRADATION OF SENSORY NEURON MU-OPIOID RECEPTORS**

AUTHORS: S. Mousa, M. Shakibaei, M. Shaqura, L. Schaad, B. Khalefa, M. Schaefer

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INTRODUCTION: Loss in the antinociceptive efficacy of systemic, spinal, and supraspinal administration of opioids has been reported in rats with diabetic neuropathic pain. Recent studies investigated alterations in opioid receptor expression and signaling at the spinal level, however, results were conflicting. Since diabetic neuropathy is primarily a disease of the peripheral sensory neuron, this study aimed at investigating alterations of opioid responsiveness during the development of streptozotocin-induced diabetic neuropathic pain in rats.

METHODS: Following IRB approval for animal research dorsal root ganglia (DRG), sciatic nerves and subcutaneous tissue of Wistar rats were removed and examined by use of immunohistochemistry, electron microscopy, ligand binding, and G protein coupling assay. Antinociceptive effects of intraplantarly applied fentanyl were assessed by paw pressure algometry.

RESULTS: Results showed a significant decreased number of mu-opioid receptors (MOR) in DRG, reduced MOR axonal transport towards peripheral nerve endings, and diminished MOR number on peripheral nerve terminals in parallel with a significant loss in behavioral opioid responsiveness to i.pl. fentanyl. Downregulation of MOR in neuronal DRG of diabetic rats was due to enhanced Rab7-dependent MOR targeting from neuronal membranes towards lysosomal degradation. Importantly, intrathecal delivery of nerve growth factor, Rab7 siRNA or lysosome inhibitor chloroquine prevented these alterations and rescued fentanyl responsiveness.

DISCUSSION: These findings may help to better understand the differential regulation of opioid responsiveness during various states of disease and may give novel incentives for future treatment.

REFERENCES:

Supported by DFG grants MO 1006/1-4, SCHA 820/3-2, SCHA 820/4-1

S-299.**HYPERBARIC OXYGENATION ALLEVIATES CCI-INDUCED NEUROPATHIC PAIN AND DECREASES APOPTOSIS IN SPINAL CORD****AUTHORS:** Z. Yang,¹ L. Fang,¹ F. Li,¹ G. Bosco,² E. M. Camporesi³**AFFILIATION:** ¹Department of Anesthesiology, Upstate Medical University, Syracuse, NY; ²Department of Basic and Applied Medical Sciences, University of Chieti-Pescara, Chieti, Italy; ³Department of Surgery/Anesthesiology, University of South Florida, Tampa, FL**INTRODUCTION:** Increased apoptotic changes in spinal cord has been hypothesized to be responsible to the development of chronic constriction injury (CCI) induced neuropathic pain. The beneficial effect of hyperbaric oxygen treatment (HBOT) in pain disorders has been observed. We previously reported that HBOT alleviated CCI-induced neuropathic pain and reduces endoneurial TNF- α production. The present study was designed to test our hypotheses that 1) CCI-induced neuropathic pain may be associated with increased apoptotic cells in spinal cord; 2) HBOT may alleviate CCI-induced neuropathic pain; and 3) alleviated pain may be associated with reduced apoptotic cells in spinal cord.**METHODS:** Three groups of Sprague-Dawley rats were used as follows: 1) CCI (n=8), 2) CCI + HBOT (n=8), and 3) sham (n=6). Mechanical hyperalgesia was tested by von Frey filament daily following surgery. Meanwhile, the HBO rats were treated at 2.4 ATA for 60 minutes once a day. After 7 days post-CCI, animals were sacrificed and the spinal cords were harvested. The lumbar 4-5 region of the spinal cord was cryosectioned at 10 μ m and the incidence of apoptotic cells was investigated using the TUNEL technique.**RESULTS:** By 7 days post-CCI, mechanical allodynia had developed in the ipsilateral paw (4.31 ± 0.10) compared to the contralateral paw (5.26 ± 0.10) and sham animals (5.17 ± 0.08), $p < 0.05$, respectively. HBOT significantly improved mechanical allodynia (4.69 ± 0.11 vs. 4.31 ± 0.11 , $p < 0.05$). In comparison to Sham, CCI-induced neuropathic pain was associated with significantly more apoptotic cells in the dorsal horn of the spinal cord at day 7, being 19.25 ± 2.44 vs. 10 ± 0.45 , $p < 0.05$. HBOT reduced the extent of CCI-induced apoptosis to the level seen in sham animals, being 8.25 ± 0.90 vs. 10 ± 0.45 , $p = \text{ns}$.**DISCUSSION:** The present study demonstrates that CCI-induced neuropathic pain was associated with increased apoptosis in the dorsal horn of the spinal cord. HBOT alleviated CCI-induced neuropathic pain and reduced apoptosis in the dorsal horn of the spinal cord. The present study suggests that the spinal apoptotic changes may contribute to the development of CCI-induced neuropathic pain. The beneficial effect of HBOT in CCI-induced neuropathic pain may be, at least in part, due to its inhibitory role on spinal apoptosis.**REFERENCES:**

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S-300.**PROPHYLACTIC EFFECT OF COENZYME Q10 TREATMENT ON TYPE I DIABETIC NEUROPATHIC PAIN IN MICE****AUTHORS:** Y. Zhang, A. E. Eber, Y. Yuan, Y. Rodriguez, K. Candiotti**AFFILIATION:** University of Miami, Department of Anesthesiology, School of Medicine, Miami, FL**INTRODUCTION:** The pharmacologic treatment of chronic painful diabetic neuropathy remains a challenge. Coenzyme Q10 (CoQ10) is an endogenously-synthesized compound that acts as an electron carrier in the mitochondrial respiratory chain. It functions as an antioxidant, scavenging free radicals and inhibiting lipid peroxidation. We explored the effects of CoQ10 treatment on the development of mechanical hyperalgesia in type I diabetic mice and the inhibitory effect of CoQ10 on lipid peroxide.**METHODS:** Animals: All experiments were performed following approval from the IACUC Committee of the University of Miami. 200 mg/kg streptozotocin (STZ) induced type I diabetic C57 B/6 mice were used. Body weight (BW) and blood glucose levels were monitored at each time point. Three groups of mice were used: G1—Normal mice as naïve control (n=6); G2—diabetic mice (n=10) treated by vehicle; G3—diabetic mice (n=10) treated by 50 mg/kg of CoQ10 for 24 days starting on the 2nd day of diabetes. Von Frey filaments were applied to the hind paw to determine mechanical hyperalgesia thresholds. TBARS assay was performed to measure lipid peroxidation to quantify oxidative stress. Data Analysis: Data are presented as means \pm SEMs. Statistical analyses were done using one-way ANOVA or T-test with $p < 0.05$ considered statistically significant.**Challenging Case Report (only complete if your submission falls into the “Challenging Case Report” category. If you select the “Challenging Case Report” category on the next step, this section must be completed.):** N/A**RESULTS:** Final BWs were lower in both groups of diabetic mice than in the control mice. The BWs of CoQ10-treated mice were significantly higher than vehicle-treated diabetic mice (BW of G1= 28.8 ± 1.04 , G2= 26.6 ± 0.55 , G3= 21.59 ± 0.54 ; G1 vs G2 and G3, $p < 0.01$; G2 vs G3, $p < 0.01$). Final blood glucose concentrations were also elevated in both groups of diabetic mice. CoQ10 did not affect blood glucose concentrations (levels of G1= 113 ± 7.43 , G2= 323 ± 40.09 , G3= 310 ± 25.33 ; G1 vs G2 and G3 $p < 0.001$, G2 vs G3 $p > 0.05$).Diabetic mice treated with vehicle only developed significant mechanical hyperalgesia after 8 days of diabetes, however, in the diabetic mice treated with CoQ10, the onset of neuropathic pain was significantly delayed and its severity decreased. Thresholds of withdrawal for the diabetic CoQ10 treated mice were significantly higher than those treated with vehicle ($p < 0.05$). Hyperglycemia induced an increase in lipid peroxide however; CoQ10 inhibited the production of lipid peroxide in peripheral tissue like blood serum, DRG and sciatic nerve.**DISCUSSION:** CoQ10 markedly postponed the development and decreased the severity of mechanical hyperalgesia in type I diabetic mice. CoQ10's effects may be due to inhibition of free radical production. Diabetic mice treated with CoQ10 also showed weight gain compared to mice treated with vehicle only.**REFERENCES:** N/A

S-301.**INHIBITION THE NOREPINEPHRINE RELEASE IN MIDBRAIN PERIAQUEDUCTAL GRAY MAY EXPLAIN THE ANALGESIA EFFECTS OF DEXMEDETOMIDINE****AUTHORS:** S. She, Y. Zeng, X. Xu**AFFILIATION:** Dept of Anesthesiology, The First People's Hospital of Guangzhou, Guangzhou, China

INTRODUCTION: High selective $\alpha(2)$ -adrenoceptor agonists dexmedetomidine had showed potent analgesia, though its mechanism is not fully understood. This study investigated the analgesic effects of dexmedetomidine(Dex) given peritoneally in rats with Brennan's incisional pain model and their effects on norepinephrine(NE) release from periaqueductal gray (PAG).

METHODS: After approved by the Institutional Animal Care and Use Committee of the First People's Hospital of Guangzhou. 24 male Wistar rats, which microdialysis system in PAG had been successfully placed, were randomly divided into 4 groups (n=6), those were control group(Group A), incisional pain model group(Group I), Dex group(Group D) and Dex plus yohimbine group (Group DY). In Group A, rats without operation of Brennan's incisional pain were peritoneally given 2ml 0.9% normal saline. In Group I, Group D and Group DY, the rats were peritoneally given 2ml 0.9% normal saline, Dex 30 μ g/kg and Dex 30 μ g/kg plus yohimbine 0.5mg/kg respectively, then underwent operation of Brennan's incisional pain after 15 minutes. Mechanical withdrawal threshold (MWT) with Von Frey filament stimulation was measured at 30 minutes before (baseline) and 1, 2, 3, 4 hours after operation. Dialysate samples 10 μ l were collected at 30 minutes before(as baseline) and in 4 hours after operation with 30 minutes intervals via PAG microdialysis, and then immediately analyzed via high performance liquid chromatography with electrochemical detection.

RESULTS: There is no significant difference on the MWT and NE release baseline between four groups($p>0.05$). In group A, MWT showed no significant change in each checkpoint ($p>0.05$). In group I, MWT significantly dropped from (14.4 \pm 2.1)g to (4.0 \pm 0.9)g. In group D, MWT results dropped significantly only after 3 hours after the operation of incision, and were still lower than those results from group I in the same checkpoint. In group DY, MWT dropped immediately after incision, but was still higher than results from group D in each checkpoint especially in two hours after incision. In group A, the NE concentration in PAG maintained steadily. In group I, the NE concentration sharply rose from (4.98 \pm 0.12)ng/ml to (5.46 \pm 0.28)ng/ml. In group D, the NE concentration showed no significant change in first 2 hours, and rose slowly 3 hours after operation. Compared with group D, the NE concentration of group DY was higher in each checkpoint ($P<0.05$).

DISCUSSION: The NMT changed parallelly with the NE concentration in PAG. These results indicated that the analgesic and antinociceptive effects of dexmedetomidine may partially mediated by inhibition of norepinephrine release from PAG.

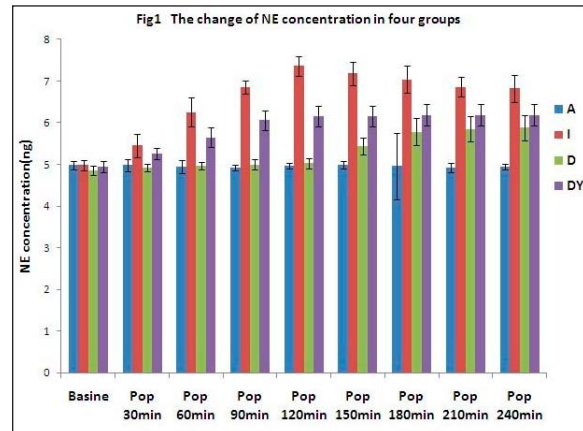
REFERENCES:

Pharmacol Res(2001)44(3):195-208.

Tab 1 The change of MWT in rats of four groups ($\chi \pm s$)g

| Group(n=6) | Baseline | Postoperative 1h | Postoperative 2h | Postoperative 3h | Postoperative 4h |
|------------|----------------|------------------|------------------|------------------|------------------|
| A | 14.1 \pm 2.7 | 13.9 \pm 2.5 | 13.8 \pm 3.0 | 14.4 \pm 2.3 | 14.2 \pm 2.6 |
| I | 14.4 \pm 2.1 | 4.0 \pm 0.9* | 3.8 \pm 1.1* | 5.3 \pm 1.5* | 5.5 \pm 1.0* |
| D | 13.9 \pm 2.0 | 12.3 \pm 1.5# | 11.3 \pm 2.2# | 8.7 \pm 1.3*# | 9.1 \pm 1.8*# |
| DY | 14.1 \pm 2.3 | 9.3 \pm 1.1*#□ | 8.4 \pm 1.4*#□ | 7.5 \pm 2.0* | 7.5 \pm 2.2* |

* $P<0.05$, compared with those of the same point of group A; # $P<0.05$, compared with those of the same point of group S; □ $P<0.05$, compared with those of the same point of group D.



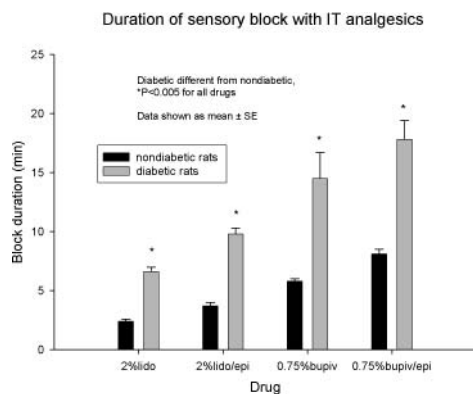
S-302.**EFFECT OF DIABETES ON DURATION OF SPINAL BLOCKS IN RATS****AUTHORS:** A. Buvanendran, J. M. Kerns, J. Kroin, K. J. Tuman**AFFILIATION:** Rush University Medical Center, Chicago, IL

INTRODUCTION: Although retrospective studies show the risk of neurological complications in diabetic patients after spinal anesthesia with local anesthetics is small (Anesth Analg 2006;103:1294), there is still concern among some anesthesiologists about the safety of spinal anesthetics, with or without epinephrine in diabetics undergoing surgery. In one clinical study (Eur J Anaesth 2008;25:1014), intrathecal 0.5% bupivacaine with epinephrine increased the duration of maximum sensory block in diabetics versus controls. This extended duration in diabetics is similar to a rat study with sciatic nerve blocks (RAPM 2010;35:343). Our study looks at the duration of sensory and motor blockade in diabetic rats versus nondiabetic rats with intrathecal local anesthetics.

METHODS: Male Sprague-Dawley rats were made diabetic by intravenous injection of streptozotocin (STZ), 50 mg/kg (RAPM 2010;35:343). Nondiabetic rats received vehicle. Blood glucose was tested at day 2 post-STZ to verify diabetes (>350 mg/dl). Diabetic neuropathy was verified by tactile sensitivity (von Frey filament) of plantar hindpaws. At 28 days after intravenous injection, an intrathecal catheter with tip at lumbar enlargement was implanted (Anesth Analg 2008;107:300). After 7 days of recovery, baseline sensory (pinprick) and motor (toe spreading reflex) responses were recorded. All animals were given an intrathecal injection of a local anesthetic: 10 μ L drug + 10 μ L saline catheter flush. Duration of sensory and motor block was monitored. Injections were repeated at 3-4 day intervals. The local anesthetics tested were 0.75% isobaric bupivacaine, with or without 100 μ g/mL epinephrine; and 2% lidocaine, with or without 100 μ g/mL epinephrine. For each local anesthetic tested, block duration was compared between diabetic rats (n=10) and nondiabetic rats (n=10) with independent samples t-test.

RESULTS: Prior to STZ injection, rats had mean force withdrawal thresholds >12 g, but by day 28 post-STZ the threshold was reduced to 2.0 ± 0.3 g in diabetic rats versus 14.0 ± 0.3 in control rats ($P<0.001$), indicating neuropathy in the diabetic animals. Spinal block with all local anesthetics showed a longer duration of sensory block in diabetic rats versus control rats (Figure). Motor block duration was also longer in diabetic rats.

DISCUSSION: Duration of local anesthetic spinal block is longer in diabetic animals than in normal animals. This may have implications for the dosing of spinal anesthetics, and the use of adjuvants, in diabetic patients.

REFERENCES: In text**S-303.****CONTRIBUTION OF SUPRASPINAL, SPINAL AND PERIPHERAL OPIOID RECEPTORS TO THE ANTINOCICEPTIVE EFFECTS OF DIFFERENT SYSTEMIC OPIOIDS IN A RAT MODEL OF INFLAMMATORY PAIN****AUTHORS:** M. Shaqura,¹ B. Khalefa,¹ M. Al-Khrasani,² S. Mousa,¹ M. Schaefer¹**AFFILIATION:** ¹Dep. of Anesthesiology, Charité University Berlin, Berlin, Germany; ²Dep. of Pharmacology, Semmelweis University, Budapest, Hungary

INTRODUCTION: Opioid binding sites have been first characterized within the brain as potential targets for their central analgesic effects. Later, however, they have been identified also in the dorsal horn of the spinal cord and on peripheral sensory nerves as additional targets for their analgesic effects. The aim of this study was to differentiate the supraspinal, spinal and peripheral MOR contribution to the overall antinociceptive effects of intravenously administered fentanyl, morphine and loperamid.

METHODS: Following IRB approval for animal research the time course of nociceptive paw pressure thresholds (PPT) following different doses of intraplantar (ipl) as well as intravenous (iv) fentanyl (6.25-50 μ g/kg), morphine (1-7.5 mg/kg) or loperamid (1-7.5 mg/kg) was examined in Wistar rats with Freund's complete adjuvant hindpaw inflammation. To assess the relative contribution of supraspinal, spinal and peripheral MOR rats received naloxone methiodide (20-100 μ g) either intracerebroventricular (icv), intrathecal or intraplantar and results were analyzed by two-way ANOVA.

RESULTS: Dose-dependent maximum efficacy of systemic fentanyl and morphine, but not of the peripherally selective loperamid were 2-fold greater and longer lasting compared to the i.pl. administration. I.c.v. but not i.pl. pretreatment with naloxone methiodide significantly reversed the antinociceptive effects of i.v. fentanyl and morphine by about 80%. Consistently, i.t. naloxone methiodide blocked about 20% of their antinociceptive effects. In contrast, i.c.v. and i.t. pretreatment with naloxone methiodide did not change antinociception of i.v. loperamid, while i.pl. administration of naloxone methiodide completely reversed it.

DISCUSSION: Taken together, antinociceptive effects of systemic opioids such as fentanyl or morphine are predominantly due to supraspinal and to a much lesser degree to spinal MOR confirming that their powerful analgesic effects are mainly through central actions. Although local application of these opioids elicits antinociception, the contribution of peripheral MOR to the antinociceptive effects of systemic opioids seems to be small. Intravenous and even local application of loperamid elicits only peripheral antinociception which showed 2-fold less efficacy than the systemic effects of fentanyl or morphine.

REFERENCES:

SM and MS are funded by DFG grant MO 1006/1-4, SCHA 820/3-2, SCHA 820/4-1

Pain – Clinical – Acute

S-304.**PATIENTS CAN PREDICT THE SEVERITY OF ACUTE POSTOPERATIVE PAIN**

AUTHORS: P. S. Manjunath, Y. Rodriguez, M. C. Gitlin, K. Candiotti

AFFILIATION: University of Miami/Jackson Memorial Hospital, Miami, FL

INTRODUCTION: In spite of numerous advances in pain management, surgical pain remains a problem for many patients who suffer from inadequate pain control. The ability to identify the subset of patients who will require more aggressive postoperative pain control may be beneficial. In this trial we assessed if patients were able to accurately predict their own level of pain tolerance and opiate consumption in the postoperative period following a nephrectomy.

METHODS: This was a prospective observational study. Following the approval from our IRB, 93 patients undergoing an open nephrectomy were recruited for the study. Written Informed consent was obtained from all patients. During the preoperative visit patients were asked to rate their level of pain tolerance as High, Moderate or Low, no other definitions were provided. All patients underwent a standardized general anesthesia with the anesthesiologists adjusting agents as they saw fit. The intraoperative opiates fentanyl and/or morphine were dosed as indicated. Postoperatively, patients were placed on morphine PCAs. Total opiate consumption at 24 and 48 hours was recorded. VAS scores were recorded at regular intervals. Patient blood samples were obtained perioperatively for IL-1Ra genotyping. Data were analyzed using non-parametric statistical test (Jonckheere-Terpstra) and Chi-Square tests.

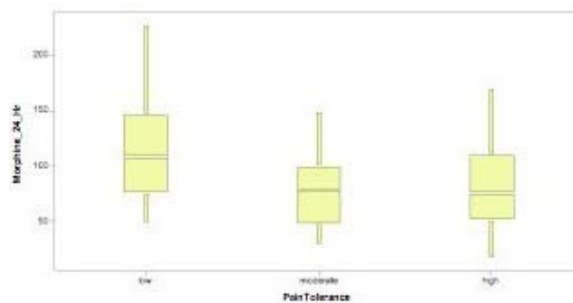
RESULTS: Results for a non-parametric statistical test (Jonckheere-Terpstra) showed that a one-tailed, but not a two-tailed, test was significant at the 0.05 level ($p < 0.05$) for total morphine consumption at 24 and 48 hours. The results suggest that individuals identifying with the "Low pain tolerance" group use more morphine than those in the "High pain tolerance" group postoperatively.

The chi-square test for independence between pain tolerance and genotype was not significant ($p = 0.689$). Accordingly, there is no evidence for an association between self-reported pain tolerance and IL-1Ra genotype.

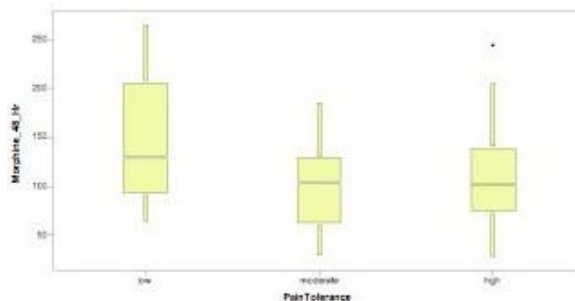
DISCUSSION: We have demonstrated that patients can reliably predict the severity of their postoperative pain and opiate consumption. However, there was no association between self-reported pain tolerance and IL-1Ra polymorphisms. Predicting which patients will require extra measures for surgical pain control is difficult as the perception of pain involves bio-psycho-social, and genetic factors. We recommend inclusion of patient self-reported pain tolerances in future models aimed at predicting the level of acute postoperative pain.

REFERENCES:

Anesthesiology 2010; 112: 1311-2



24 Hr Opiate consumption



48 Hr Opiate consumption

S-305.**THE SAFETY OF EXPAREL™, A MULTI-VESICULAR LIPOSOMAL EXTENDED-RELEASE BUPIVACAINE****AUTHORS:** E. R. Viscusi,¹ R. S. Sinatra²**AFFILIATION:** ¹Thomas Jefferson University, Philadelphia, PA; ²Yale University, New Haven, CT

INTRODUCTION: EXPAREL is an investigational long-acting local analgesic. Efficacy in wound infiltration has been demonstrated for over three days. Safety in wound infiltration studies has also been demonstrated in multiple trials; the purpose of this analysis is to examine the pooled safety profile of EXPAREL in 10 studies.

METHODS: A total of 823 patients were exposed to EXPAREL in 10 IRB approved wound infiltration studies at doses from 75mg to 600mg in five different surgical models (hemorrhoidectomy, bunionectomy, breast augmentation, total knee arthroplasty, and hernia repair); 48% were male, 21% were 65 years of age or older, and 16% were ASA class 3 or 4. In those studies, 446 control patients received bupivacaine (dose: 75mg to 200mg) and 190 received placebo; patient demographics were similar within each study. Adverse events were collected for up to 36 days post administration of study drug.

RESULTS: 62% of EXPAREL patients exhibited at least one treatment emergent adverse event (TEAE); by contrast, 75% of bupivacaine patients and 43% of placebo patients had at least one TEAE. There was one death in the EXPAREL group and one death in the bupivacaine group; both were deemed unrelated to study drug by the investigator. Serious adverse events (SAEs) occurred in 25 EXPAREL patients, 24 bupivacaine patients, and 2 placebo patients; cardiac Serious Adverse Events occurred with equal frequency in the EXPAREL group as in the bupivacaine group (0.4%). TEAEs generally increased with an increasing dose of either bupivacaine or EXPAREL. 6% of patients in both the EXPAREL and bupivacaine groups experienced a cardiac adverse event; these were primarily tachycardia (4% vs 5%, respectively) or bradycardia (2% vs 1%, respectively). The incidence of treatment related cardiac TEAEs was <1%; all were assessed by the investigator as “possibly related,” all were mild or moderate in severity, and none required therapeutic intervention. The most common TEAEs in the EXPAREL group were nausea, constipation, and vomiting.

DISCUSSION: EXPAREL, an investigational long-acting local analgesic, was generally well-tolerated and demonstrated an acceptable safety profile across 823 patient exposures. This analysis supports that EXPAREL may be a well tolerated adjunct for the management of postsurgical pain across a number of types of surgery.

REFERENCES: N/A**S-306.****A RETROSPECTIVE EVALUATION OF THE EFFICACY OF LOW VS ULTRA LOW DOSE EPIDURAL FENTANYL-BUPIVACAINE FOR POST-OPERATIVE PATIENT CONTROLLED EPIDURAL ANALGESIA IN A COMMUNITY HOSPITAL****AUTHORS:** S. L. Blum,¹ A. J. Parnass,¹ M. Moric,² S. C. Toleikis,² A. M. Schroeder,¹ S. M. Parnass¹**AFFILIATION:** ¹Anesthesiology, NorthShore-Skokie Hospital, Skokie, IL; ²Rush Medical College, Chicago, IL

INTRODUCTION: Continuous Postoperative Epidural Analgesia (POEA) with fentanyl-bupivacaine has been a well established regimen. However, concerns over respiratory depression have led to an updated PRACTICE Guideline from the ASA Task Force on Neuraxial Opioids, stating “the lowest efficacious dose of neuraxial opioids should be administered to minimize the risk of respiratory depression”.¹ In light of this we have reduced fentanyl concentration from 5 mcg/ml (FB5) to 2mcg/ml (FB2) in our epidural solution with 0.1% bupivacaine. In this retrospective study we compared the efficacy and side effects of these two solutions.

Methods: 1627 patients undergoing elective total joint arthroplasty between February 2008 and December 2010 were evaluated. Verbal Pain Numeric Rating Scores (NRS)(scale 1-10), requested/delivered, and total ml of epidural solution were recorded, as well as side effects of nausea/vomiting, itching, motor/sensory deficits, and headache, by our acute pain service on POD 0, 1 and 2. Significant differences were tested using Student’s T-test for continuous data and Fisher’s exact test.

RESULTS: There were no significant differences in requested boluses, delivered boluses, cumulative epidural solution consumption, or the use of supplemental narcotic in the two groups, even though the mean NRS was elevated in FB2, 2.8 [S.D. 2.2] vs. FB5, 2.5 [S.D. 2.1] P=0.0045. Pruritis was significantly reduced in the FB2 group, 21% FB2 v.s. 27% FB5 (P=0.0097), as was nausea/vomiting, 9% FB2 v 13% FB5 (P=0.0300). There were no differences in the incidences of headache, motor block, tingling or numbness.

DISCUSSION: In accordance with the ASA PRACTICE Guideline to use the lowest effective concentration of narcotic, we have found our FB2 solution to be clinically equivalent as evidenced by similar requested total and per day boluses and use of supplemental narcotics, while having fewer side effects than our FB5 solution. The statistically higher pain score in the FB2 solution was not felt to be clinically relevant by the acute pain service as the average pain score in both groups were less than NRS 3.

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1. Practice Guidelines for the Prevention, Detection, and Management of Respiratory Depression Associated with Neuraxial Opioid Administration. Anesthesiology 2009;110:218

S-307.**POST-OPERATIVE PAIN FOLLOWING KNEE ARTHROPLASTY: ROLE OF AGE, GENDER AND OBESITY****AUTHORS:** S. A. Azim, R. Sangster, D. Coleman, C. Curcio, R. A. Reinsel, H. Benveniste**AFFILIATION:** Department of Anesthesiology, Stony Brook University, Stony Brook, NY

INTRODUCTION: Optimized peri-operative pain management of patients undergoing total knee arthroplasty (TKA) is essential for patient health, satisfaction, rehabilitation and for prevention of chronic pain.¹ Currently, at our institution post-operative pain management for TKAs involves a peripheral femoral nerve catheter combined with opioids and non-opioid analgesics (e.g. pregabalin and celebrex). Here we tested the hypothesis, that this multi-modal analgesic regimen would provide adequate pain relief for all TKA patients with expected average pain scores <3-4 over the first 24 hrs post-operatively.

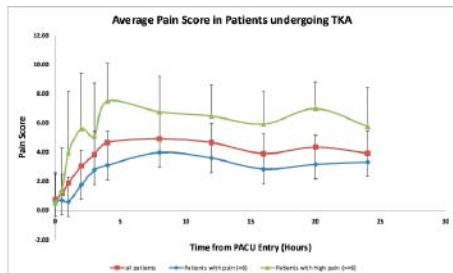
METHODS: With approval from the IRB we collected retrospective data from 100 patients undergoing TKA under this anesthetic regimen during 2009 (consent waived). Data collection included demographic data, visual analogue pain scores (VAS, 0-10) collected every 4 hours thereafter until the femoral nerve catheter was discontinued. In addition, opioid consumption was recorded as the amount of morphine equivalents administered during the first 24 hrs.

RESULTS: Demographic analysis revealed that the mean age of the TKA patients was 65.5 ±11.1 years with a mean body mass index of 33.2 ±6.7 and 60% were female. Further, 33 % of our TKA patients had average pain scores of >6 ('High pain' Group) in spite of indwelling functioning femoral nerve catheters and also predictably consumed significantly more opioids than the 'Low Pain' Group over the first 24 hrs post-operatively. A chi-square test demonstrated that 'younger' age was a significant independent variable (p=0.035) between the 'High Pain' (HP) and 'Low Pain' (LP) groups. We also observed that the HP group trended to be more obese compared to the LP group.

DISCUSSION: Our retrospective analysis demonstrated that the majority of our patients were female with a BMI>33 (33.2 ±6.7) and further that younger patients were at higher risk for acute post-operative pain compared to elderly patients. Specifically, in spite of multi-modal analgesic care which included indwelling femoral nerve catheters, pregabalin and NSAIDS, 33% of our patients undergoing unilateral TKA experienced excessive pain (>6 VAS) during the first 24-hr post-operatively and also tended to be characterized by higher BMIs. We are in the process of implementing a prospective study to improve our pain management and to examine the impact of circulating levels of leptin which is a hormone involved in regulating body weight and is known to be increased in conjunction with proinflammatory cytokines including IL-6 and TNF-alpha in most obese adults.²

REFERENCES:

1. Nikolejsen et al., Acta Anesthesiologica Scand. 2006 Apr;50(4):495-500.
2. Ahima and Osei, Front Horm Res. 2008;36:182-97

**S-308.****HIGH AND LOW PREOPERATIVE ANXIETY AND POSTOPERATIVE PAIN****AUTHORS:** D. Kramer, H. Bennett, M. Baik, G. Shah, P. Byrnes**AFFILIATION:** St. Lukes-Roosevelt Hospital, New York City, NY

INTRODUCTION: There has been controversy over the role that preoperative anxiety plays in affecting post-operative pain.^{1,2} We conducted the following study to evaluate anesthetic drug use and reported outcomes for POD1 and POD2 in high and low anxiety patients.

METHODS: Following Institutional IRB approval patients were enrolled in the study and preoperative evaluation of their anxiety state using the State-Trait Anxiety Inventory, or STAI(3) was performed on the day of surgery. The anesthesiology, surgical and nursing staff were blinded to results of STAI. Patients also ranked importance of avoidance of 10 anesthetic sequelae (e.g., discomfort with ETT, pain, nausea). Intraoperative and demographic data were obtained from CompuRecord® AIMS. On POD 2, patients completed a survey of their anesthesia experience. Patients were segregated into quartiles based on STAI and the data was analyzed for patients in the first (Group I- 1st quartile- Lowest anxiety - STAI <29) and fourth (Group IV- Highest anxiety - STAI >39) quartiles.

Challenging Case Report (only complete if your submission falls into the "Challenging Case Report" category. If you select the "Challenging Case Report" category on the next step, this section must be completed.): N/A

RESULTS: 282 patients were studied and of these 141 patients were segregated based on STAI into Group I and Group IV. Table I reviews STAI scores and demographic indicators for the quartile subgroups. Table II reviews Intra-operative IV Medication and Table III Pain Reporting and Complaints.

The two quartiles subgroups were similar in age, educational, ASA score, and prior anesthetic experience; with the exception that a higher percentage of Group IV were women. Intra-operative narcotic, sedative and anxiolytic use were similar. Patients in Group IV reported higher preoperative pain than Group I, whereas there was no difference in pain immediately following the surgery and at 48 hours between the 2 quartiles. Postoperative pain at 24 hours was higher in Group IV.

DISCUSSION: While controversy still exists regarding the role of preoperative anxiety in the postoperative experience, we noted an increased pain ranking at 24 hours post-op in highly anxious patients. This data is useful to anticipate acute pain management needs and help advise in caring for the highly anxious surgical patients.

REFERENCES:

1. AORN 2007; 85:589-94
2. Anesth Analg 1997;85:117-2
3. State Trait Anxiety Index, <http://www.mindgarden.com/products/staisad.htm>

Table I STAI and demographic indicators

| | STAI | Age | Gender %F* | Educational Level | ASA Class | Prior Anesth. % |
|----------|------|------|------------|-------------------|-----------|-----------------|
| Group I | 25.0 | 47.2 | 58 | 15.68 | 2 | 92.4 |
| Group IV | 53.7 | 45.5 | 74 | 15.58 | 2 | 89.2 |

*p = 0.0421

Table II Intra-operative IV medication

| | Pentanyl (ug) | Hydromorphone (mg) | Midazolam (mg) | Propofol (mg) |
|----------|---------------|--------------------|----------------|---------------|
| Group I | 180.7 | 0.15 | 2.71 | 131.25 |
| Group IV | 183.3 | 0.27 | 3.39 | 128.26 |

Table III Pain reporting and complaints

| | Preop Pain Scale | Preop Pain Outcome Ranking | Postoperative Complaints | Pain Rank Immediate | Pain Rank 24 Hr** | Pain Rank 48 Hr |
|----------|------------------|----------------------------|--------------------------|---------------------|-------------------|-----------------|
| Group I | 1.4 | 3 | 20.0 | 2.55 | 3.18 | 2.55 |
| Group IV | 2.2 | 3 | 28.6 | 3.83 | 5.49 | 3.76 |

*p=0.0238 **p = 0.0010

S-309.**THE EVALUATION OF POSTOPERATIVE PAIN IN PATIENTS UNDERGOING ROBOTIC VS. OPEN LAPAROTOMY APPROACH FOR STAGING OF ENDOMETRIAL CANCER**

AUTHORS: E. G. Puente,¹ M. A. Antor,¹ E. Lopez,¹ D. E. Cohn,² S. D. Bergese¹

AFFILIATION: ¹The Ohio State University, Department of Anesthesiology, Columbus, OH; ²The Ohio State University, Department of Gynecology Oncology, Columbus, OH

INTRODUCTION: Endometrial cancer (EC) is the 4th most common cause of cancer (CA) in American women and the number one gynecological CA in the US. Robotic surgery (RS), a minimally invasive procedure, is a novel laparoscopic approach (LA) for surgical staging and treatment of EC. While, the abdominal approach is associated with moderate to severe postoperative pain (POP), the LA is sought to present significantly less POP. Other benefits of the LA include quicker recovery and better short term quality of life. It has been suggested that the RS technology for staging and treatment of EC, can provide the same benefits as the LA. There is limited data on the RS approach for staging of EC. Therefore, we evaluated whether there would be a reduction in postoperative pain (POP) following RS in comparison to the open laparotomy (OL) approach in patients undergoing surgical staging of EC.

METHODS: After IRB approval and informed consent, we conducted a prospective, single-center observational study on 52 females with stage I or II EC undergoing surgical staging of EC either by RS or OL at OSUMC. Patients were classified into one of the two groups R or OL and treated with intravenous opioids (PCA) for POP during the first 24 hrs and with a choice of PRN IV or PO opioids after day one. VAS scores at rest and after leg extension were obtained at baseline, 24 and 48 hrs after surgery to assess pain. Opioid consumption (OC) was registered on a daily basis until discharge.

Challenging Case Report (only complete if your submission falls into the “Challenging Case Report” category. If you select the “Challenging Case Report” category on the next step, this section must be completed.): N/A

RESULTS: After IRB approval and informed consent, 52 females were included in the study, 34 (65.38%) underwent RS and 18 (34.62%) OL for staging of EC. First day median VAS score at rest was 24.139 mm in the RS group compared to 33.070 mm in the OL group. First day Mean VAS score with leg extension was 20.856 mm in the RS group compared to 30.195 mm in the OL group (Fig. 1). Only data from 35 patients was analyzed for mean opioid consumption within the first 24 hours (MOC). In the RS group (n=19) the MOC was 80.00 mg vs. 40.10 mg in the OL group (n=16) (Fig. 2). There was no statistically significant difference in the mean values between the two groups ($p = 0.051$).

DISCUSSION: Even though there is a trend showing lower pain scores in patients undergoing RS, no statistical significant difference was found between the Mean VAS scores for the first 24 hours after surgery amongst the two groups. Also, there was no significant difference between the mean VAS scores at rest and mean VAS scores after leg extension in either the RS group or the OL group. The results suggest a greater OC in the RS group, but we cannot exclude the possibility that the difference is due to random sampling variability.

REFERENCES: N/A

S-310.**ANALGESIC EFFICACY OF PREOPERATIVE VERSUS INTRAOPERATIVE DEXAMETHASONE AFTER LAPAROSCOPIC CHOLECYSTECTOMY WITH MULTIMODAL ANALGESIA**

AUTHORS: S. Lim, K. Lee, S. Cheong, K. Cho

AFFILIATION Paik Hospital, Busan, Republic of Korea

INTRODUCTION: Pain after laparoscopy is multifactorial and different treatments have been proposed to provide pain relief. Multimodal analgesia is now recommended to prevent and treat post-laparoscopy pain. Dexamethasone is effective in reducing postoperative pain. The timing of steroid administration seems to be important. We evaluated the analgesic efficacy of preoperative intravenous dexamethasone 1 hour before versus during laparoscopic cholecystectomy with multimodal analgesia.

METHODS: One hundred twenty patients aged 20 to 65 years old were allocated randomly into one of three groups (n = 40, in each). The patients in the group N received normal saline 1 hour before induction and after the resection of gall bladder. The patients in the group S1 received dexamethasone 8 mg 1 hour before induction and normal saline after the resection of gall bladder. The patients in the group S2 received normal saline 1 hour before induction and dexamethasone 8 mg after the resection of gall bladder.

RESULTS: VAS scores of group S1 and S2 were lower than that of group N during 48 hours after laparoscopic cholecystectomy. There were no significant differences of VAS scores between the group S1 and the group S2. The analgesic consumption of group S1 and S2 were significantly lower than that of group N.

DISCUSSION: A single dose of dexamethasone (8 mg) intravenously given 1 hour before induction or during operation was effective in reducing postoperative pain after laparoscopic cholecystectomy with multimodal analgesia. The analgesic efficacy of preoperative intravenous dexamethasone 1 hour before versus during surgery was not significantly different.

REFERENCES:

1. Menten O, Harlak A, Yigit T, Balkan A, Balkan M, Cosar A, et al. Effect of intraoperative magnesium sulphate infusion on pain relief after laparoscopic cholecystectomy. *Acta Anaesthesiol Scand* 2008; 52: 1353-9.

S-311.**THE EFFICACY OF EXPAREL™, A MULTI-VESICULAR LIPOSOMAL EXTENDED-RELEASE BUPIVACAINE****AUTHORS:** S. D. Bergese,¹ K. Candiotti,² S. R. Gorfine³**AFFILIATION:** ¹The Ohio State University, Columbus, OH; ²University of Miami, Miami, FL; ³The Mount Sinai Medical Center, New York, NY**INTRODUCTION:** EXPAREL is an investigational long-acting local analgesic. A well-tolerated safety profile has been demonstrated. Efficacy in wound infiltration studies has also been demonstrated for three days in multiple trials which are summarized here.**METHODS:** The EXPAREL wound infiltration program encompassed multiple dosing comparisons throughout ten clinical trials; nine of these were randomized parallel-group clinical trials, seven of which had a bupivacaine control and two of which had a placebo control. A total of 823 patients were exposed to EXPAREL at doses from 75mg to 600mg in both soft-tissue and orthopedic models across five different surgical procedures: hemorrhoidectomy, bunionectomy, breast augmentation, total knee arthroplasty, and inguinal hernia repair. In those studies, 446 control patients received bupivacaine (dose: 75mg to 200mg) and 190 received placebo. Efficacy was assessed by multiple methods, with a program-wide endpoint of the area under the curve of the numeric rating scale for pain at rest through 72 hours applied.**RESULTS:** The pivotal trials met their primary endpoint (the numeric rating scale scores for pain at rest combined to generate the area under the curve through 72 hours [Hemorrhoidectomy] and through 24 hours [Bunionectomy]) with $p < 0.0001$ and $p = 0.0005$, respectively. When a program-wide endpoint of the area under the curve of the numeric rating scale score for pain at rest from 0 through 72 hours was applied, statistical significance was again achieved in both the soft-tissue and orthopedic models favoring EXPAREL over the control arm (see figure below).**DISCUSSION:** EXPAREL, as demonstrated by the body of evidence presented, has efficacy as a long-acting local analgesic for three days and may therefore be useful in the reduction of postsurgical pain.**REFERENCES:** N/A

S-312.**CSF NEUROTRANSMITTER CHANGES IN THE PERIOPERATIVE PERIOD IN PATIENTS UNDERGOING TOTAL KNEE REPLACEMENT SURGERY****AUTHORS:** A. Buvaendran, J. Kroin, C. Della Valle, M. Moric, K. J. Tuman**AFFILIATION:** Rush University Medical Center, Chicago, IL**INTRODUCTION:** While total knee replacement (TKR) has been of enormous benefit to patients with knee osteoarthritis, acute postoperative pain and even persistent postoperative pain can be severe and difficult to manage (Pain 2003;106:393;Anesth Analg 2010;110:199). The role that the major spinal cord neurotransmitters play in the acute postoperative period is not clear and has been studied infrequently in humans.**METHODS:** All patients had an intrathecal catheter placed for spinal anesthesia during TKR, and for continuous spinal analgesia during the postop period using fentanyl and bupivacaine. The same catheter was used to sample cerebrospinal fluid (CSF) presurgery and at 2, 4, 8, 12, 24, and 32 h after catheter placement. CSF samples were assayed for norepinephrine, substance P, calcitonin gene related peptide (CGRP) and glutamate. The bodily pain scale of the SF-36 health survey was measured presurgery, and numerical rating scale (NRS) pain scores and intrathecal analgesic consumption were recorded postsurgery. We performed a randomized, placebo-controlled, double-blind trial with 3 drug groups (N=16/gp): placebo; single-dose pregabalin (150 mg administered p.o. prior to surgery); and multi-dose pregabalin (150 mg administered p.o. presurgery and 12 and 24 h later); to determine the effect of an antihyperalgesic drug on spinal neurotransmitters.**RESULTS:** Prior to surgery, increased bodily pain was correlated with increased CSF norepinephrine and CGRP concentrations. In patients receiving placebo, norepinephrine levels at the early time points (2 and 4 h) were lower than the presurgery baseline value, and in both pregabalin groups this reduction lasted 12 h. Substance P levels had an early peak value (at 2 h) in all 3 groups, and then returned to baseline. CGRP levels only decreased at the 32-h time point in the placebo group but in both pregabalin groups, CGRP levels decreased over the 4-32 h period. In the placebo group only, glutamate decreased over the 4-32 h period. However, there was no difference in the CSF neurotransmitter concentrations between the three treatment groups over the 32-h sampling period. In the placebo group, the early NRS pain score area under-curve, AUC [0-12 h], was positively correlated ($R=0.67$, $P=0.0088$) to the late CSF norepinephrine concentration AUC [12-24 h]; but none of the other neurotransmitters were correlated with NRS. None of the neurotransmitter levels were correlated to postoperative analgesic consumption or range of motion.**DISCUSSION:** In the perioperative period, the concentration change of each spinal neurotransmitter has a distinct time course, both with and without pregabalin administration.**REFERENCES:** In text

S-313.**THE RELATIONSHIP OF INTRA-OPERATIVE OPIOIDS AND POST TRAUMATIC STRESS DISORDER IN BURNED SOLDIERS**

AUTHORS: M. Fowler, T. H. Garza, H. E. Cortez, C. V. Maani, J. J. Hansen, L. McGhee

AFFILIATION: US Army Institute of Surgical Research, Fort Sam Houston, TX

INTRODUCTION: Post Traumatic Stress Disorder (PTSD) is a psychological disorder characterized by recurrent flashbacks, nightmares, emotional disturbances, social withdrawal and forgetfulness.¹ It often arises after a traumatic experience in which the participant is threatened with harm or death. The risk of PTSD increases if the participant is physically harmed. Recent efforts by Holbrook et al. identified a correlation between increased morphine usage in Marines during the first 24 hours after injury and decreased PTSD development.² This study examined a relationship between intra-operative opioid usage and PTSD development in burned Soldiers.

METHODS: After IRB approval and in accordance with the approved protocol, the intra-operative records of Soldiers who were screened for PTSD were examined to determine the amount of opioids received, the number of surgeries, and demographic data. The study population was U.S. soldiers who had sustained thermal injuries during OIF/OEF deployments, and who were cared for at the USAISR Burn Center between 2002 and 2008.

Challenging Case Report (only complete if your submission falls into the “Challenging Case Report” category. If you select the “Challenging Case Report” category on the next step, this section must be completed.): N/A

RESULTS: Soldiers were sorted into two groups: those with PTSD and those without PTSD. The groups had similar injuries [Injury Severity Score (ISS) and Total Body Surface Area burned (TBSA)]. They underwent a similar number of surgeries during the first 30 days after injury and throughout their treatment. They received a similar amount of opioids during the operative sessions and received similar amounts of intra-operative ketamine.

DISCUSSION: We see no relationship between the amount of intra-operative opioids and PTSD development in burned Soldiers in either the amount received throughout their care or the amount received during the first 30 days after injury. The development of PTSD is a complex process and multiple factors play a part making isolation of one relationship difficult, especially with small sample sizes.

REFERENCES:

1. Association, A.P., Diagnostic and statistical manual of mental disorders. 4th ed. 1994, Washington, D.C.: American Psychiatric Association.
2. Holbrook, T.L., et al., Morphine use after combat injury in Iraq and post-traumatic stress disorder. *N Engl J Med.* 362(2): p. 110-7.

| | Soldiers with PTSD N=46 | Soldiers without PTSD N=97 | P value |
|--|--|---|----------------|
| ISS | 24.1 ± 15.3 | 27.3 ± 21.6 | P=0.787 |
| TBSA | 19.3 ± 12.6 | 19.4 ± 13.3 | P=0.960 |
| Surgeries in acute phase | 2.0 ± 1.6 | 2.2 ± 1.8 | P=0.516 |
| Intra-operative Morphine Equivalent Units in Acute Phase | 219.0 ± 470.3 | 227.7 ± 284.3 | P=0.775 |
| Intra-operative ketamine in Acute Phase | 156.1 ± 201.4 | 245.2 ± 408.6 | P=0.268 |
| Surgeries throughout treatment | 4.4 ± 4.4 | 4.6 ± 4.4 | P=0.869 |
| Intra-operative Morphine Equivalent Units throughout treatment | 338.5 ± 541.2 | 405.1 ± 560.3 | P=0.878 |
| Intra-operative ketamine throughout treatment | 278.7 ± 363.4 | 367.7 ± 633.8 | P=0.660 |

S-314.**CONTINUOUS LIDOCAINE INFUSION FOR INTRACTABLE ALLODYNIA IN AN ICU PATIENT****AUTHORS:** B. B. O'Donnell, J. C. Estebe, M. Depinto, W. T. Edwards**AFFILIATION:** University of Washington, Seattle, WA**INTRODUCTION:** We describe the successful use of a week-long lidocaine infusion for intractable allodynia in a setting of escalating opioid tolerance.**METHODS:** see challenging case report below

Challenging Case Report (only complete if your submission falls into the "Challenging Case Report" category. If you select the "Challenging Case Report" category on the next step, this section must be completed.): A 34-year old male who sustained severe pelvic crush & enteric injuries when hit in a pedestrian accident. After large volume resuscitation (120+ units PRBCs + FFP), and admission to the ICU, he became septic. Six weeks of escalating fentanyl, hydromorphone, midazolam, and ketamine infusions (plus IV methadone) had been used, when he developed a global allodynia unresponsive to all treatments. He grimaced in pain from any contact or movement, with an elevation of vital signs and respiratory rate. Given that all standard avenues of therapy had been tried (opioid, NMDA antagonist, gabapentinoid) without effect, it was proposed that a lidocaine infusion be utilized. Adapting the protocol of Kaba et al.,¹ a rate of 1.33 mg/kg/hr was used, but without a bolus/loading dose. The next day, he could be turned to new positions without wincing or elevation of vital signs. His dose was reduced to 1 mg/kg/hr due to concerns about renal clearance of MEGX, the metabolite of lidocaine. The lower dose maintained effective treatment of movement associated pain for the next three days. Then he returned to the OR and his pain became uncontrollable again. A resumption of 1.33 mg/kg/hr for 24 hours provided improved pain relief before tapering him off over 3 days.

RESULTS: The lidocaine infusion was efficacious at controlling the pain during its duration and enabled pain control with the previously ineffective regimen after its cessation. There were no episodes of hemodynamic/cardiac instability associated with the week long infusion. Unfortunately, the patient experienced further episodes of sepsis and was ultimately placed on comfort care.

DISCUSSION: As noted by many authors, pain associated with movement does not respond well to opioids. The presumption here was that sensitization of pressure-sensing pathways contributed to the patient's allodynia. The escalating dose of opioids prior to the infusion suggests tolerance/opioid induced hyperalgesia contributing to pain. Lidocaine was chosen for its non-opioidergic mechanism, and its known ability to suppress A δ and C fibers.² This is an early report of lidocaine for pain control in an ICU setting for a sustained period of time.

REFERENCES:

1. Anesthesiology. 2007 Jan;106(1):11-8.
2. Anesthesiology. 1991 May;74(5):934-6

S-315.**EVIDENCE-BASED MANAGEMENT OF PAIN AFTER INGUINAL HERNIA REPAIR IN ADULTS****AUTHORS:** G. P. Joshi,¹ N. Rawal,² H. Kehlet³**AFFILIATION:** ¹Department of Anesthesiology and Pain Management, University of Texas Southwestern Medical School, Dallas, TX; ²Department of Anaesthesiology and Intensive Care, University Hospital, Örebro, Sweden; ³Section for Surgical Pathophysiology, Copenhagen, Denmark

INTRODUCTION: Inguinal hernia repair is associated with moderate postoperative pain, but optimal evidence-based pain therapy remains controversial. The aim of this study is to develop evidence-based, consensus recommendations for the effective management of pain after hernia repair, developed from a procedure-specific systematic review, transferable evidence from relevant procedures, and clinical practice observations.

METHODS: Systematic literature review using the Cochrane protocol was performed. Randomized studies in English, assessing analgesic or anesthetic interventions in hernia repair surgery in adults, and reporting pain on a linear analogue, verbal or numerical rating scale published between 1966 and March 2009 were included. Primary outcome measures were postoperative pain scores and secondary outcome measures were supplemental analgesic requirements and other recovery outcomes (e.g., adverse effects, functional recovery). Both qualitative and quantitative analyses were performed where appropriate.

Challenging Case Report (only complete if your submission falls into the "Challenging Case Report" category. If you select the "Challenging Case Report" category on the next step, this section must be completed.): N/A

RESULTS: Of the 335 randomised studies identified, 81 studies were included. The reasons for exclusion included pain scores not reported, alternative non-pharmacologic interventions evaluated, surgical interventions assessed, and laparoscopic approach used.

DISCUSSION: Although SA provides excellent surgical anaesthesia and early postoperative analgesia, potential limitations (e.g., delayed ambulation and increased incidence of urinary retention) could impact discharge after ambulatory surgery. Field block (ilioinguinal/iliohypogastric/genitofemoral nerve blocks) with or without wound infiltration, either as a sole anaesthetic/analgesic technique or as adjunct to GA, is recommended to reduce postoperative pain. Continuous local anaesthetic infusion of surgical wound provides longer duration of analgesia. Conventional NSAIDs or COX-2-selective inhibitors in combination with paracetamol, administered in time to provide sufficient analgesia in the early recovery period, are recommended. In addition, weak opioids are recommended for moderate pain, and strong opioids for severe pain on request.

There is a need to evaluate optimal multimodal analgesia strategies. The role of TAP block in comparison with traditional field block needs to be evaluated. Intra-wound capsaicin has been shown to provide excellent analgesia, and requires further evaluation. Furthermore, the role of ketamine and alpha-2-delta ligands (gabapentin/pregabalin), particularly in patients at high risk of persistent postoperative pain, need evaluation.

REFERENCES: N/A

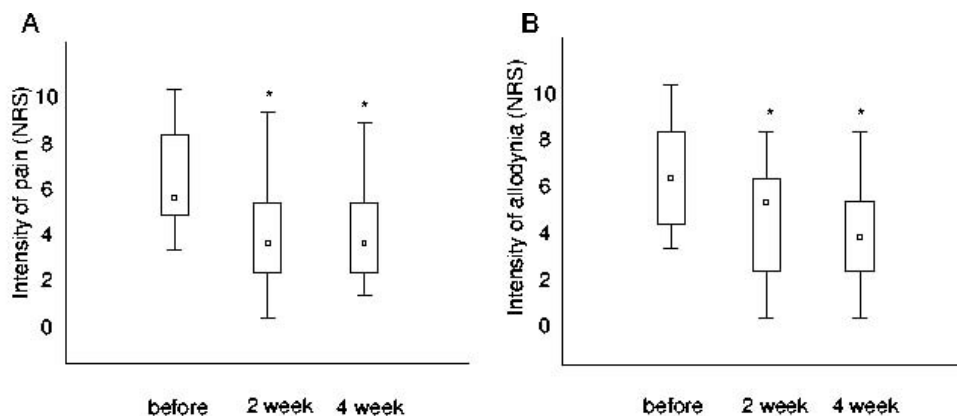
Pain – Clinical – Chronic

S-316.**YOKU-KAN-SAN ALLEVIATES PAIN AND ALLODYNIA
IN PATIENTS WITH POSTHERPETIC NEURALGIA****AUTHORS:** T. Sakai, K. Sumikawa**AFFILIATION:** Department of Anesthesiology, Nagasaki University School of Medicine, Nagasaki, Japan**INTRODUCTION:** Yoku-Kan-San, Japanese herbal medicine, is used against anxiety and insomnia, and known to improve agitation and irritation. Recently, some reports demonstrated that Yoku-Kan-San is effective for neurological disorders.^{1,2}Postherpetic neuralgia is one of neuropathic pain syndromes which is defined as dysfunction of the nervous system, and often causes mood and sleep disturbances.³

This study was carried out prospectively to investigate the analgesic effect of Yoku-Kan-San on postherpetic neuralgia.

METHODS: After obtaining institutional approval and written informed consent, 14 patients with postherpetic neuralgia were included. The patients were administered Yoku-Kan-San, 7.5 mg/day, orally. The intensities of pain and allodynia were assessed before and at 2 and 4 weeks after administration, using a numerical rating scale (NRS), from 0 to 10, in which 0 = no pain and 10 = excruciating pain. We also investigated whether insomnia and irritation were improved after administration. For statistical analysis of repeated measures over time, the Friedman test was used. When significance was found, the Wilcoxon signed rank test was used for post-hoc testing. $P < 0.05$ was considered statistically significant.**RESULTS:** The intensities of pain and allodynia at 2 and 4 weeks after administration were significantly lower than those before administration (fig. A and B). Eleven and 13 of the patients suffered from insomnia and irritation before the study, respectively. Insomnia and irritation were improved in 10 and 11 patients, respectively.**DISCUSSION:** Yoku-Kan-San relieved pain in patients with postherpetic neuralgia, possibly resulting from improvement of mental symptoms such as insomnia and irritation, which could aggravate pain.**REFERENCES:**

1. J Clin Psychiatry 2005;66:248-252
2. Int J Neuropsychopharmacol 2009;12:191-9
3. J Pain 2005;6:356-63

**Fig. A and B.**

The intensities of pain (A) and allodynia (B) before and 2 and 4 weeks after administration of Yoku-Kan-San. The intensities of pain and allodynia 2 and 4 weeks after administration of Yoku-Kan-San were significantly lower than before (* $p < 0.05$).

Data values are presented as medians, 25th and 75th percentiles and ranges.

NRS, numerical rating scale.

S-317.**A NOVEL TECHNIQUE TO DENERVATION OF THE SACROILIAC JOINT: MULTIPLE SITE RADIOFREQUENCY LESIONS****AUTHORS:** G. Ranganathan, R. Diaz**AFFILIATION:** University of Texas Medical Branch, Galveston, TX

INTRODUCTION: The sacroiliac (SI) joint is the primary source of pain in 10% to 27% of the patients with chronic low back pain.¹⁻³ Currently, intraarticular injections or neurolysis of the nerve supply via radiofrequency thermocoagulation (RFTC) are the only methods available to manage this pain.⁴⁻⁵ These forms of therapy are conducted on the basis that diagnostic sacroiliac joint injections relieved the patient's pain for a significant amount of time. Thus, neurolysis of the sacroiliac joint theoretically should provide prolonged pain relief. Unfortunately, current methods for SI joint radiofrequency neurotomy have only showed an II-3 indicated level of evidence and 2B/A weak recommendation based on Guyatt et al.⁶ Because there are no long term effective treatment options for SI joint pain, we developed an alternative technique to conventional radiofrequency neurotomy of the sacroiliac joint in the hopes of improving patient outcome.

METHODS: The patient is placed in a well padded prone position. The S1 and S2 foramen are identified under fluoroscopy. Topical analgesia is applied followed by insertion of a curved 22 gauge spinal needle into the 4 o'clock position of the right S1/S2 foramen or 8 o'clock position of the left S1/S2 foramen. The S1 and S2 lateral nerve roots are then delineated with omnipaque. Three curved 22 gauge SMK needles are placed along the nerve and RFTC is applied along the nerve followed by a steroid/ local anesthetic solution.

Challenging Case Report (only complete if your submission falls into the "Challenging Case Report" category. If you select the "Challenging Case Report" category on the next step, this section must be completed.): N/A

RESULTS: N/A

DISCUSSION: As noted per the literature, standard RFTC for chronic or refractory sacroiliac joint pain is a variably effective treatment for 3 to 6 months (7). The technique described in our report offers the safety and diagnostic accuracy of traditional RFTC but longer duration of effective pain relief is anticipated with our multiple lesion technique.

REFERENCES:

1. Pain Physician, vol 4, pages 308-316, year 2001
2. American Journal Physical Medicine Rehabilitation, vol 85, pages 997-1006, year 2006
3. Pain Physician, vol 9, pages 61-67, year 2006
4. Pain Physician, vol 10, pages 165-184, year 2007
5. Pain Physician, vol 8, pages 115-125, year 2005
6. Pain Physician, vol 12, pages 399-418, year 2009
7. Physical medicine and rehab, vol 2, pages 842-851, year 2010



Fig 1. Fluoroscopic image demonstrating the delineation of the S1 lateral nerve root from the sacral foramen innervating the right SI joint.

S-318.**ANATOMIC ANALYSIS OF COMPUTED TOMOGRAPHY IMAGES FOR DETERMINING THE OPTIMAL OBLIQUE FLUOROSCOPE ANGLE FOR PERCUTANEOUS CELIAC PLEXUS BLOCK****AUTHORS:** C. Lee, W. Kim, S. Kim, W. Sim**AFFILIATION:** Dept of Anesthesiology and Pain Medicine, Samsung Seoul Hospital, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Republic of Korea

INTRODUCTION: Percutaneous celiac plexus block (CPB) is a valuable therapeutic modality in the treatment of refractory abdominal pain caused by late stage abdominal malignancies¹ as well as other inflammatory conditions such as chronic pancreatitis.² The target in the retrocrural celiac plexus block (CPB) is the retrocrural space posterior to the crus of the diaphragm, which is just posterior to the aorta on the left and to the anterolateral aspect of the aorta on the right.¹ The present study aimed to determine an optimal safe oblique angle for fluoroscopy in fluoroscope-assisted CPB through the use of abdominal computed tomography (CT) scan images. Additionally, we sought to determine whether differences in the optimal safe oblique angle exist among patients with pancreatic head cancer (CAH), body and tail cancer (CAB), or chronic pancreatitis (CP).

METHODS: Abdominal CT scans from 150 patients were included in the study sample after approval of IRB. The oblique angle and entry distance from midline were measured in all subjects at the T12 and L1 levels. The range of the angle was from the minimum angle to the celiac plexus, passing over the lateral aspect of the body, to the maximum angle to the target not puncturing the pleural space, liver, or kidney. Measurements from three groups were subsequently compared with each other.

RESULTS: There were significant differences in the optimal angle between the T12 and L1 levels. The optimal angle was significantly different between right and left sides at the T12 level, although no such difference was identified for the L1 level. There was no significant difference of angle between genders. Likewise, there was no significant difference of oblique angle or entry distance among the three groups.

DISCUSSION: The measurements derived from this study can be used as a reference for CPB and neurolysis to prevent complications. Specifically, our data indicate that the optimal oblique angle of fluoroscopy is 17 degrees for right T12 approach, 18 degrees for left T12 approach, and 19 degrees for both left and right L1 approaches for CPB. The optimal angle varies among patients, and pneumothorax is unavoidable for some patients when performing at the level of T12. Therefore, it may be worthwhile to examine abdominal CT scans prior to CPB.

REFERENCES:

1. Abdom imaging 2006;31:710-718.
2. Aliment Pharmacol Ther 2009;29:979-84.

S-319.**RISK FACTORS AND MECHANISMS FOR PERSISTENT POSTSURGICAL PAIN AFTER TOTAL KNEE REPLACEMENT****AUTHORS:** A. Buvanendran, M. Moric, J. Kroin, K. J. Tuman**AFFILIATION:** Rush University Medical Center, Chicago, IL

INTRODUCTION: Total knee replacement (TKR) is regarded as a safe, cost-effective treatment for osteoarthritis providing substantial improvements in functional status and quality of life. However, for the 15% of patients dissatisfied after TKR, persistent postsurgical pain (PPP) of the operated knee is their most frequent complaint (Clin Orthop Relat Res 2003;416:27).

METHODS: In 38 patients undergoing primary TKR, we evaluated PPP at 6 months after surgery, in addition to pre- and postsurgical SF-36 measure of health status (total score) and KOOS (Knee injury and Osteoarthritis Outcome Score-Physical function Short-form) questionnaires. Patients were evaluated at 1, 3 and 6 months after TKR to determine level of functionality and knee pain. PPP was defined as "pain in the operated knee at six months after TKR, with other causes of pain excluded and reported intensity on 0-10 NRS scale of ≥ 4 ".

RESULTS: At 6 months after TKR surgery, 9/38 (24%) patients had PPP. Preoperative total SF-36 score is an independent risk factor for the development of PPP. The preoperative SF-36 total score was predictive of PPP at 6-months ($P=0.0142$) with an odds ratio of 0.866 (95% confidence interval: 0.772, 0.971), indicating that a lower SF-36 total score (indicating poorer functional and psychosocial state) can lead to PPP. The preoperative scores on the KOOS activity of daily living (ADL) and KOOS quality of life (QOL) were not significantly different between the patients with PPP versus those without PPP at 6 months ($P=0.5819$ for KOOS ADL and $P=0.7008$ for KOOS QOL). In addition, higher acute postoperative NRS pain intensity independently predicts increased incidence of PPP. The acute postoperative NRS pain intensity is significantly higher, by 1.3 NRS, for the PPP than the non-PPP group (repeated measures test, $P=0.0358$) and the predictive model trended towards significance (logistic regression, $P=0.064$) with an odds ratio of 1.86 (95% CI: 0.97, 3.58). Finally, we found that preoperative SF-36 total score was a predictor of 6 month KOOS ADL scores ($P < 0.0001$), specifically that high values of SF-36 predict high values of KOOS ADL (high functioning) at 6 months. Preoperative SF-36 total score also predicted KOOS QOL ($P=0.0075$), again with a positive relationship.

DISCUSSION: The results indicate that broadly defined mental and physical functioning at preop (SF-36 scores) independently predict the development of persistent knee pain and also predict the levels of ADL function and QOL at 6 months post TKR surgery. A larger prospective study is needed to explore all of the risk factors and mechanisms, including importance (weighting) and interactions.

REFERENCES: In text

S-320.**KAMPO, A COMPLEX OF MEDICAL HERBS, IS SUPERIOR TO AN α 1 BLOCKER ON REDUCTION IN INTENSITY OF CHRONIC INTRACTABLE NECK PAIN DUE TO TRAUMATIC CERVICAL SYNDROME****AUTHOR:** Y. Inagaki**AFFILIATION:** Tottori University Hospital, Yonago, Japan

INTRODUCTION: There are few effective therapies for intractable neck pain due to traumatic cervical syndrome (TCS). Patients with TCS complain of cold sensation on the injured upper arm that is suggested strongly the activation of sympathetic nervous system. Therefore, we conducted a prospective cohort study to clarify the effect of Kampo, a complex of medical herbs, on reduction in intensities of pain and cold sensation.

METHODS: Twenty consecutive patients, aged 30 to 76 years old, were enrolled to this study after obtaining informed consent. All patients received first doxazocine, an α 1 receptor antagonist for twelve weeks and subsequently Ninjin-yoei-to (NYT) for twelve weeks, added to the present prescription including antidepressants, anticonvulsants and anxiolytic agents. We measured intensity of pain using visual analog scale (VAS), palm surface temperatures on both upper arms at 25°C for 15 min covered with a cotton towel and recorded number of either trigger point block or epidural block for each twelve weeks and an incidence of use of an oral rescue drug (diclofenac 37.5 mg). Data was analyzed with appropriate statistical tests. $P < 0.05$ was considered statistically significant.

Challenging Case Report (only complete if your submission falls into the “Challenging Case Report” category. If you select the “Challenging Case Report” category on the next step, this section must be completed.): N/A

RESULTS: VAS on neck pain did not change for the first twelve weeks (63.8 [9.1] to 61.7 [9.5] mm, mean [SD]) but reduced significantly ($p < 0.001$) for next twelve weeks (61.7 [9.5] to 35.7 [12.1] mm). Six patients showed VAS values more than 40 mm after treatment of Kampo. Palm surface temperature on the injured upper arm also increased significantly after administration of Kampo (32.8 [0.5] to 33.6 [0.5]°C) compared with that for the first twelve weeks (32.8 [0.5] to 32.8 [0.5]°C). Numbers of interventions (neural blocks and rescue drugs) were significantly reduced after administration of Kampo.

DISCUSSION: NYT is prescribed for warming the body and increasing physical power and improves peripheral blood flow. Such effects of Kampo appear to be superior to vasodilation by an α 1 blocker in the patients with intractable neck pain due to TCS. NYT may become one of the second line therapies for neck pain and cold sensation.

REFERENCES: N/A**S-321.****EFFECT OF NITROUS OXIDE AND NEFOPAM ON HYPERALGESIA AND CHRONIC PAIN AFTER BREAST CANCER SURGERY****AUTHORS:** L. Fievez, V. Decottenier, J. Salengros, M. Sosnowski**AFFILIATION:** Jules Bordet Institute, Brussels, Belgium

INTRODUCTION: Nociceptive inputs from the surgical wound induce a central nervous system sensitization leading to a state of postoperative pain hypersensitivity. Opioids used in the perioperative setting paradoxically enhance this phenomenon. This neuroplasticity expressed clinically by allodynia/hyperalgesia may be associated with an increased risk of chronic pain after surgery. Nefopam and nitrous oxide have both shown interesting antihyperalgesic properties in animal studies.

We designed thus this clinical trial to assess the impact of these two agents on postoperative pain hypersensitivity and furthermore on chronic pain (Postmastectomy Pain Syndrome).

METHODS: Sixty patients scheduled for either partial or radical mastectomy with axillary dissection were enrolled in an IRB approved, prospective, randomized, double-blind, placebo-controlled clinical trial. The treatment regimens were: nefopam given orally q6h from 1h preop till 48h postop +/- nitrous oxide administered as part of the general anesthesia, in a mixture with 50% oxygen.

Pain scores (VRS) were noted at 30 minutes, 4h and 24h postop. Analgesic requirements = morphine PCA consumption were recorded at 4 and 24h postop. Pressure pain thresholds (PPT) were measured over 12 target points using a pressure algometer, at baseline and the day after surgery. Three months after surgery, the subjects were asked for the presence of residual pain, and neuropathic characteristics were searched (DN4 tool).

RESULTS: There were no significant differences between the groups with regard to the VRS scores and PCA morphine consumption.

The PPT did not differ significantly between the groups on the operated site. In contrast, we observed a significant difference in the pain threshold at 24h postop on a control site on the thigh, PPT being lower in the control group ($p = 0.01$).

Definitive results on chronic pain at three months will be available for April 2011

DISCUSSION: The reduction in PPT on the thigh seems to traduce a general state of pain hypersensitivity, which is alleviated by the treatment. The absence of significant difference with regard to the other tested points could be explained to some extent as follows: in some patients and at some points of the injured site, modifications due to neuroplasticity are indicated by a hyperalgesia; but at other points, we may rather observe a hypoesthesia secondary to denervation process of the operated area. These particular constataions need further focus because they neutralize each other, becoming masked in a gross statistical analysis.

Whether the antihyperalgesic strategy will be successful at three month is still in assessment.

REFERENCES:

Anesthesiology 2005; 103 (4) : 845-54

Anesth Analg 2009; 109(2) : 623-31

S-322.**PREVALENCE OF RADIOPAQUE ALLERGY IN 200 CONSECUTIVE OUTPATIENTS PRESENTING FOR INTERVENTIONAL PAIN PROCEDURE**

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Introduction: Allergies to radiopaque media are well documented with a wide range of incidences reported. The true incidence is not known, but is considered to be quite low. When patients present with a history of iodine allergy, risk-benefit of using an iodine-containing solution to disinfect the skin or iodine-containing radiopaque contrast material must be considered. The objective of this study is to determine how many patients in a sample of 200 who present to our pain clinic for interventional pain treatments report a history of iodine allergy, what were the triggers and nature of the reactions, which risk factors the patients have for iodine allergy and the incidence of reactions during treatment.

Methods: After receiving institutional review board approval, data from 200 consecutive outpatients is currently being collected using a self-administered questionnaire, which is based on several previously validated methodologies. Demographic data and information about past medical history is being obtained from each patient that satisfies specific inclusion criteria.

Challenging Case Report (only complete if your submission falls into the “Challenging Case Report” category. If you select the “Challenging Case Report” category on the next step, this section must be completed.): N/A

Results: Of the 109 patients surveyed thus far in the study, nine have reported an allergy to iodine. Common risk factors among these nine patients included a past medical history significant for diabetes, hypertension or thyroid disease. These patients also report a history of allergic reaction to at least one other compound (e.g., food item, medication). The most common associated symptoms reported with a reaction to iodine were pruritus and rash. Less common were symptoms of shortness of breath, swelling of the throat or tongue, pain and hypotension. No reactions to iodine based cleaning solutions or contrast media have been observed during the procedures performed on these patients.

Discussion: These data show that the incidence of self-reported allergic reactions to iodine containing substances is low but not insignificant. While the risk of a reaction during a treatment appears to be low, it nonetheless is prudent to be alert for reactions by these patients.

References: 1. Hunt CH, Hartman RP, Hesley GK. Frequency and severity of adverse effects of iodinated and gadolinium contrast materials: retrospective review of 456,930 doses. *AJR Am J Roentgenol* 2009;193:1124-7.

2. Namasivayam S, Kalra MK, Torres WE, Small WC. Adverse reactions to intravenous iodinated contrast media: a primer for radiologists. *Emerg Radiol* 2006;12:210-5.

Pediatric Anesthesia: General Topics

S-323.**RESPIRATORY COMPLICATIONS ASSOCIATED WITH KETAMINE PREMEDICATION FOR MEASUREMENT OF INTRAOCULAR PRESSURE IN CHILDREN**

AUTHORS: L. Wu,¹ K. Lalwani,¹ K. Hook,² B. M. Almario,² R. Fu,³ B. Edmunds²

AFFILIATION: ¹Department of Anesthesiology, Oregon Health and Science University, Portland, OR; ²Department of Ophthalmology, Oregon Health and Science University, Portland, OR; ³Department of Public Health, Oregon Health and Science University, Portland, OR

INTRODUCTION: Measurement of intraocular pressure (IOP) in children requires examination under anesthesia (EUA). Ketamine is an ideal anesthetic because it does not affect patient's IOP.¹ Some studies have shown ketamine to be safe²⁻⁴ while others have noted it is associated with respiratory complications (RC).⁵ At our institution, perioperative staff noticed that patients who received intramuscular (IM) ketamine for EUA experienced RC more frequently than those who did not during a 30-month period when it was in use. Thus, the aim of this retrospective cohort study was to compare the odds of RC between patients who received IM ketamine versus IV ketamine or no ketamine for IOP measurements.

METHODS: 149 ketamine EUAs in 27 patients performed by one of the authors (B.E.) were identified between 2/1/2006 and 7/31/2009. For each subject, their date of birth, gender, comorbidities, presence of upper respiratory infection, ASA class, method of airway control, anesthetic agent/s, initial and total doses of ketamine, and occurrence of RC (oxygen desaturation, apnea, and laryngospasm) were recorded. For each ketamine patient, 3 matched non-ketamine patients were selected based on the age at the time of their first EUA and gender. A total of 263 non-ketamine EUAs in 81 patients were selected and the same set of information was collected for each. Patient characteristics were summarized using descriptive statistics. A mixed effects logistic regression model was used to assess the association between the occurrence of RC and use of ketamine while accounting for correlations due to multiple procedures from the same patient, matching, as well as controlling for potential confounding variables.

RESULTS: 41% (n=11) of subjects received IM ketamine only, 22% (n=6) of subjects received IV ketamine only, and 37% (n=10) of subjects received both IM and IV ketamine. There was no statistical difference in age, gender and weight between ketamine and non-ketamine patients. Overall, RC occurred in 22.8% (23/101) of IM ketamine EUAs compared to 4.2% (2/48) of IV ketamine EUAs, and to 2.7% (7/263) of non-ketamine EUAs. Three variables were significantly associated with increased odds of RC: ketamine use, ASA class, and use of volatile agents following ketamine administration (Table1).

DISCUSSION: IM ketamine should be avoided in children undergoing EUA for IOP measurements. High ASA class and use of volatile anesthetics also increased children's odds of RC in this cohort.

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1. Anesth Analg. 1976;55(6):773-775
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3. Ann Emerg Med. 1998;31(6):688-697
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5. Pediatr Emerg Care. 2009;25(5):325-328

Table 1. Odds Ratios For Respiratory Complications

| Variables | OR (95% CI) | P Value |
|--------------------------|---------------------|---------|
| Ketamine Use | | < 0.01* |
| IM vs No ketamine | 20.23 (6.13, 66.74) | < 0.01* |
| IV vs No ketamine | 2.98 (0.50, 17.67) | = 0.23 |
| IM vs IV | 6.78 (1.36, 33.82) | = 0.02* |
| ASA Class 3/4 vs 1/2 | 2.60 (1.03, 6.54) | = 0.04* |
| Volatile Agents (Y vs N) | 3.32 (1.18, 9.32) | = 0.02* |

*statistically significant

S-324.**THE INITIAL CUFF VOLUME IN PEDIATRIC LMA-PROSEAL® LARYNGEAL MASK AIRWAY WITHOUT MANOMETERS**

AUTHORS: K. Maeda, K. Okutani, K. Sakai, M. Hara

AFFILIATION: Chiba Children's Hospital, Chiba, Japan

INTRODUCTION: LMA-ProSeal® laryngeal mask airways (PLMA) are increasingly used in pediatric anesthesia. While recommendations about maximum filling volumes and pressures (60 cmH₂O) are given by the manufacturers, some studies have shown the maximum recommended cuff volumes lead hyperinflation. Hyperinflation of LMA cuffs carries the risk of airway morbidity by exerting high pressure on laryngeal and pharyngeal structures. Although cuff manometers may be used to monitor cuff pressure, their use is not routine in many institutions. Clinical endpoints are used in adult, but it is also associated with significant hyperinflation in children. Some studies have shown the initial guide volumes of LMA in adult under situations without manometers. We hypothesized that optimal initial cuff volume could brought the safe and effective use of PLMA without manometers as in adult.

The aim of this study is to study the initial cuff volume in PLMA (sizes 1.5-2.5) that is safe and effective, and to analyze factors that influence cuff volumes and pressures in pediatric PLMA.

METHODS: We studied children undergoing general anesthesia with PLMA #1.5-2.5. Following PLMA insertion, the cuff was inflated as cuff pressures achieved 20, 40, and 60 cmH₂O. Each cuff volumes and seal pressures were recorded. We also studied influence of age, height, and body weight on cuff volumes and cuff pressure- seal pressure relationship.

RESULTS: Cuff volumes to achieve 20, 40, and 60 cmH₂O cuff pressures are shown in table below. In size 1.5 the influence of body weight, height, and age on cuff volumes was not seen. In PLMA #2 and 2.5, cuff volumes tended to be higher as patients were heavier, higher, or older, but the change was not significant.

Seal pressures were almost equal in all sizes and all cuff pressures studied. Positive pressure ventilation were able to be performed effectively.

In PLMA #1.5, 2, and 2.5, cuff volumes of 4, 5, and 6ml respectively were likely to achieve cuff pressures 20-60 cmH₂O.

DISCUSSION: In PLMA #1.5-2.5 cuff volumes were not much influenced by body weight, height, and age, which suggested that cuff volumes depended on the size of PLMA. A small amount of cuff inflation could bring high cuff pressures. In order to avoid hyperinflation, following initial cuff inflation, cuff volumes should be adjusted with 1-ml increments.

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- Ong M, et al. Anaesthesia 2008;63:738-744
 Licina A, et al. Paediatr Anaesth 2008;18:952-956
 Maino P, et al. Paediatr Anaesth 2006;16:1244-1250
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Cuff volumes to achieve cuff pressures 20, 40 and 60 mmHg

| | #1.5 | #2 | #2.5 |
|-------------------------------------|---------|---------|---------|
| cuff volumes to achieve *cp-20 (ml) | 2.9±0.4 | 3.5±1.1 | 4.3±1.3 |
| cuff volumes to achieve cp-40 (ml) | 3.8±0.3 | 4.6±1.1 | 5.7±1.6 |
| cuff volumes to achieve cp-60 (ml) | 4.4±0.4 | 5.6±1.1 | 7.5±1.8 |
| recommended maximum volume (ml) | 7 | 10 | 14 |

*cp=cuff pressure

S-325.**WITHDRAWN.**

S-326.**PERIOPERATIVE RESPIRATORY ADVERSE EVENTS
IN PEDIATRIC OBSTRUCTIVE SLEEP APNEA
SYNDROME: MAKING SENSE OF THE COMPLEXITIES****AUTHORS:** S. Thampi,¹ D. Pawar,¹ T. Oon Hoe,² C. Shang Yee¹**AFFILIATION:** ¹Department of Paediatric Anaesthesia, KK Women's and Children's Hospital, Singapore, Singapore; ²Department of Respiratory Medicine, KK Women's and Children's Hospital, Singapore, Singapore**INTRODUCTION:** Obstructive Sleep Apnea (OSA) in children is associated with perioperative respiratory adverse events. Although, there are established guidelines for the perioperative management of children with OSA,¹ not much is known about the implications of the severity of OSA, coexistent medical illnesses, the choice of anaesthetic techniques and perioperative analgesia, and the indications for post-operative high dependency unit admissions. The aim of our study was to address these issues.**METHODS:** After IRB approval, those children with a preoperative polysomnography were selected from a retrospective review of Audit forms with a clinical diagnosis of OSA over a 5-yr period from 2004 to 2009. The variables recorded included demographics, type of surgery, coexistent medical illnesses, anaesthetic techniques including induction agents, muscle relaxants used and perioperative analgesia. Severity of OSA was determined based on polysomnographic criteria. Adverse events recorded included oxygen desaturation, bronchospasm, laryngospasm, and unplanned ICU admissions, collected up to 24 hours post operatively.Statistical analysis included chi square tests for categorical variables. Logistic regression was used to determine association between the variables and adverse events. Odds ratio and 95% confidence interval were computed. Variables significantly associated with adverse events were then entered into multiple logistic regression model. $P < 0.05$ denoted statistical significance.**RESULTS:** Two hundred and nine children were selected from a total of 517 patients. Demographics and adverse events of the study sample are shown in Table 1&2. Univariate analysis found that severe OSA (OR, 5.4; 95% CI 2.1-13.3), ASA III, IV (OR, 3.67; 95% CI 1.57-8.60) and preoperative CPAP (OR, 17.55; 95% CI 4.64-66.1) are associated with adverse events (Table 3). Preoperative CPAP could suggest a more severe degree of OSA. Multiple logistic regression analysis showed that severe OSA (OR 2.1 95% CI 1.3-3.3; $P = 0.001$) was the only independent risk factor associated with complications. There was no correlation between the intraoperative anaesthetic techniques or perioperative opioid analgesics used and adverse events.**DISCUSSION:** Severity of OSA is the single most important variable that would determine the adverse profile outcome. Coexisting medical illnesses, anaesthetic technique, perioperative opioids are not independent risk factors for perioperative adverse events in children with OSA. Those with severe OSA require high dependency unit monitoring postoperatively.**REFERENCES:**

1. Anaesthesiology 2006; 104:1081-93

S-327.**EPIDURAL ANALGESIA FOLLOWING SERIAL TRANSVERSE ENTEROPLASTY (STEP) AND BIANCHI PROCEDURES**

AUTHORS: S. Reece-Stremtan, C. Torres, I. Cohen, A. Tauber, A. Sandler, Y. Johnson

AFFILIATION: Children's National Medical Center, Washington, DC

INTRODUCTION: Short bowel syndrome (SBS) occurs in over 350 out of 100,000 premature infants.¹ Serial transverse enteroplasty (STEP) and Bianchi procedures increase bowel length improving intestinal function in children with SBS. Although long-term bowel motility is preserved with the STEP procedure, an early complication is possible bowel obstruction.^{2,3} Thus the concern remains for use of parenteral opioids postoperatively in patients undergoing these procedures. As bowel lengthening techniques are increasing in volume nationally, it is important to develop a postoperative pain regimen that takes into consideration severely reduced intestinal function. Here we report a series of patients that have undergone intestinal lengthening surgery with epidural analgesia.

METHODS: From 2009-2010 five children, ages 7-35 months, underwent bowel lengthening procedures for short gut syndrome with epidural (thoracic or lumbar) placement for intraoperative and postoperative analgesia. Patients received epidural ropivacaine +/- fentanyl as well as general inhalation anesthesia during surgery; the infusions were changed to a ropivacaine 0.1%/fentanyl 2mcg/mL mixture postoperatively. Epidural analgesia was continued at the rate of 0.4cc/kg/hr until post-operative day 4-5. Intravenous opioids for breakthrough pain were available while the epidural catheter was in place. All children received TPN post-operatively.

RESULTS: The children all tolerated epidural analgesia well. Only one patient required supplemental intravenous opioids while the epidural catheter was infusing. No patients required IV opioids after discontinuation of the epidural catheter. Enteral feeding, which was intentionally delayed for healing purposes, was begun between postoperative days 7-11. All patient families expressed satisfaction with the pain control their children received. There were no complications secondary to epidural placement and no patients incurred postoperative bowel obstruction.

DISCUSSION: Mu-opioid agonists decrease peristalsis and increase transit time through the intestine which may be especially deleterious in patients with baseline decreased gut function. In addition, epidural analgesia inhibits afferent pain signals and efferent sympathetic reflex arcs when used intra- and postoperatively which potentially has a beneficial effect on gut motility. This is especially important in children that are TPN dependent with severely reduced baseline intestinal motility. Epidural analgesia should be considered as a modality for analgesia children undergoing bowel lengthening surgery.

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3. Journal of Pediatric Surgery 2009;44:229-35.

S-328.**POSTOPERATIVE ADVERSE RESPIRATORY EVENTS IN CHILDREN WITH OSAS FOLLOWING ADENOTONSILLECTOMY**

AUTHORS: C. G. Rodriguez,¹ J. M. Eaglin,² A. S. Wang,² K. M. Dodson,² J. Shapiro,¹ J. F. Kierce¹

AFFILIATION: ¹VCUHS-MCVH Department of Anesthesiology, Richmond, VA; ²VCUHS-MCVH Department of Otolaryngology, Richmond, VA

INTRODUCTION: The goal of this study was to evaluate the frequency and timing of postoperative adverse respiratory events in children undergoing adenotonsillectomy, particularly in those children with a diagnosis of Obstructive Sleep Apnea Syndrome (OSAS).

METHODS: After obtaining IRB approval, the anesthetic records of 263 patients (ages 2 to 16) undergoing adenotonsillectomy between 2007 and 2009 were reviewed. Data collected included preoperative assessment of OSAS symptoms, polysomnogram results, comorbidities, and the timing of postoperative adverse events. Postoperative adverse events were defined as oxygen desaturation below 90%, requirement of oxygen supplementation including continuous positive airway pressure and mask ventilation, requirement of diuretic therapy, intubations, and insertion of nasopharyngeal airway in the postanesthesia care unit (PACU). Additional data collected included surgical method, length of hospital stay, age, BMI and tonsil and adenoid grade.

RESULTS: A clinical diagnosis of OSAS was given to 196 patients, 21 of these confirmed with polysomnogram. A total of 28 postoperative adverse events were recorded in 27 patients, 21 patients with OSAS and 6 patients without OSAS. The majority of adverse events occurred immediately postextubation or within one hour of admission to PACU. Three events were noted in 2 patients (1 with a diagnosis of OSAS and 1 without a diagnosis of OSAS) between 1 and 4 hours postoperatively. Only 2 events occurred more than 4 hours postoperatively, both in patients with a diagnosis of OSAS.

DISCUSSION: The incidence of OSAS among our pediatric patients continues to increase and adenotonsillectomy remains the treatment of choice. While it is commonly accepted that there is a correlation of increased postoperative respiratory events in patients with OSAS, most of the studies have been done in adults. The etiology of OSAS in children is not necessarily the same, so it is unclear if the adult data and recommendations on postoperative observation should be applied. Those current guidelines include observation of 4 or more hours. Our data indicates that these events are most likely to occur within the first hour after surgery. However, there were significant events noted 2 hours or later postoperatively, suggesting the need for longer observations in this patient population.

REFERENCES: N/A

S-329.**GLIDESCOPE® FACILITATED LARYNGOSCOPY AND INTUBATION IN CHILDREN WITH COMPLEX VASCULAR AIRWAY MALFORMATIONS: A CASE SERIES****AUTHORS:** R. Bolash, F. Resta-Flarer, J. Lesser, J. Kim**AFFILIATION:** St. Luke's/Roosevelt Hospital Center, College of Physicians and Surgeons, Columbia University, New York City, NY**INTRODUCTION:** Arterial, venous, hemangiomas and lymphatic malformations affecting the pediatric airway present a unique challenge to the anesthetist. Physical examination may be deceptive, and radiologic studies may underestimate the extent of laryngeal deformation caused by these neoplasms. We present a case series of 99 successful endotracheal intubations using the GlideScope® in children with vascular malformations of the airway.**METHODS:** The study was approved by the institutional IRB. During a thirteen month period, 103 anesthetics were administered to children ranging in ages from 3 months to 20 years with complex vascular airway malformations where endotracheal intubation was required for the proposed procedure. Laryngoscopy using the GlideScope® was performed on all subjects, and a recording of the video output feed was archived.**Challenging Case Report (only complete if your submission falls into the "Challenging Case Report" category. If you select the "Challenging Case Report" category on the next step, this section must be completed.):** N/A**RESULTS:** Eighty children with hemangiomas (28%), arteriovenous (6%), venous (31%) or lymphatic (38%) malformations of the airway received 103 anesthetics during the study period. Nineteen patients had, either a previous tracheostomy, or were undergoing tracheostomy revision which necessitated an alternative route of ventilation. Using the GlideScope®, we were able to perform laryngoscopy and tracheal intubation on the first attempt in 95% of cases, with only an additional 3% requiring more than one attempt. We were unable to intubate four children using the device, all of whom had pre-existing tracheostomies.**DISCUSSION:** GlideScope® proved to be a useful tool for performing laryngoscopy and endotracheal intubation in pediatric patients suffering from complex vascular malformations of the airway. Additionally, amongst those patients receiving multiple anesthetics, the video laryngoscope permitted us to monitor disease progression and response to treatment over time. The device has also allowed us to create a library of videos which we use for education.**REFERENCES:** N/A**S-330.****MANAGEMENT OF AN ADOLESCENT WITH DIAGNOSIS OF EPIGLOTTITIS: TO INTUBATE OR NOT TO INTUBATE?****AUTHORS:** D. S. Carollo, A. S. Whigham, C. Abdallah**AFFILIATION:** Children's National Medical Center, Washington, DC**INTRODUCTION:** Acute epiglottitis is a life-threatening disorder with potential for irrevocable loss of the airway. There are differences in trends, occurrences and management of acute epiglottitis between children and adults. Adolescent patients may present a challenge secondary to management of acute epiglottitis.**METHODS:** A 16 years old presented to the emergency room complaining of severe sore throat, vocal changes and decreased oral intake. Dysphagia was noted with no evidence of stridor or drooling. A lateral neck x-ray revealed the "thumb sign" (Fig.1). Controlled intubation in the operating room after availability of an otorhinolaryngologist to create a surgical airway was planned. A deep plane of anesthesia was obtained with inhalation anesthesia (end tidal sevoflurane 4% in 100% O₂) with the patient breathing spontaneously in a sitting position. Direct laryngoscopy showed a grade IV view secondary to an edematous epiglottis (Fig.2). The airway was secured with a 6.5 mm endotracheal tube using a Parsons Laryngoscope and a rigid bronchoscope. Anesthesia maintenance was achieved with a propofol infusion titrated to patient's spontaneous ventilation. Trachea was extubated after two days treatment with antibiotics and corticosteroids. Blood and sputum culture showed no pathogens.**RESULTS:** Epiglottitis in children is mostly due to *Haemophilus influenzae* type b (Hib), with decline in incidence due to Hib vaccination. Only 11% of sputum cultures and 31% of blood cultures in adults with epiglottitis reveal Hib etiology. There is increase in incidence of clinically less severe epiglottitis, with negative sputum cultures in adults.¹**DISCUSSION:** Difficulty in breathing and stridor are common signs of epiglottitis in children, but less frequent in adults. Selective airway intervention is possible in adults as those without severe airway compromise at presentation may recover well with medical treatment alone. Stridor in adults is regarded as a warning sign for occlusion of the upper airway. In this patient, despite the absence of stridor, a fast intervention by securing the airway under controlled conditions was justified considering hoarseness, dysphagia and a "thumb sign" on radiography. Criteria for selective airway intervention are not well defined in the adolescent patient with epiglottitis. Significant predictors for imminent airway compromise may include drooling, stridor, and shortness of breath or "thumb-sign" present in 79% of cases on X-rays of the neck. In the absence of a positive radiological finding, performing a flexible fiberoptic laryngoscopy for a timely diagnosis should be done cautiously.**REFERENCES:**

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Fig. 1: The “thumb-sign” on lat X Ray of the neck.

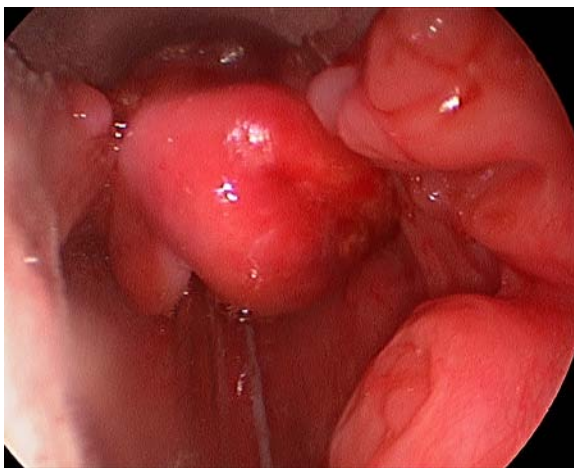


Fig. 2: Swollen epiglottis leading to a difficult visualization of the vocal cords.

S-331.

GIVING GENERAL ANESTHESIA IN CHILDREN, BUT CALLING IT SEDATION

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INTRODUCTION: Because of confusion over the usage of the terms “sedation” and “general anesthesia,” the American Society of Anesthesiologists (ASA) adopted guidelines that define different levels of sedation and general anesthesia in 2004.¹ Subsequently, the American Academy of Pediatrics and American Academy of Pediatric Dentistry (AAP/AAPD) as well as Center for Medicare and Medicaid Services (CMS) all have adopted similar definitions for sedation and general anesthesia.^{2,3} General anesthesia (GA) is defined as when a patient is not arousable to even painful stimulation. Deep sedation is when a patient only responds to painful stimulation, while moderate sedation is when a patient is arousable to verbal stimulation.

The goal of these definitions is to clarify when sedation (SED) is occurring and when GA is provided. In this study, we reviewed major American and international anesthesiology journals to see if the term “SED” is being used properly.

METHODS: We performed a Medline search to identify studies published from 1/1/00 to 11/1/10. We included the following journals: Anesthesiology, Anesth Analg, J Clin Anesth, Can J Anaesth, Br J Anaesth, J Anesth, Paediatr Anaesth, Eur J Anaesthesiol. The search terms were Sevoflurane (Sevo) and SED; Sevo and MAC; Propofol and Ketamine (Prop/Ket) and SED; Prop/Ket and MAC. The search was limited to age less than 18 years and English language. All papers were reviewed and included if the SEVO or Prop/Ket was used for SED. Articles were excluded if SED was not primary goal (e.g., study of recovery time post GA) or review articles. For each paper included, the SED provided was reviewed using the CMS, ASA, & AAP/AAPD definitions.

RESULTS: Of the 111 papers identified in the Medline search, 10 studies met inclusion criteria with the results shown in the Table. Two studies did not specify whether the patients were arousable, all 10 used the term sedation incorrectly - that is provided GA as defined by CMS, ASA & AAP/AAPD.

DISCUSSION: Despite clear definitions of what GA and deep SED are, investigators still misuse the term “sedation”. Further, the peer-review process does not correct this misuse. The danger is the potential for non-anesthesia trained providers to use techniques studied as “sedation” when they are general anesthesia.

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3. <http://www.pediatrics.org/cgi/content/full/118/6/2587>

S-332.**COMPARISON OF THE AIR-Q ILA AND PROSEAL LMA IN CHILDREN**

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INTRODUCTION: The Air-Q® intubating laryngeal airway (ILA) is a supraglottic device (SGD) specifically engineered for use both as a primary airway and as a rescue device to facilitate fiberoptic bronchoscope (FOB) guided endotracheal intubation. In this study - the second of three designed to evaluate ILA performance in paediatric patients in clinical practice - our objective is to compare the ILA's performance to the current standard of care, the ProSeal® LMA (PLMA), using a within-patient crossover study design.

METHODS: With IRB approval and written informed parental consent (assent where appropriate), we will recruit 120 subjects, stratified by ILA size, into four groups of 30: size 1.0 (<7 kg), size 1.5 (7-17 kg), size 2.0 (17-30 kg) and size 2.5 (30-50 kg). Following induction of anaesthesia, either the PLMA or ILA is inserted using the manufacturer's recommended technique, and the cuff is inflated to an intracuff pressure of 60 cmH₂O, as measured with a digital pressure cuff monitor. The first SGD is evaluated, removed, then the other SGD is inserted and evaluated. The order of devices is randomized. The SGDs are evaluated using a standardized methodology which includes: number of placement attempts; ease of insertion; quality of ventilation; presence or absence of gastric insufflation; oropharyngeal leak pressure (OLP); maximum tidal volume (VT max); FOB view; and presence of blood after removal. The primary outcome measure is OLP. In order to minimize variability, the number of evaluators is limited to five.

RESULTS: Data are reported from the 38 subjects recruited to date (Table 1). Quality of ventilation was acceptable, defined as chest rise ± audible leak, with all devices. In neutral head position, mean (SD) OLP for the ILA and PLMA was 15.8 (6.5) and 21.1 (6.3) cmH₂O, respectively. In flexion, mean (SD) OLP for the ILA and PLMA was 25.2 (7.5) and 30.2 (9.7) cmH₂O, respectively. The mean (SD) VT max for the ILA and PLMA was 17.8 (8.2) and 16.7 (6.5) mL/kg, respectively. Using Brimacombe and Berry's scoring system¹, vocal cords were visible in 34/38 with an ILA and 33/38 with a PLMA; 19 ILAs afforded a view of cords only (no epiglottis), only 11 PLMAs provided a cords only view. Inferential statistical analysis will follow study completion.

DISCUSSION: On current data, neutral OLP values for the ILA appear lower than for the PLMA and are lower than existing published data for the PLMA2-5. Maximum VT is comparable and comfortably exceeds clinical goals of 7-8 mL/kg. The FOB view appears optimized more often with the ILA.

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| Reference (Title year vol:pg) | Agent | Invasive procedure or imaging? | Was goal GA? |
|-----------------------------------|-------|--------------------------------|---------------|
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| 4. Br J Anaesth 2005; 94:385-9 | P/K | Inv | Not Specified |
| Ped Anesth 2006; 102:465-10 | P/K | Inv | Not specified |
| Ped Anes 2009 19:784 | P/K | Inv | Y |
| Ped Anes 2009 19:500 | P/K | Inv | Y |
| Ped Anes 2008 18:43 | P/K | Inv | Y |
| Ped Anes 2007 17:983 | P/K | Inv | Y |
| Ped Anes 17:592 | P/K | Inv | Y |
| Anesth 2005 103:600 | Sev | Inv | Y |
| Ped Anes 2005. 15:62 | Sev | Img | Y |
| Ped Anes 2005 15:9 | Sev | Img | Y |
| Ped Anes 2002 12:556 | Sev | Img | Y |

S-333.**SAFETY OF MODERN ANESTHESIA FOR CHILDREN WITH LONG QT SYNDROME (LQTS)**

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INTRODUCTION: Long QT syndromes (LQTS) are a family of cardiac ion channelopathies with a clinical spectrum ranging from asymptomatic through presyncope, syncope, and aborted cardiac arrest to sudden cardiac death. Arrhythmias in LQTS are often precipitated by autonomic changes. Patients with LQTS are believed to be at high risk for perioperative dysrhythmia, specifically torsades de pointes (TdP), based on limited literature that pre-dates current inhalational (IH) and intravenous (IV) anesthetic drugs and standards of perioperative monitoring. We present one of the largest reviews of anesthesia conducted in children with LQTS, to provide evidence for the optimal anesthetic management in LQTS.

METHODS: Following IRB approval, in this multicentre review we identified children with LQTS who had undergone general anesthesia (GA) between Jan 2005 and Jan 2010. Charts were reviewed for LQTS and perioperative management. Data was abstracted by each centre and sent to the coordinating centre for aggregation and analysis.

RESULTS: During the study period, 53 LQTS patients, age range 1 d - 18 yr, underwent GA. In 60% surgery was LQTS-related; 40% required incidental surgery. Perioperative management is detailed in Table 1. Of note, 64% received beta-blocker (BB) on day of surgery and 26% received sedative pre-medication. In addition to the modes of anesthesia noted in Table 1, 90% received IV opioids and 26% received ondansetron antiemetic prophylaxis. None received droperidol. There were 2 perioperative episodes of TdP; 1 in a 6 mo old LQT3 patient undergoing emergent implantable cardioverter-defibrillator placement for sustained TdP/VF in spite of BB + pacing, and 1 in a neonate who had undergone emergent pacemaker insertion for life threatening TdP. In all but 2 patients, the post-operative disposition was as planned pre-operatively; 2 unplanned ICU admissions were attributable to bleeding (1) and bed availability (1).

DISCUSSION: There were no episodes of perioperative dysrhythmia attributable to choice of anesthetic agents. TIVA was over-represented but volatile exposure remained common. Maintenance of perioperative BB therapy was routine. With this information we have begun an evidence base for modern anesthetic management of pediatric patients with LQTS.

REFERENCES: N/A

S-334.**IS REGIONAL ANAESTHESIA IN CHILDREN SAFER WITH TIVA?**

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INTRODUCTION: Local anaesthetic (LA) supplementation of general anaesthesia (GA) is often used for analgesia during and after paediatric surgery, but potential LA toxicity limits dosage, and hence block density, spread and duration. Although rare, LA toxicity is life threatening. Any strategy that reduces this risk would improve patient safety and may allow for larger dosing regimens and associated clinical benefits. The discovery that high dose Intralipid® can reverse established LA toxicity¹⁻⁵ suggests that it could also prevent it. Intralipid® is administered in low doses during total intravenous anaesthesia (TIVA) with propofol, which is formulated in 10% Intralipid®, but not during inhalational anaesthesia (IHA). This pilot study compares plasma bupivacaine concentrations between paediatric patients randomized to receive either TIVA or IHA, who all receive caudal epidural anaesthesia (CEA) with bupivacaine.

METHODS: With IRB approval in this randomized, single-blinded study we are recruiting 60 children, ASA I-II, ages 1-5 yr, undergoing elective surgery with GA and CEA. Exclusion criteria include non-elective surgery, weight <3rd or >97th centile, contraindication to CEA, and ongoing or recently resolved acute inflammatory process. TIVA subjects undergo induction with propofol 5 mg/kg and remifentanyl 2.5 mcg/kg, then maintenance with propofol 200-400 mcg/kg/min and remifentanyl 0.1-0.2 mcg/kg/min. IHA subjects undergo induction with sevoflurane and remifentanyl 2.5 mcg/kg, then maintenance with volatile and remifentanyl 0.1-0.2 mcg/kg/min. Venous blood samples of 5 mL are taken from a second indwelling cannula 15 and 30 min after CEA completion (1 mL/kg 0.25% bupivacaine + epinephrine 5 mcg/mL). A pharmacy research technician, blind to anaesthetic group, employs high pressure liquid chromatography⁶ and ultrafiltration^{7,8} to determine total and free bupivacaine concentrations.

RESULTS: Recruitment began Nov. 2010 (current n = 20). Our department performs >20 CEAs/week. We anticipate complete recruitment and analysis by May 2011.

DISCUSSION: If TIVA reduces plasma bupivacaine concentrations, it will create a wider therapeutic margin and improve the safety of CEA. Change in dosing regimens could provide increased analgesia duration, extend types of surgeries amenable to regional anaesthetic, and reduce the total dose of GA required. Results will support feasibility and design of a randomized controlled trial to explore the capacity of TIVA to reduce LA toxicity.

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S-335.**WITHDRAWN.**

S-336.**LONG-TERM DIFFERENCES IN COGNITIVE AND LANGUAGE ABILITY AFTER EXPOSURE TO SURGERY AND ANESTHESIA IN INFANCY**

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INTRODUCTION: Animal studies have documented long-term neurobehavioral deficits after exposure to anesthetic agents in the developing brain. Longitudinal human neurodevelopmental outcome studies after exposure to anesthesia are limited, with no clear data on whether and which specific neurocognitive domains are affected. We used a prospective birth cohort of children who had undergone longitudinal neuropsychological testing to determine the effects of anesthetic exposure in a wide range of neurocognitive domains.

METHODS: We obtained data from the Western Australian Pregnancy Cohort (Raine) consisting of 2868 children born from 1989 to 1992.¹ Neuropsychological tests were performed for cognitive function (SDMT: Symbol Digit Modality Test), abstract reasoning (CPM: Colored Progressive Matrices), perceptual reasoning (WISC-b: Wechsler Intelligence Scale for Children-Block Design), fine and gross motor skills (MAND: McCarron Assessment of Neuromuscular Development) receptive and expressive language (CELF: Clinical Evaluation of Language Fundamentals), vocabulary and verbal ability (PPVT: Peabody Picture Vocabulary) and behavior (CBCL: Child Behavior Checklist) at birth, 1, 2, 3, 5, 8, 10, 13, and 16 years of age. All children who had surgery before 3 years old according to parental report were considered as EXPOSED, and the rest UNEXPOSED. Dichotomous outcome values for clinically significant impairment were <70 (CELF), <10th percentile (CPM), <85 (MAND), and ≥60 (CBCL). We conducted t-tests and χ^2 tests to compare exposed and unexposed on demographic and outcome variables with $p < 0.05$ deemed significant. We used bivariate analyses to obtain odds ratios of association to assess clinical outcomes, then performed logistic regression analysis controlling for gender, birth weight, APGAR score, race, family income, and paternal presence at home.

RESULTS: On CELF for clinical impairment at 10 years, the exposed group had an adjusted odds ratio (OR) of 2.3 (95% CI=1.2 - 4.5) for receptive language, OR of 1.7 (95% CI=1.1 - 2.7) for expressive language, and OR of 2.5 (95% CI=1.5 - 4.3) for total score. On CPM at 10 years, the exposed group had an OR of 3.4 (95% CI=1.6 - 7.2). No clinical differences were found on the other outcomes. Follow-up rates for tests ranged from 43.1 - 75.7%.

DISCUSSION: A history of anesthesia/surgery before age 3 was associated with an increased risk of clinical language impairment between 1.7 to 2.5 fold and abstract reasoning of 3.4 fold. Thus, language and abstract reasoning are two major areas to focus on for hypothesis testing in future studies of developmental neurotoxicity in the setting of anesthesia and surgery.

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S-337.**SEX DIFFERENCES IN METABOLIC DISEASE IN A MOUSE MODEL OF CHILDHOOD OBESITY****AUTHORS:** L. Ring,^{1,2} L. Zeltser,^{2,3}**AFFILIATION:** ¹Department of Anesthesiology, Columbia University, New York, NY; ²Naomi Berrie Diabetes Center, Columbia University, New York, NY; ³Department of Pathology, Columbia University, New York, NY

INTRODUCTION: With rates of obesity exceeding 30% in many pediatric age groups, a better understanding of the mechanisms of energy homeostasis in children and adolescents, and how they might be different than adults has become imperative. One clue in elucidating unique mechanisms of obesity between children and adults has been the finding that rates of metabolic syndrome in pre-pubertal girls and boys are similar, while the rate of metabolic disease in post-pubertal boys is significantly higher than is seen in post-pubertal girls.¹ To develop a model of sex differences in metabolic disease, we employed a genetically obese mouse strain, *Lepr^{Nkx2.1}KO*, which we have previously shown to be an excellent model of childhood obesity.²

METHODS: At 3 weeks of age, male and female *Lepr^{Nkx2.1}KO* mice were divided into ad lib and pair fed groups. Ad lib mice (KO-AL) were allowed free access to food. Pair fed mice (KO-PF) were fed on a daily basis only as much food as was consumed by age- and sex-matched wild type control (CON) animals. This scenario was maintained until mice were 10 weeks of age at which time pair feeding was released and all animals were allowed unlimited access to food.

RESULTS: Adiposity over the course of the experiment were very different between male and female KO-PF animals. Adiposity in male KO-PF animals only diverged from adiposity in male KO-AL animals after 8 weeks. Further, male KO-PF animals were able to maintain this lower adiposity even with the release of pair feeding. Female KO-PF animals displayed a significantly reduced adiposity from 3 weeks. However, with the release of pair feeding, female KO-PF animals were not able to maintain their reduced adiposity; rather, their adiposity converged with that seen in the female KO-AL group (Fig 1). Female KO-PF animals were also found to have delayed sexual maturity, which in some cases did not occur until after the completion of the pair feeding portion of the experiment.

DISCUSSION: Adiposity levels differed greatly between male and female *Lepr^{Nkx2.1}KO* under pair-fed and release scenarios in a way such that early caloric restriction in males but not females was effective at resetting lifelong adiposity to a lower level. These findings suggest two important conclusions. First, metabolic findings taken with the delayed sexual maturity in KO-PF females suggests that puberty and/or metabolic state at the time puberty may be an important factor in lifelong energy homeostasis in females. And second, caloric moderation, a major component of weight-loss strategy, may be ineffective in inducing reduction of adiposity when initiated in pre-pubescent girls.

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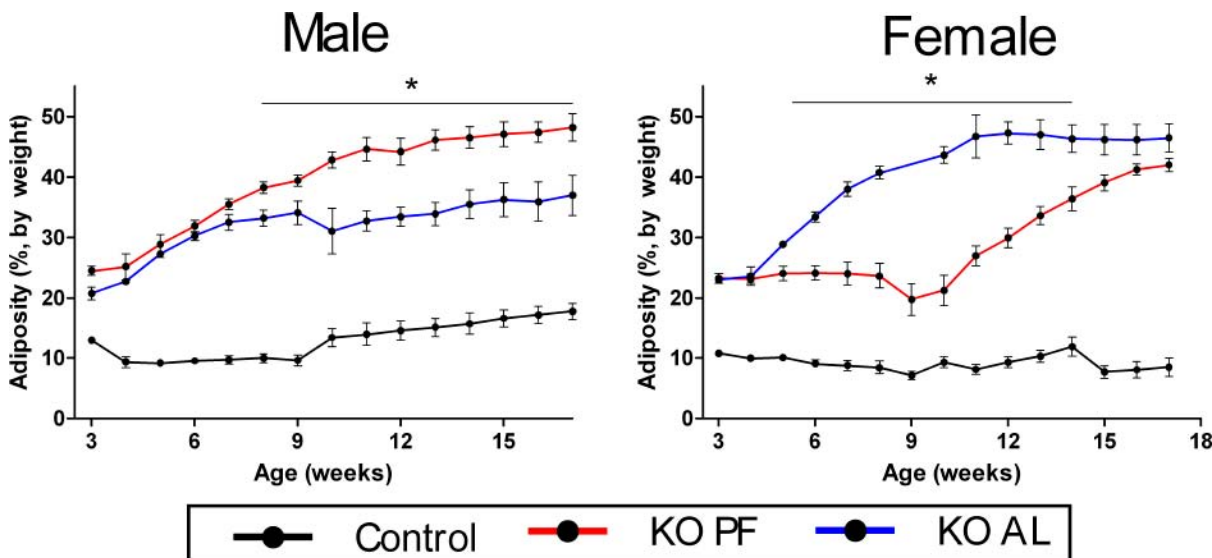


Figure 1. Male KO-PF mice, unlike female KO-PF mice, maintain reduced adiposity even after the release of pair feeding at 10 weeks of age.

S-338.**A COMPARISON OF REGIONAL AND GENERAL ANESTHESIA FOR GASTROSCHISIS REPAIR IN INFANTS**

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INTRODUCTION: While there are some data comparing regional anesthesia (RA) and general anesthesia (GA) on perioperative outcomes in adults,¹ such comparative analysis of anesthetic techniques has not been performed in critically ill infants who need surgery and anesthesia. Although most US centers use GA for major surgery in infants, spinal anesthesia (SA) is the preferred anesthetic technique at the University of Vermont/Fletcher Allen Health Care (FAHC).² Gastroschisis is usually an isolated defect without associated congenital anomalies or premature birth and is surgically repaired during the neonatal period. To test the hypothesis that SA reduces anesthesia-related and overall complication rates in infant surgical patients and decreases resource utilization, we compared short term safety outcomes and resource utilization between infants undergoing gastroschisis repair under GA at Columbia University Medical Center (CUMC) and SA at FAHC.

METHODS: After IRB approval at FAHC and CUMC, we identified infants who had gastroschisis repair between 2000 and 2008 who (1) had RA only (5/16 were excluded for having had both SA and GA, n=11, all from FAHC) and (2) had GA only (n=35, all from CUMC). Demographic data and clinical data during the perioperative period were obtained from a review of anesthesia and medical records. The following complications were identified: documented oxygen desaturation (desat), postoperative infection/sepsis, and post-op mechanical ventilation (mech). ICU and total hospital length of stay (LOS) were determined to evaluate resource utilization. Patients with associated anomalies, complicated birth, or missing data were excluded. Unpaired t-tests and Fisher's exact tests were used for analyses, and p<0.05 was deemed significant.

RESULTS: The two cohorts were similar in gestational age, gender distribution, and weight. There was no difference in the rate of desat or infection between groups, but GA infants had more mech (100% vs 25%, p=0.02). ICU and total LOS were similar between GA and SA infants.

DISCUSSION: Our results indicate that anesthesia techniques did not influence rates of complications and resource utilization in infants for gastroschisis repair. Interestingly, the difference in the use of mech did not impact resource utilization in terms of ICU or total LOS. However, because the low incidence of gastroschisis, our sample size was small, and our findings will need further confirmation with larger sample sizes.

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S-339.**INTER-OBSERVER AND INTRA-OBSERVER REPEATABILITY OF CAPILLARY REFILL TIME**

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INTRODUCTION: Capillary refill time (CRT) is part of the rapid and structured cardiopulmonary assessment of critically ill patients.¹ It serves as a 'red flag' for serious infection in both developed and developing countries.^{2,3} Despite this, there is poor intra- and inter-observer repeatability for CRT measurement^{4,5} and a lack of consensus as to how best to measure it. We assessed the intra-observer repeatability of CRT measurement performed by trained observers who agreed upon and implemented a standardized technique. We compared this standardized methodology to the 'usual practice' of health professionals.

METHODS: In both phases of this study, ethical board approval and parental written informed consent were obtained (assent was sought where applicable). In Phase I (normal CRT expected), 30 subjects, 1 to 5 years old, who were to receive general anesthesia for elective surgery, were recruited. In Phase II (abnormal CRT expected), 34 subjects (out of a total of 50), 1 day to 18 years old, have been recruited thus far in the Emergency Room (ER) and Intensive Care Unit (ICU). An anesthetist (Phase I) or nurse (Phase II) measured the subject's CRT according to his/her 'usual practice' to 0.5 second accuracy. In both phases, a trained observer also measured CRT in a standardized manner. The subject's hand was elevated to just above heart level and pressure was applied to the pulp of the distal phalanx of a finger so that there was blanching of the capillary bed for 5 seconds. The time to return of original colour (CRT) was measured using a stopwatch.

RESULTS: Overall the trained observers' intra-observer repeatability coefficient was 0.56 seconds. Inter-observer repeatability of CRT, assessed using the Bland-Altman method, showed narrower limits of agreement between the CRT measurements of two trained observers (-0.61 to 0.55) compared to the mean of these from the observers and health professionals (-1.30 to 1.67, Fig.1.).

DISCUSSION: There is poor agreement between health professionals' and trained observers' measurements of CRT (Fig. 1). This contrasts with the more acceptable intra- and inter-observer repeatability observed when trained observers use a standardized technique to measure CRT. An automated method of measuring CRT may make measurements more accurate and departmental research into CRT measurement using digital plethysmography is ongoing.

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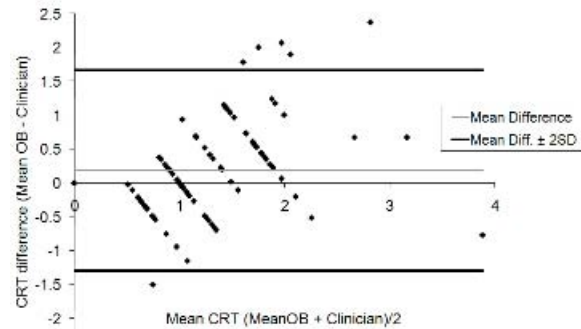


Figure 1: Bland-Altman agreement plot between trained observer (OB) and clinician's measurement of CRT

S-340.**ANESTHETIC OUTCOMES OF CHILDREN WITH EPIDERMOLYSIS BULLOSA UNDERGOING BONE MARROW TRANSPLANTATION**

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INTRODUCTION: Recessive dystrophic epidermolysis bullosa (RDEB) is a life-threatening mucocutaneous disorder caused by mutations in type VII collagen (C7) gene, COL7A1. Allogeneic bone marrow stem cell transplantation (BMT) may be an effective strategy for replacing mutant C7 with normal protein leading to a reduction in skin and aeropharyngeal blistering.¹ However children with RDEB undergoing (BMT) require numerous anesthetics. They present anesthesia challenges due to frequent oropharyngeal lesions ± adhesions, stenosed larynx, and inability to use adhesive tapes.² The purpose of this study was to report our anesthetic experiences and outcomes in children undergoing BMT for RDEB.

METHODS: Following IRB approval a cohort review was conducted of all children undergoing BMT for RDEB between January 2007 to December 2009. Data were analyzed for perioperative care and early outcomes. Data were reported as mean ± SD, absolute numbers or percentage.

Challenging Case Report (only complete if your submission falls into the “Challenging Case Report” category. If you select the “Challenging Case Report” category on the next step, this section must be completed.): N/A

RESULTS: Seven children (4 female) underwent BMT for RDEB during this period. The ages and weights were 6.8±4.3 yrs and 22.5±13.6 kg, respectively. All contact points of monitoring devices were separated from the skin with lubricant ± hydrocortisone cream. Non-taping techniques were used to secure the airway and intravenous (iv) catheters, and soft padding was placed beneath the blood pressure cuffs. There were 42 anesthetic episodes. Procedures (some concurrent) included skin biopsies (32.8%), Hickman or other central venous catheters (32.8%), gastrostomy tube placements (12.1%), bone marrow biopsies (5.2%), endoscopies (5.2%), and other procedures (7%). The majority of children received an iv induction of anesthesia with propofol (54.1%) or propofol/ketamine (19%). Maintenance of anesthesia was usually with iv propofol (50%) or propofol/ketamine (28.6%). In 31 of the 42 anesthetics (74%) spontaneous ventilation without intubation or oral airway devices was utilized. Nine episodes were managed with standard endotracheal intubation. In 1 episode fiberoptic intubation was performed and in 1 patient a lubricated laryngeal mask airway was used. All patients tolerated their procedures well without formation of new bullae on the skin, mouth or pharynx.

DISCUSSION: Patients with REDB undergoing BMT can be managed for most procedures using total intravenous anesthesia (propofol or propofol/ketamine), spontaneous ventilation with modified skin-applied monitoring tools. Invasive airway care that was also well tolerated with the precautionary measures applied.

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S-341.**POST-OPERATIVE HYPONATREMIA IN PEDIATRIC CATHLAB PATIENTS**

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AFFILIATION: ¹University of Texas Medical School at Houston, Houston, TX; ²University of Oklahoma Health Sciences Center, Oklahoma City, OK

INTRODUCTION: Children receive care for diagnostic and interventional procedures in pediatric cathlab. During the procedures catheter & wire exchange require de-airing accomplished by using flush fluid. The amount of flush fluid injected into the patient is immeasurable since it depends on the operator as well as the duration of the case; this puts the pediatric patients at risk of fluid overload and hyponatremia if hypotonic fluid is used. There are no national guidelines to select the type of flush fluid used in pediatric cathlab. Our cathlab uses D5 0.25% saline for patients under 10kg and normal saline (NS) for patients above 10kg.

METHODS: After IRB approval we reviewed anesthesia records of the entire patient population who had a cathlab procedure from 1/1/08 to 5/10/10 and were less than 10 kg. Data was collected for patient age, weight, preoperative & post-operative serum Na, diagnosis, duration of the procedure and type of IV fluid given (LR/NS/D).

RESULTS: 54 patients met the weight criteria. Serum Na values were available for only 49 patients. Pre-op mean serum Na 137±3.07; at the end of procedure mean serum Na 131±4.16. Mean % decrease in Na 4.08± 0.028. Mean age 6.26±5.79 month. Mean Wt. 5.84±2.05kg. Mean duration 209±91 min. The IV fluid breakdown was- 23 NS, 18 LR, 1 D10 & 12 unknown.

DISCUSSION: In our study we found a strong trend toward hyponatremia (serum Na <135mEq/L) after the procedure though not statistically significant; but still the findings show the use of hypotonic flush fluid puts these patients at risk of hyponatremia.

Hyponatremia is a well recognized complication in the postoperative period in children. Two major causative mechanisms 1) decreased free water elimination due to excess arginine vasopressin (AVP) and 2) hypotonic IV fluids infusion.¹ Hyponatremic encephalopathy is a dreaded complication of hyponatremia and could lead to permanent neurologic damage or death.² Children and hypoxemic patients have the highest risk to develop hyponatremic encephalopathy even with mild decrease in Na levels.^{2,3} On the other hand NS is isotonic and studies have proved it is safe and prevents post-operative hyponatremia.⁴ In conclusion hyponatremia is a risk with hypotonic flush fluid use and further prospective studies comparing NS vs. hypotonic fluids are needed.

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S-342.**TITRATION OF INTRAOPERATIVE FENTANYL IN PEDIATRIC ANESTHESIA**

AUTHORS: S. Yoshizawa, Y. Fujita, H. Sasano, T. Sugiura, K. Sobue

AFFILIATION: Department of Anesthesiology and Medical Crisis Management, Nagoya City University Graduate School of Medical Sciences, Nagoya, Japan

INTRODUCTION: In pediatric anesthesia, the best method of titrating intraoperative fentanyl to obtain sufficient analgesia has yet to be established. We examined whether frequency of use of analgesics for postoperative pain could be reduced with our protocol for titration of intraoperative fentanyl.

METHODS: We conducted a matched case-control study. We enrolled 32 pediatric patients (less than ten years of age) who were undergoing surgical plasty for hypospadias (19 patients) or inguinal hernia (13 patients). As a control, we chose the same number (32) of patients who had the same types of surgery in the same month. Our titration strategy added a respiratory sign to common signs of need for analgesia. The additional respiratory sign was as follows. First, we determined the optimal ventilation volume in pressure control ventilation mode with muscle relaxation. Second, after intubation with muscle relaxation, no muscle relaxation was added. Third, if the inspiratory volume decreased, we added fentanyl to eliminate straining by the patient. The control strategy, fentanyl were used as appropriate. For statistical analysis, the Wilcoxon t-test and chi-square test were used.

RESULTS: No differences were observed in operative time or time from the end of surgery to extubation between the groups. Among patients undergoing surgical plasty for hypospadias, those with the titration strategy (T group) had significantly more intraoperative fentanyl ($6.6 \pm 2.7 \mu\text{g/kg/h}$) than those with the control strategy (C group) ($3.2 \pm 1.5 \mu\text{g/kg/h}$) ($P < 0.05$). Moreover, patients in group T did not cry (11% vs. 42%) in the recovery room ($P < 0.05$). Frequency of use of analgesics in group T (21%) was less than that in group C (38%), though not to a significant extent. On the other hand, among the patients undergoing surgery inguinal hernia, those in group T had significantly more intraoperative fentanyl ($7.8 \pm 2.8 \mu\text{g/kg/h}$) than those in group C ($6.2 \pm 2.3 \mu\text{g/kg/h}$) ($P < 0.05$). However, there were no differences in frequency of crying (15% vs. 15%) or use of analgesics (15% vs. 15%) between the groups.

DISCUSSION: Our titration strategy may reduce the frequency of use of analgesics for postoperative pain in patients undergoing surgical plasty for hypospadias. It appeared that difference in the length of surgery (145.7 ± 75.3 vs. 59.2 ± 27.5 minutes) was the main reason for the differences in results between the two types of surgery, since in relatively long operations more analgesics were required to obtain optimal analgesia. Our strategy may be associated with better titration of intraoperative fentanyl, since no complications occurred and more use of fentanyl was possible for postoperative pain.

REFERENCES: N/A

S-343.**AVAILABILITY OF 5% LIDOCAINE PATCH ON VENIPUNCTURE OR INJECTION RELATED PAIN IN CHILDREN**

AUTHORS: S. Shin, J. Yoon, H. Lee

AFFILIATION: Department of Anesthesia and Pain medicine, Pusan National University Yangsan Hospital, Yangsan, Republic of Korea

INTRODUCTION: Venipuncture or injection related pain is still major problem during the anesthetic induction in children. This study was designed to determine the availability of 5% lidocaine patch on venipuncture or injection related pain during the induction of anesthesia.

METHODS: In a randomized, double-blind study, 72 pediatric patients were allocated to one of two groups: pretreatment with 5% lidocaine patch (Lidoderm®, Endo Pharmaceuticals, Chadds Ford, PA) (Group A): pretreatment with placebo patch (Group B). The patch was applied over a wide area of the nondominant hand and distal forearm 120 min before surgery in a 5 cm X 7 cm width following allocation to the groups. Pain severity was evaluated using the Faces, Legs, Activity, Cry and Consolability score (FLACC) during venipuncture and 4-point scale during injection of rocuronium. Adverse reactions such as burning sensation, pruritus, and dizziness were monitored.

RESULTS: The FLACC score during venipuncture was significantly lower for Group A (5.83) than in Group B (9.22) ($p < 0.001$). There was no significant difference in 4-point scale during injection of rocuronium between Group A and B. There was no significant adverse effect among the groups.

DISCUSSION: Pretreatment with a 5% lidocaine patch was safe, effective, and simple method to prevent venipuncture pain in children, although this method did not reduce rocuronium injection pain during the induction of anesthesia. The injection pain of rocuronium was not controlled by topical lidocaine, which suggest that there could be a different mechanism with other injection pain commonly occurred by induction anesthetics.

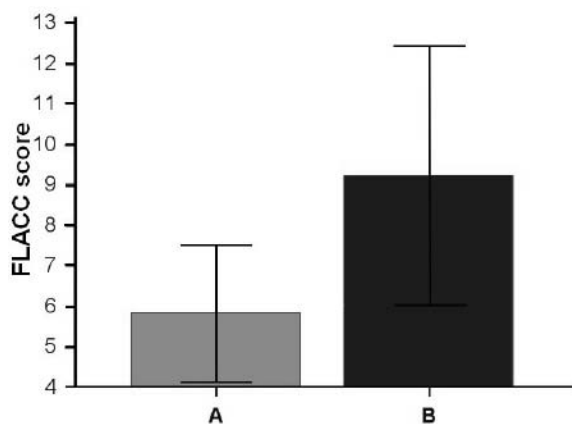
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Four point scale during Injection of Rocuronium

| Group | 1 | 2 | 3 | 4 |
|-------|-----------|----------|------------|------------|
| A | 3 (7.5%) | 6 (15%) | 13 (32.5%) | 18 (45%) |
| B | 5 (15.6%) | 3 (9.4%) | 7 (21.9%) | 17 (53.1%) |

No statistical difference was found between Group A and B. $P = 0.4807$



The FLACC scores during venipuncture were significantly reduced after pretreatment with 5% lidocaine patch in Group A compared with the Group B.

S-344.**NEUROMUSCULAR BLOCKING DRUG CHOICE DURING PYLOROMYOTOMY**

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AFFILIATION: Loma Linda University Medical Center, Loma Linda, CA

INTRODUCTION: Many anesthesiologists consider infants with pyloric stenosis scheduled for laparoscopic pyloromyotomy to have full stomachs requiring rapid sequence induction (RSI) for tracheal intubation. Although the rapid onset of succinylcholine (SUCC) makes it an ideal neuromuscular blocking drug (NMBD) for this procedure, its use in children may be associated with rare serious adverse effects. The US FDA has issued a black box warning recommending restriction of SUCC to emergency settings including RSI for full stomach. Rocuronium (ROC) is widely accepted as an alternative to SUCC for RSI in children. We evaluated the impact of NMBD choice on term infants undergoing pyloromyotomy.

METHODS: After IRB approval, retrospective data was collected on infants undergoing pyloromyotomy at Loma Linda University Medical Center Children's Hospital from January 2006 to May 2010. Demographic data, anesthetic drugs, surgical and anesthetic times, and operating surgeon were recorded. To facilitate comparisons, only full term infants who received propofol induction, sevoflurane maintenance, no intraoperative narcotics, and extubation at the end of surgery as well as having received only ROC, SUCC, or BOTH during surgery were included. The primary outcome measure was time to transport (TTT) out of the operating room after surgery stop time. This surrogate for emergence and extubation includes time needed to recover from both anesthesia and relaxant. Statistical analysis with $p < 0.05$ considered significant was performed using JMP 8.0.2. Continuous data comparisons were analyzed by ANOVA (3 groups) or t-test (2 groups), and ordinal data was analyzed using Chi Square.

RESULTS: 185 patients met inclusion criteria, with results summarized in Table 1. Preoperative electrolytes were in the normal range and did not correlate to TTT. TTT was not affected by amount of propofol or NMBD given (mg/kg), surgery length, or surgeon. BOTH received less ROC than ROC group ($p < 0.001$) and more SUCC than SUCC group ($p = 0.001$) despite similar surgery duration. The SUCC group had shorter TTT compared to the ROC and BOTH groups.

DISCUSSION: Results of this analysis suggest that for term infants undergoing pyloromyotomy with propofol, sevoflurane and no intraoperative opioid, SUCC may be the best choice NMBD for this procedure based on TTT, provided no other contraindication to the use of SUCC is present. However, induction doses of ROC or ROC after SUCC has a small clinical impact on TTT and may be preferred over SUCC by some clinicians.

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Table 1: Analysis of intergroup differences by ANOVA or *t-test

| | BOTH n = 72 | ROC n = 57 | SUCC n = 56 | p value |
|-----------------------|-------------|-------------|-------------|---------|
| Age days | 38.4 ± 16.5 | 37.1 ± 14.4 | 34.9 ± 15.6 | 0.43 |
| Weight kg | 4.1 ± 0.7 | 4.0 ± 0.6 | 4.1 ± 0.7 | 0.82 |
| Gender F; M | 10; 61 | 8; 49 | 10; 46 | 0.81 |
| Propofol mg/kg | 3.1 ± 1.2 | 3.3 ± 1.4 | 2.9 ± 1.4 | 0.38 |
| ROC mg/kg * | 0.4 ± 0.2 | 0.7 ± 0.2 | | <0.001 |
| SUCC mg/kg * | 2.2 ± 0.8 | | 1.8 ± 0.5 | 0.001 |
| Surgery duration min | 25.0 ± 10.3 | 27.3 ± 15.0 | 22.8 ± 9.4 | 0.12 |
| Time to transport min | 18.4 ± 11.7 | 18.6 ± 9.6 | 14.4 ± 8.4 | 0.04 |

S-345.**COMPLICATIONS ASSOCIATED WITH THORACIC EPIDURALS IN CHILDREN****AUTHORS:** S. G. Mukkamala, T. Pinyavat, R. Kazim**AFFILIATION:** Children's Hospital of New York, Columbia University, New York, NY**INTRODUCTION:** The use of thoracic epidural analgesia is controversial in pediatric populations due to risk of neurologic sequelae. Few studies address these neurologic complications.**METHODS:** We performed a PubMed literature search from 1993 to present on complication rates of pediatric thoracic epidurals.**RESULTS:** These studies reported on all pediatric epidurals, including thoracic epidurals. They were performed in the United States, Japan, France, Belgium, Italy and Canada. All but two of the studies¹⁻⁸ were retrospective. Sample sizes ranged from 21-303 patients. The largest study, a multi-center, prospective, mail-in survey included 24,409 patients and 135 thoracic catheters.¹ Patient ages ranged from neonates to 18 years. Procedure types included both cardiac and non-cardiac cases, including the Nuss procedure. The graphic below highlights catheter use and complication rates.¹⁻¹⁰

Discussion: This study suggests that thoracic epidurals may have a lower neurologic complication rate when compared to other regional techniques. This lower rate may be a reflection of: 1. more careful patient selection,² a self-reporting bias,³ an under-reported incidence of thoracic epidural use,⁴ more meticulous placement using fluoroscopic imaging,⁵ placement by specialists with advanced training. A prospective, multi-center trial directly addressing the use of thoracic epidurals in pediatric populations may address these sources of bias and improve our understanding of complications rates.

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Complications Reported in Pediatric Epidural Studies

| References | Sample Size (n) | Catheter Type | Complications |
|------------|-----------------|-----------------------------------|---|
| 1 | 24409 | L = 2396, T= 135, C=15013, S= 506 | Dural puncture n=8 T=0 Intravascular injection n=6 T=0 Transient paresthesia n=2, T=0 |
| 2 | 21 | T=21 | Needed additional analgesia T=9 |
| 3 | 220 | L, C = 164, T=38, S=18 | Transient paresthesia n=7, T=0 Intravascular injection n=1, T=0 |
| 4 | 190 | Epidural under GA n=190 | Seizure n=1 Motor blockade n=30 Leak at site n=24 Over-sedation n=12 |
| 5 | 63 | T=63 | Pruritis T=6 |
| 6 | Unspecified | Unspecified | Death n=3 Tetraplegia n=1 Paraplegia n=1 T=0 |
| 7 | 174 | L=100, T= 40, C=27, P=7 | Epidural Abscess T=1 |
| 8 | 19 | T=17 | Failure to work T=1 |
| 9 | 42 | T=42 | None |
| 10 | 303 | T=66 | Transient extremity paralysis T=1 Horner's = several |

L= Lumbar, T= Thoracic, C= Caudal, S= Spinal, P=Pleural, n= number

Pediatric Anesthesia: Neonatal Safety & Anesthetics

S-346.**EXCITATORY AND EPILEPTIFORM EEG
ACTIVITY IN HUMAN NEONATES DURING
SEVOFLURANE-BASED ANESTHESIA**

AUTHORS: C. Moran, S. Bunch, M. Herman, N. Dobija, A. Martynyuk, C. Seubert

AFFILIATION: University of Florida, Gainesville, FL

INTRODUCTION: We recently demonstrated in neonatal rats that anesthesia with sevoflurane caused excitatory EEG changes in the form of brief episodes of epileptiform activity as well as apoptotic neurotoxicity. Attenuation of both epileptiform activity and neurotoxicity by bumetanide, an inhibitor of the Na⁺-K⁺-2Cl⁻-co-transporter (NKCC1), suggests that sevoflurane caused GABA-A receptor mediated excitation in both phenomena. To investigate whether this sevoflurane-induced excitation is applicable to humans, we performed an observational pilot study examining intraoperative EEGs in neonatal patients undergoing surgical procedures under sevoflurane-based anesthesia.

METHODS: After institutional IRB approval, neonates less than 55 weeks post-conceptual age (PCA) were studied with an 8-channel referential EEG montage. Data were collected after induction of anesthesia (WaveGuardTM EEG caps, Advanced Neuro Technology). Except for the use of sevoflurane, no other constraints were placed on the anesthetic. At the discretion of the anesthesiologist, some patients received midazolam, propofol or fentanyl either before or during the study period. EEG data were reviewed by a pediatric neurologist.

RESULTS: The 23 patients receiving 24 anesthetics ranged in age from 36 to 54 weeks PCA and underwent a variety of procedures including but not limited to inguinal hernia and bowel surgery, heart catheterizations and repairs of congenital heart defects. In this study cohort, 6 patients had epileptiform activity and 7 had excitatory activity. The epileptiform activity appeared to be self limited and was not associated with gross motor activity or changes in vital signs. The duration of seizures ranged from 2 to 50 seconds and occurred at end-tidal sevoflurane concentrations from 0.16 to 4.25. There did not appear to be a correlation between excitatory or epileptiform activity and the dose of sevoflurane or use of intravenous anesthetic agents. Previous exposure to anesthetic or type of surgery also did not correlate with excitatory or epileptiform activity.

DISCUSSION: This case series demonstrates that some neonates undergoing a general anesthetic with sevoflurane have excitatory and even epileptiform EEG activity. The findings raise concerns that the pathomechanism linking excitatory phenomena and developmental neurotoxicity to sevoflurane-enhanced GABA-A receptor-mediated excitation may apply to the immature human central nervous system. Further research is necessary to better understand the short and long term effects of sevoflurane in human neonates.

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Bumetanide alleviates epileptogenic and neurotoxic effects of sevoflurane in neonatal rat brain. *Anesthesiology*. 2010 Mar;112(3):567-75.

S-347.**THE EFFECT OF ISOFLURANE ON THE DEVELOPING HYPOXIC RAT BRAIN****AUTHORS:** C. Wood,² N. Hamilton,² L. Wise-Faberowski^{1,2}**AFFILIATION:** ¹Stanford University, Palo Alto, CA; ²University of Colorado, Aurora, CO

INTRODUCTION: Both oxygen and isoflurane have effects on the NMDA 2B (NR2B) receptor subunit composition. The NR2B subunit composition and hypoxia inducible factor 1- α (HIF1- α) both, independently, allow the brain to tolerate hypoxic conditions. NR2B is also necessary in early brain development because of its ability to promote brain derived neurotrophic factor (BDNF) and thereby inhibit apoptosis. We hypothesized that exposure to chronic hypoxia during development would increase NR2B, BDNF and HIF1- α and be protective against exposure to isoflurane when compared to normoxic controls.

METHODS: According to NIH guidelines and after institutional approval, OHS were prepared from postnatal day (PND) 4, 7 and 14 normoxic and hypoxic pups. Hypoxic rat pups were housed in an OxyCyclerTM (Biospherix; United Kingdom) Hypoxia A Chamber with dams at PND2 and maintained at 12% oxygen for 2, 5 and 12 days respectively. The OHS prepared from normoxic and hypoxic rat pups were exposed to 1.5% isoflurane or air/control for 5 hours. Hippocampal neuronal survival in areas CA1, CA3 and DG was assessed immediately, 24 and 72 h after exposure using Sytox staining. In addition, NMDA 2B receptor subunit expression, BDNF and HIF1- α were determined using western blot analysis.

RESULTS: Chronic hypoxia increased cell death as compared to all postnatal age matched normoxic controls (Figure 1). Isoflurane had minimal effect on cell death in OHS prepared from hypoxic rat pups but increased cell death in OHS prepared from normoxic rat pups (Figure 1). Chronic hypoxia was associated with increased NR2B subunit composition (Figure 2), BDNF (Figure 3) and HIF1- α (Figure 4). In both hypoxic and normoxic (Figures 1, 2, 3 and 4) animals NR2B subunit composition, BDNF and HIF1- α were decreased by exposure to 1.5% isoflurane for 5h.

DISCUSSION: Increased NR2B subunit composition, BDNF and HIF1- α associated with chronic hypoxia may protect the developing hypoxic brain from isoflurane-induced cell death. This may have implications in children with chronic hypoxia, such as children with congenital heart disease, who experience prolonged anesthesia exposure during surgical repair of their heart defect.

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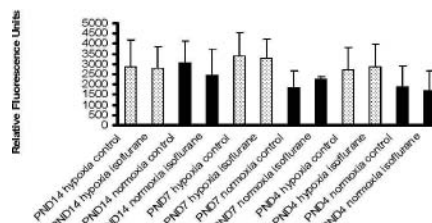


Figure 1: Cell death (CA1, CA3 and DG) in OHS prepared from normoxic (black bars) and hypoxic (stippled bars) PND 4, 7 and 14 rat pups exposed to 1.5% isoflurane or air (control) for 5 hours for all times of examination (immediately, 24 and 72 hours) after exposure.

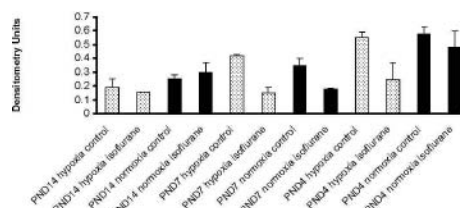


Figure 2: NMDA receptor subunit composition, NR2B (52 kD) was determined using western blot analysis and normalized to B-actin (42 kD) in OHS prepared from normoxic (black bars) and hypoxic (stippled bars) PND 4, 7 and 14 rat pups exposed to 1.5% isoflurane or air (control) for 5 hours, for all times of examination (immediately, 24 and 72 hours) after exposure.

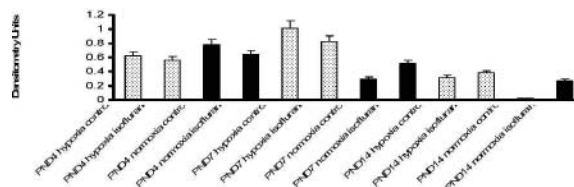
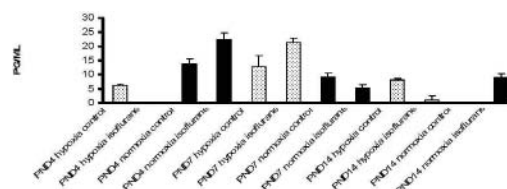


Figure 3: BDNF was determined using western blot analysis and normalized to B-actin (42 kD) in OHS prepared from normoxic (black bars) and hypoxic (stippled bars) PND 4, 7 and 14 rat pups exposed to 1.5% isoflurane or air (control) for 5 hours.



HIF1- α was determined using HIF1- α ELISA in protein prepared from normoxic (black bars) and hypoxic (stippled bars) PND 4, 7 and 14 OHS exposed to 1.5% isoflurane or air (control) for 5 hours.

S-348.**VOLATILE VERSUS NARCOTIC ANESTHETIC FOR SURGICAL REPAIR OF CONGENITAL HEART DISEASE: THE EFFECT ON POSTOPERATIVE EEG****AUTHORS:** L. Wise-Faberowski,^{1,2} J. Zuk,² N. Serkova²**AFFILIATION:** ¹Stanford University, Palo Alto, CA; ²University of Colorado, Aurora, CO

INTRODUCTION: Seizure activity in initial 24-48 hours postoperatively has been a prior predictor of poor developmental outcome in children after surgical repair for congenital heart disease (CHD). High dose narcotic was the primary anesthetic technique used during these studies. Anesthetic induced neurotoxicity after a prolonged exposure to volatile anesthetics early in development is a current concern. We hypothesized that infants anesthetized with volatile agents as compared to narcotic based anesthesia for surgical repair of CHD would have abnormal postoperative EEG's.

METHODS: After Institutional Board approval and according to NIH guidelines, infants undergoing surgical repair of a cyanotic heart lesion were randomized to one of three groups: narcotic (fentanyl), volatile (desflurane) or mixed (fentanyl and desflurane) anesthetic based technique. The assigned group was also maintained during cardiopulmonary bypass. Continuous 18 channel video EEG monitoring was performed 24-48 hours postoperatively.

RESULTS: Twenty-one infants (14 male and 21 female; 10 volatile and 11 narcotic-based technique) have been enrolled in a prospective randomized study thus far. Thirteen of which had a postoperative EEG performed. Mean weight was 3.07 +/- 0.6 kg and mean anesthetic duration was 7.8 +/- 1.2 hours. Cardiopulmonary bypass duration was 180 +/- 28 min and cross clamp of 110 +/- 21 min. Two patients required post-operative ECMO, three patients had incomplete data and two patients had aortic arch reconstruction in addition to the primary procedure and were withdrawn from the study. Of the 13 EEG's performed only three were normal and none had evidence of seizure activity. The primary EEG findings were diffuse dysfunction or abnormal/non-seizure activity in the right temporal lobe region. The three normal EEG's were narcotic and the 10 abnormal were volatile (6) or mixed (7) anesthetic technique.

DISCUSSION: Based on our preliminary results, infants undergoing surgical repair for a cyanotic heart lesion have an 85% risk of an abnormal postoperative EEG. These abnormalities can be diffuse or localized to the right temporal lobe region and are not seizure activity. A narcotic-based anesthetic technique seems to pose less risk for abnormal EEG findings, but further investigation is required to determine the implications of these findings.

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S-349.**WITHDRAWN.**

S-350.**OZONE LEVELS IN AMBIENT AIR VS. MEDICAL GASSES****AUTHORS:** V. J. Kopp, M. J. Hazucha**AFFILIATION:** University of North Carolina at Chapel Hill, Chapel Hill, NC

INTRODUCTION: Ozone is a reactive oxygen allotrope, bioeffector, and air pollutant. Its baseline levels in medical oxygen and air are undocumented. To evaluate possible ozone exposure at the start of general anesthesia via inhalation induction we measured ambient (room) air vs. medical gas samples drawn through a standard anesthesia delivery system.

METHODS: Our study involved no patients; IRB approval was not required. Ambient atmosphere samples came from an off-line operating room. Medical gas samples came from “wall” and “tank” sources. These were collected from an occluded standard anesthesia circuit attached to a volatile anesthetic-free Modulus SE anesthesia delivery system with clean carbon dioxide absorbers. A stop-cock system at the distal occluded end permitted sample switching between ambient atmosphere and medical gases. Samples were directed into a photometric ozone analyzer (API model 400A) with a detection range of 0 to 100 parts per billion (ppb), calibrated with API model 401. Data recorded at five minute intervals were analyzed with SAS Jmp (version 8.0) with a one-way ANOVA; the Tukey-Kramer HSD test was used for post hoc group comparisons. The α value was 0.05 ($P < 0.05$ = significant).

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RESULTS: Ambient (room) atmosphere ozone, N=19: 20.2 ± 5.7 (mean \pm SD) was significantly higher than other sources of ozone: Wall oxygen ozone, N=18: 3.0 ± 0.6 ; Tank oxygen ozone, N=9: 3.1 ± 0.5 ; Wall air ozone, N=9: 3.7 ± 0.4 . ANOVA P value = < 0.0001.

Ambient ozone levels varied by time of day (AM, N=4: 15.1 ± 1.8 ; PM, N=5: 26.6 ± 5.4 , $P < 0.005$) but ozone levels in medical grade wall source oxygen did not (AM, N=9: 3.1 ± 0.6 ; PM, N=9: 2.8 ± 0.6 , $p = \text{NS}$). Employing the Tukey-Kramer HSD post-hoc analyses ambient ozone levels differed significantly from any medical gas samples regardless of time of day or medical gas sources. Using the same statistics ozone level differences among medical gases were not significant.

DISCUSSION: Ozone is a bioeffector, free radical donor, air pollutant, and radiation absorber. Iatrogenic oxygen use presumes ozone formation and exposure but knowledge about ozone’s potential anesthesia-related cellular and sub-cellular toxicity is limited. Such information may be germane to the safe use of oxygen in children. A starting point is measurement of ozone levels in medical gases administered to patients. Our study shows ambient room atmosphere likely reflecting changing outdoor ozone concentration and medical gas ozone levels differ significantly. More work may show nitrous oxide and volatile anesthetics added under similar conditions might alter ozone levels. Mass spectroscopy measurements will be needed to analyze more complex anesthetic atmospheres.

REFERENCES: N/A**S-351.****BRAIN METABOLITES DISCRIMINATE SEVOFLURANE FROM PROPOFOL ANESTHESIA IN CHILDREN****AUTHORS:** Z. Jacob, H. Li, S. Zhang, S. Jambawalikar, R. Makaryus, H. Benveniste**AFFILIATION:** Stony Brook University Medical Center, Stony Brook, NY

INTRODUCTION: In vivo proton MR spectroscopy (1H-MRS) is a non-invasive modality used to detect cerebral metabolites. We hypothesized that specific metabolites or metabolomic patterns would discriminate sevoflurane from propofol anesthesia in developing brains and identify children who will experience emergence delirium (ED).

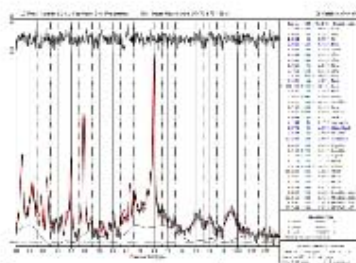
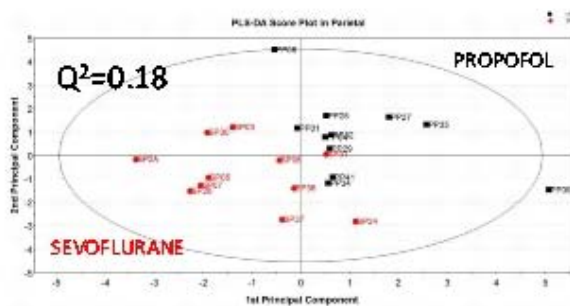
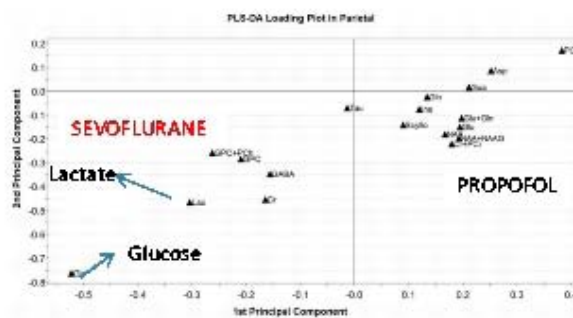
METHODS: With IRB approval and parental permission, 1H-MRS was performed on children aged 2-7 years undergoing MRI under general anesthesia who were randomized to receive either sevoflurane or propofol. All patients underwent inhalational induction. Group S was maintained by sevoflurane anesthesia using LMA. Group P received propofol infusion with supplemental oxygen. 1H-MRS spectra were acquired in parietal cortex on a 3T scanner while the radiologist assessed the diagnostic MRIs. Each child was assessed for ED using the Pediatric Anesthesia Emergence Delirium (PAED) Scale.¹

RESULTS: Comparison of Group S (n=10) and Group P (n=11) found no differences in age, body weight, ASA status, or physiological data. Quantitative LCModel analysis of 1H-MRS spectra revealed that concentrations of glucose [glc] were ~50% higher in Group S compared to Group P. Phosphocreatine trended to be lower with sevoflurane ($p=0.051$). The concentration of lactate [lac] was also found to be ~50% higher with sevoflurane compared to propofol, but this was not statistically significant. Metabolite concentrations calculated using the LCModel revealed a significant separation between groups, as observed in the score plot (Fig 1). Glucose and phosphocreatine were assigned VIP values of 2.2 and 1.6 respectively, indicating that [glc] is the most important metabolite for discriminating sevoflurane from propofol anesthesia. The PAED score revealed that ED was more frequent in children in Group S ($p=0.046$), where more severe ED correlated with a lower concentration of aspartate [asp] ($r=-.69$, $p=.026$).

DISCUSSION: Our data suggest that the brain metabolome during sevoflurane anesthesia is different from propofol: a relatively higher [glc] and [PCr] characterizes sevoflurane at 1-1.5 MAC. Higher cortical [glc] in sevoflurane-anesthetized children might be due to differences in blood glucose concentrations, which were not measured in this experiment. An intriguing inverse relationship emerged between [asp] and ED scores with sevoflurane. Aspartate is an excitatory neurotransmitter and important metabolite in several processes including the citrate cycle; it has also been implicated in seizure and metabolic disorders. The different metabolomic patterns between sevoflurane and propofol may be relevant to possible anesthesia-related neurotoxicity in the developing brain.

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**A. Parietal voxel position****B. ¹H MRS spectra from parietal cortex analyzed with LCModel****C. PLS-DA analysis: Score plot****D. PLS-DA analysis: Loading plot**

S-352.**ISOFLURANE AS THE SOLE ANESTHETIC AGENT DOES NOT INCREASE CELL DEATH IN THE HIPPOCAMPUS OR SUBVENTRICULAR ZONE IN EARLY POSTNATAL PIGLETS****AUTHORS:** B. Costine,² R. Zhu,¹ S. R. Taylor,² S. C. Hillier¹**AFFILIATION:** ¹Anesthesiology, Dartmouth-Hitchcock Medical Center, Lebanon, NH; ²Pediatric Neurosurgery, MGH, Boston, MA**INTRODUCTION:** Anesthetic-associated neurotoxicity during critical periods of neurodevelopment has been primarily described in rodents and primates. However, piglets are a valuable species in other models of neuropathology as their brain morphology and the rapid brain growth period parallels humans. We sought to determine if a single, 6 h isoflurane exposure induced cell or neuronal death in early postnatal swine. To date, the hippocampus and the subventricular zone (SVZ), a region of the brain contributing to postnatal neurogenesis, have been analyzed.**METHODS:** Female Yorkshire swine aged 5 - 8 d were randomly assigned to either 6 h of 1.3 MAC isoflurane (ET conc. 2.3% in 30% O₂) (exposed n = 4) or room air (naïve n = 4). Exposed animals were intubated after isoflurane induction and ventilation was controlled. Cardiorespiratory, temperature, glucose and blood gas values were maintained within the age-appropriate physiologic range. Brains were collected 18 - 24 h after the end of isoflurane exposure. The TUNEL assay and NeuN were detected on frozen sections with immunofluorescence. Nuclei were visualized with DAPI. Positive controls for the TUNEL assay included brain tissue from piglets after focal cortical impact. Cell death (positive for TUNEL and DAPI) and neuronal death (positive for TUNEL, DAPI, and NeuN) were quantified in multiple sections of the hippocampus and in multiple fields of multiple sections of the SVZ.**RESULTS:** In the analysis performed to date, in the hippocampus, there was no difference in the number of TUNEL positive cells (18.5 ± 15.5 vs. 5.9 ± 3.3) or TUNEL positive neurons (13.3 ± 7.2 vs. 11.2 ± 7.3) in the exposed vs. naïve subjects ($P > 0.05$). In the SVZ (characterized by high cell turnover), the number of TUNEL positive cells was lower in exposed compared to naïve subjects (53.0 ± 5.5 vs. 25.8 ± 2.8 ; $P < 0.05$).**DISCUSSION:** A 6 h isoflurane exposure did not increase the number of cells or neurons undergoing death in the SVZ or hippocampus, but actually reduced the number of TUNEL positive cells in the SVZ. The robust increase in cell death observed in other models of anesthetic exposure was not seen. However, human data suggests that only multiple exposures are associated with cognitive deficits.¹ Alternatively, isoflurane alone may be less neurotoxic than combinations of anesthetics. Species differences in the maturation and activity of NMDA and GABA receptors may be responsible for species differences in anesthetic neurotoxic potential. Work is ongoing to analyze additional brain regions.**REFERENCES:**

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S-353.**THE EFFECT OF POSTNATAL AGE AND GENDER ON NMDA AND GABAA RECEPTOR SUBUNIT, AND BDNF EXPRESSION IN RAT ORGANOTYPIC HIPPOCAMPAL SLICE CULTURES****AUTHORS:** B. Peluso,³ L. Foley,² L. Wise-Faberowski^{1,2}**AFFILIATION:** ¹Stanford, Palo Alto, CA; ²University of Colorado, Aurora, CO; ³Westminster College, Westminster, PA**INTRODUCTION:** The neurotoxic effect of anesthetic agents, which act via gamma-amino butyric acid (GABAA) potentiation and/or N-methyl-D-aspartate (NMDA) antagonism, has been demonstrated in both in vivo and in vitro postnatal day (PND) 7 rat pup models. Neurotoxic cell death in PND7 animals is felt to be related to diminished expression of brain derived neurotrophic factor (BDNF). BDNF is believed to inhibit apoptosis and its absence promotes apoptosis in developing neurons. Using a developmental organotypic hippocampal slice model (OHS), we hypothesized that age and gender would affect NMDA and GABAA receptor subunit in addition to BDNF expression.**METHODS:** After institutional animal care approval, and according to NIH guidelines, male and female rat pups of PND ages 4 and 7 were used to prepare organotypic hippocampal slices (OHS). After 1 week in culture, approximately 50 slices for each condition were frozen in liquid nitrogen and stored at -80° for western blot analysis. Each western blot for the specific receptor subunit studied (GABAA α -1 and GABAA α -2; NMDA 2A and NMDA 2B) and BDNF compared male versus female OHS for each developmental age.**RESULTS:** When comparing developmental age for females only, both GABAA α -1 and GABAA α -2 increased with increasing postnatal day age (Figure 1); whereas, NMDA 2A decreased and NMDA 2B (Figure 2) increased with increasing postnatal age. When comparing developmental age for males only, NMDA 2B and GABAA α -1 increased but NMDA 2A and GABAA α -2 decreased with increasing postnatal day age.When comparing the two genders, the greatest difference was noted for NMDA 2A at PND 4 and GABAA α -2 and NMDA 2B at PND 7. On PND7, females had significantly more GABAA α -2 and NMDA 2B than males but on PND 4 males had significantly more NMDA 2A than females. When comparing all developmental ages for both females and males, BDNF was not observed until PND 7 and only in the OHS prepared from female rat pups (Figure 3).**DISCUSSION:** In adult animal models of stroke, gender differences are noted when evaluating neuroprotection. In our investigation, there are gender- and age-related differences in GABAA and NMDA receptor subunit in addition to BDNF expression. More importantly, BDNF expression is unique to PND 7 female rat pups. Based on our findings, the effect of gender in anesthetic neurotoxicity requires further investigation.**REFERENCES:**

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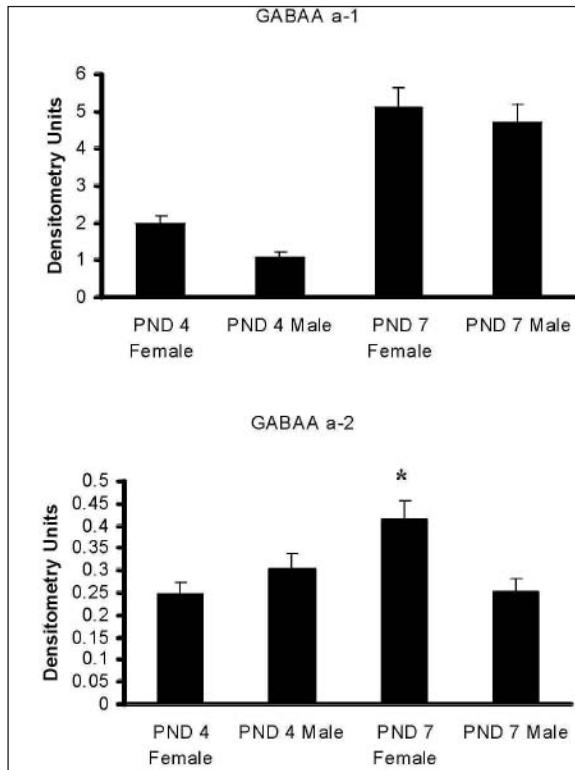


Figure 1

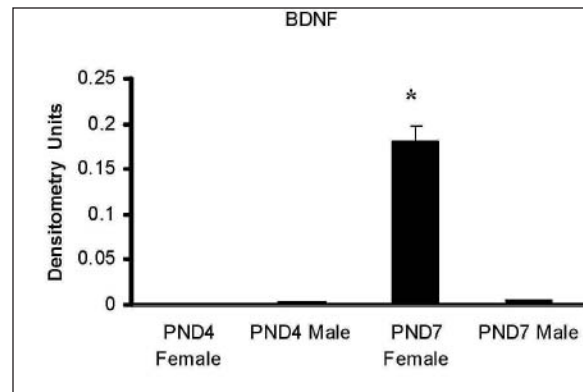


Figure 3

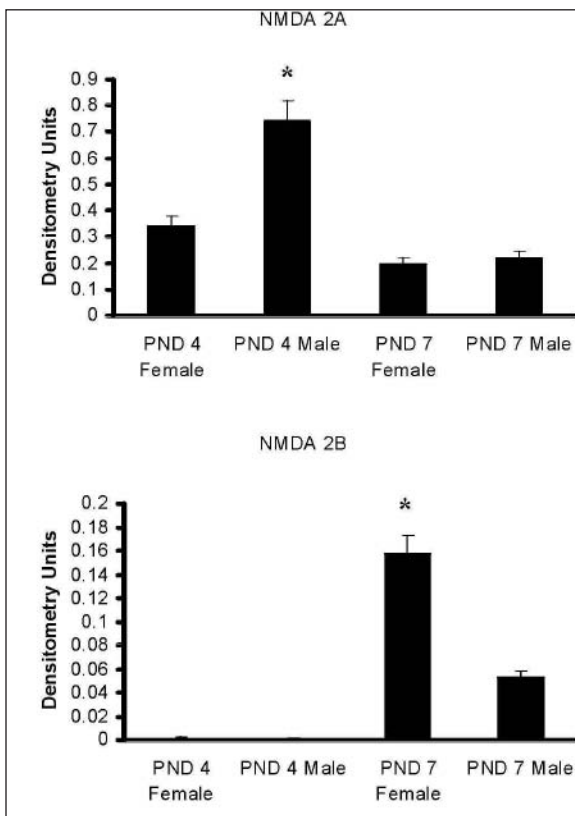


Figure 2

S-354.**EXCITATORY ACTION OF SEVOFLURANE AND ENHANCED ACTION OF ALDOSTERONE IN THE DEVELOPING BRAIN MAY PLAY A PIVOTAL ROLE IN COMPLICATIONS OF NEONATAL ANESTHESIA**

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INTRODUCTION: The neonatal anesthesia-caused brain abnormalities and underlying mechanisms remain poorly understood. Sevoflurane-caused impairments in a number of brain functions and the roles in these impairments of GABA_A receptor-mediated depolarization along with the effects of aldosterone and oxytocin, which may increase and depress GABA-initiated depolarization, respectively, were investigated.

METHODS: Anesthesia was induced and maintained with 6% and 2.1% sevoflurane over 3 min and 0.5-6 hrs, respectively. Acute sevoflurane effects were assessed by measuring electroencephalographic (EEG) activity in postnatal days 4-9 (P4-P9) rats. Delayed effects were evaluated in rats anesthetized at P4-P5 by determining activated caspase-3 levels either two hours or one day later and by measuring prepulse inhibition (PPI) of acoustic startle and grooming behavior at P24. All treatments were administered either prior or during sevoflurane.

RESULTS: Sevoflurane, in addition to previously reported seizure-like activity and increased level of activated caspase-3,¹ impaired PPI of startle and increased the time spent in non-syntactic chain grooming; all effects were alleviated by pretreatment with bumetanide (5 µmol/kg, i.p.), a specific inhibitor of the Na⁺-K⁺-2Cl⁻ co-transporter. Bumetanide without anesthesia affected neither PPI of startle nor grooming behavior. Aldosterone receptor antagonist, spironolactone (20 mg/kg, s.c.), normalized activated caspase-3 level and PPI of startle altered by sevoflurane, but was not as effective as bumetanide in preventing cortical seizures during sevoflurane anesthesia. Exogenous aldosterone (20 mg/kg, s.c.) further increased cortical seizures, level of activated caspase-3 and disruption of PPI of startle, but not grooming behavior. Aldosterone had no effect on EEG activity of P17-P21 rats. Oxytocin or its synthetic analog carbetocin (1.5 µg, i.c.v.) depressed sevoflurane-caused cortical seizures and normalized PPI of startle and grooming behavior.

DISCUSSION: These findings support the notion that: 1) a single exposure of neonatal rats to anesthesia with sevoflurane causes delayed behavioral abnormalities that are hallmarks of major neuropsychiatric disorders; 2) excitatory action of GABA and enhanced action of aldosterone in the developing brain as well as lower levels of oxytocin may play important roles in these complications; 3) preexisting abnormalities in aldosterone and oxytocin systems may exacerbate complications caused by neonatal sevoflurane.

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Pharmacology – Basic Science

S-355.**ISOFLURANE IMPAIRS ODOR DISCRIMINATION LEARNING IN RATS: DIFFERENTIAL EFFECTS ON SHORT-TERM VS. LONG-TERM MEMORY**

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AFFILIATION: ¹University of Wisconsin School of Medicine and Public Health, Madison, WI; ²National Cancer Institute, Rockville, MD

INTRODUCTION: Anesthetics suppress the formation of lasting memories at concentrations that do not suppress perception. What elements of the complex cascade leading from a conscious experience to a lasting memory trace are disrupted? Experiments in conscious humans suggest that subhypnotic concentrations of inhaled anesthetics impair consolidation or maintenance rather than acquisition of a representation (long-term more than short-term memory). In the present study we used operant conditioning in rats to examine the effect of isoflurane on acquisition vs. long-term (24 hour) memory of non-aversive olfactory memories.

METHODS: Experiments were approved by the University of Wisconsin IACUC. Using two different odor discrimination tasks posing different cognitive demands, rats were trained to learn the “valences” of odors presented in pairs. Odors were presented either separately (Task A: go/no-go) or simultaneously (Task B: go-left/go-right). After animals successfully learned the algorithm, we tested their ability to learn the valences of new odor pairs under control conditions (no anesthetic), 0.3% isoflurane, or 0.4% isoflurane. In a separate set of experiments we tested the ability of the animals to recall the learning set that had been acquired 24 hours previously under these same conditions.

RESULTS: Under 0.4% isoflurane, the number of trials required to reach criterion performance (18 correct responses in 20 successive trials) increased from 21.9 to 43.5 ($p < 0.05$) and 24.2 to 54.4 ($p < 0.05$) for tasks A and B, respectively. Under 0.3% isoflurane, only task B was impaired (from 24.2 to 31.5 trials, $p < 0.05$). Recall at 24 hours was dose-dependently impaired or prevented by isoflurane for both tasks.

DISCUSSION: These results indicate that anesthetics interfere with the encoding of new memories in a way that prevents their consolidation from short- to long-term memory.

REFERENCES: None

S-356.**METHYLNALTREXONE, A PERIPHERALLY-ACTING OPIOID RECEPTOR ANTAGONIST, REDUCES BODY WEIGHT GAIN AND POTENTIATES FAT REDUCTION WITH LEPTIN**

AUTHORS: C. Yuan,¹ C. Wang,² A. Attele³

AFFILIATION: ¹Department of Anesthesia & Critical Care, University of Chicago, Chicago, IL; ²Department of Anesthesia & Critical Care, University of Chicago, Chicago, IL; ³Department of Anesthesia & Critical Care, University of Chicago, Chicago, IL

INTRODUCTION: Both central and peripheral signals participate in the complicated neuronal circuitry that regulates feeding and energy homeostasis. Opioids may function to regulate food intake and body weight.¹ Leptin modulates food intake and energy balance.² In this study, we evaluated the effects of naloxone (a non-selective opioid antagonist) and methylnaltrexone (MNTX; a peripherally acting opioid antagonist)³ on weight changes in adult obese ob/ob mice and fat reduction in leptin-treated neonatal rats.

METHODS: Adult ob/ob mice were individually housed in a metabolic cage and food intake was determined. Body weight, temperature and oxygen consumption were measured. Plasma naltrexone and MNTX levels were obtained by HPLC. Also, neonatal rats of each litter were randomly assigned different treatment groups. Body and retroperitoneal fat pad weight were measured.

RESULTS: After a 12-day treatment with naloxone 0.3 mg/kg, ob/ob mice weight was reduced from 63.7 ± 1.1 g in the control group to 59.2 ± 0.9 g in the naloxone group ($P < 0.05$). After MNTX 3.0 mg/kg, weight increase completely ceased. The body weight was 63.9 ± 1.0 g in the control group compared 55.9 ± 1.2 g in the MNTX group ($P < 0.01$). The effect of MNTX (1.0-3.0 mg/kg) on weight changes was dose-dependent. MNTX significantly reduced daily food intake ($P < 0.05$), but did not affect body temperature and energy expenditure. Using HPLC analysis, no detectable naltrexone levels were found in association with MNTX. In leptin-treated neonatal rats, the weight gain of pups given a single daily injection of leptin 0.5 mg/kg, leptin 0.5 mg/kg plus naloxone 0.3 mg/kg, or leptin 0.5 mg/kg plus MNTX 3.0 mg/kg for 8 consecutive days was significantly reduced (all $P < 0.01$). Naloxone or MNTX significantly potentiated leptin's effect on weight ($P < 0.05-0.01$). After co-administration of leptin plus naloxone or leptin plus MNTX, weight reduction in the fat pads was also significant compared to the reduction after leptin alone ($P < 0.05-0.01$).

DISCUSSION: Our data suggest the existence of a peripheral opioid-related mechanism in leptin-active modulation of body weight. The results also suggest that the peripheral opioid mechanism contributes to modulating food ingestion and MNTX may have clinical importance in body weight change and obesity management.

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S-357.**ASPIRIN-TRIGGERED LIPOXIN A4 REDUCES NITRIC OXIDE PRODUCTION IN MICROGLIA BY INHIBITING ERK AND P38 MAPK PHOSPHORYLATION AND ACTIVATION OF AP-1****AUTHORS:** S. Yao,¹ Y. Wang,¹ Y. Shang,¹ Y. Wu²**AFFILIATION:** ¹Department of Anesthesiology and Critical Care, Union Hospital, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, China; ²Department of Neurology, Union Hospital, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, China**INTRODUCTION:** Microglial activation has been implicated in neuroinflammation in various neurodegenerative diseases.¹ Chronic neuroinflammation activates microglia, which produces proinflammatory cytokines and neurotoxic substances such as nitric oxide (NO), further contributing to inflammation, thus creating a vicious cycle of inflammation to microglial activation to inflammation. Lipoxins (LXs) and aspirin-triggered lipoxins (ATLs) function as “stop signals” in inflammation and actively participate in dampening host responses to bring the inflammation to resolution.² In this study, we investigated the effect of ATL on the expression and production of NO and iNOS induced by lipopolysaccharide (LPS) in murine microglial BV-2 cells.**METHODS:** In all experiments, BV-2 cells were treated with ATL or vehicle for 30 min before addition of 100 ng/ml LPS. The effects of ATL on NO and iNOS were analysed by Griess reaction, quantitative RT-PCR and Western blotting. Moreover, we investigated the effects of ATL on LPS-induced phosphorylation of mitogen-activated protein kinases (MAPKs) and activator protein-1 (AP-1) activation.**RESULTS:** Stimulation of BV-2 cells with LPS markedly increased (about 7.5-fold) NO production, compared with that generated under control conditions. Pretreatment with ATL significantly inhibited this increase in a concentration-dependent manner. Inhibitory effects of ATL on the LPS-induced NO production were accompanied by the attenuation of iNOS induction and up-regulation of iNOS mRNA levels in a dose-dependent manner. ATL (100 nM) markedly inhibited ERK1/2 and P38 MAPK activation, while phosphorylation of JNK was not affected. Furthermore, pretreatment with ATL markedly reduced the LPS-induced DNA-binding activity of AP-1.**DISCUSSION:** These data suggest ATL inhibits LPS-induced NO production and iNOS expression by inhibiting the ERK and p38 MAPK signaling pathway and activation of AP-1 in microglia. Thus, ATL may be useful for mitigating neuroinflammation.**REFERENCES:**

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S-358.**A TREATMENT TARGET FOR LEARNING DEFICITS AFTER ISOFLURANE IN MICE****AUTHORS:** A. Zurek,¹ B. Orser^{1,2}**AFFILIATION:** ¹Dept. Physiology, University of Toronto, Toronto, ON, Canada; ²Dept. Anesthesia, Sunnybrook Health Sciences Centre, Toronto, ON, Canada**INTRODUCTION:** Learning and memory impairments are common side-effects of surgery and anesthesia. The mechanisms underlying postoperative cognitive deficits remain poorly understood and no effective prevention or treatment strategies exist. γ -Aminobutyric acid type A (GABAA) receptors are major targets for most anesthetics and key regulators of learning and memory processes.¹ In particular, $\alpha 5$ subunit-containing GABAARs mediate acute memory blockade by anesthetics.^{2,3} A recent study showed that fear memory in mice was impaired up to 48 h following anesthesia. The impairment was prevented by preemptive treatment with the $\alpha 5$ GABAAR-selective inhibitor L-655,708.⁴ The aims of the current study were to: 1) develop a model of non-aversive learning to study post-anesthetic memory deficits; 2) use the model to characterize learning deficits in the early post-anesthetic period; 3) determine whether $\alpha 5$ GABAARs are necessary for learning deficits and 4) determine whether an inhibitor of $\alpha 5$ GABAARs can prevent or treat learning deficits after general anesthesia.**METHODS:** The study approved by the institutional Animal Care Committee. Wild-type and $\alpha 5$ GABAAR null mutant mice (Gabra5^{-/-}) were exposed to isoflurane (1 MAC) or vehicle gas for 1 h in a heated, air-tight chamber. To test whether a decrease of $\alpha 5$ GABAAR activity prevents or treats the learning deficits, the inverse agonist L-655,708 (0.7 mg/kg, high dose or 0.35 mg/kg, low dose, i.p.) or vehicle was administered either prior to (prevention) or after (treatment) anesthesia. Non-aversive learning was studied using a novel object recognition task 24 h after exposure to isoflurane.**Challenging Case Report (only complete if your submission falls into the “Challenging Case Report” category. If you select the “Challenging Case Report” category on the next step, this section must be completed.):** N/A**RESULTS:** Isoflurane impaired memory performance 24 h after anesthesia (Effect of isoflurane, $F_{1,39} = 10.39$, $P < 0.005$). In WT mice, the memory deficit after isoflurane could be prevented (vehicle gas+ vehicle 0.74 ± 0.05 versus isoflurane + L-655,708, 0.64 ± 0.05 , Tukey's HSD, $P > 0.05$) and treated by a low dose of L-655,708 (0.66 ± 0.02 versus 0.67 ± 0.03 , Tukey's HSD, $P > 0.05$). Gabra5^{-/-} mice failed to exhibit learning deficits after isoflurane anesthesia ($P > 0.05$).**DISCUSSION:** These results demonstrate that isoflurane impairs the acquisition of non-aversive memories up to 24 hours after anesthesia and suggest that activity of $\alpha 5$ GABAARs contributes to these learning deficits. Additionally, the results suggest a possible treatment strategy as the deficits could be prevented and treated by the $\alpha 5$ GABAAR inverse agonist, L-655,708.**REFERENCES:**

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S-359.**EFFECT OF GENERAL ANESTHESIA ON STEM CELL PROLIFERATION IN THE DENTATE GYRUS OF YOUNG AND AGED RATS**

AUTHORS: D. M. Erasso,¹ R. Karlinski,^{1,2} D. Mangar,² S. Saporta,¹ E. M. Camporesi^{1,2}

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INTRODUCTION: Clinical studies show that a statistically significant number of people experience long term changes in learning and memory after anesthesia. This paradigm has been mimicked in rat studies that have consistently shown long-term neurocognitive deficits following general anesthesia. We hypothesize that memory impairment following anesthesia may result from an anesthetic-induced alteration of adult neurogenesis. To test this hypothesis, we evaluated the effects of isoflurane and propofol anesthesia on adult neurogenesis in young and aged rats by the administration of halogenated thymidine analogs as markers for each stage of new cells development in the Dentate Gyrus (DG).

METHODS: Young (3 mo-old) and aged (20 mo-old) F344 rats were injected IP with 3 different halogenated thymidine analogs (CldU, IdU, and EdU) at 3 different time points, 21 days, 8 days and 4 days respectively before the anesthetic exposure, each injection time corresponded to a stage of adult neurogenesis such as integration, migration and differentiation. In addition, the proliferation stage was assessed by the endogenous marker ki67. At

the time of immunohistochemistry each time point was evaluated for co-expression of the corresponding neuronal lineage marker (doublecortin or NeuN). The rats were anesthetized for 3 hours with either 1.5% isoflurane or 35mg/Kg/hr propofol. Body temperature was maintained at 37 °C and perioperative parameters such as oxygen saturation, heart rate, and blood pressure were measured throughout the anesthesia period. A day after anesthesia, rats were euthanized and the brains analyzed via immunohistochemistry and quantitative cell-counts.

RESULTS: Isoflurane anesthesia decreased the number of cells labeled 21 days before anesthesia (CldU+) in aged rats ($p=0.022$). Co-expression of NeuN confirmed that most of these CldU+ cells were mature neurons, and that isoflurane decreased their number in aged rats ($p=0.008$) (Fig 1A,B). On the other side, propofol anesthesia decreased the number of cells labeled 8 days before anesthesia (IdU+) in young rats ($p=0.034$). Co-expression of doublecortin confirmed that most of these IdU+ cells were immature neurons, and that propofol anesthesia decreased their number ($p=0.055$) (Fig 1C,D).

DISCUSSION: The effect of anesthesia on adult neurogenesis in the DG is age and agent dependent and it is not on the proliferation stage of neurogenesis but rather on differentiation, migration or integration

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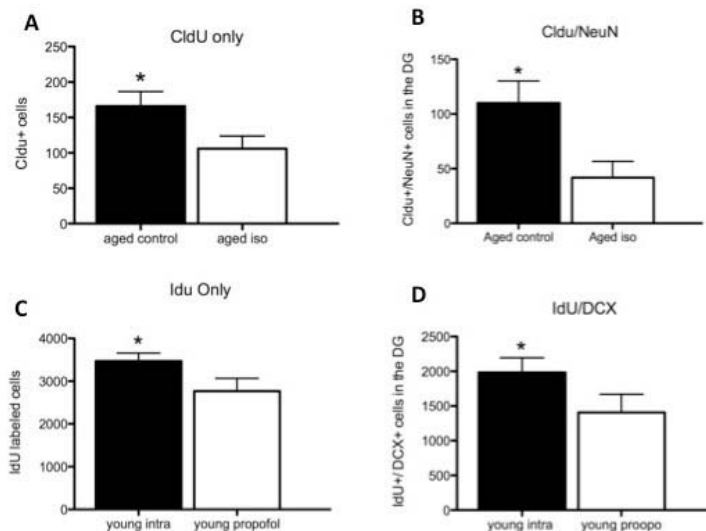


Fig 1. (A) shows the number of cells labeled 21 days before isoflurane (CldU+) in aged rats. (B) shows the co-expression of the mature neuronal marker (NeuN) in the cells labeled 21 days before isoflurane anesthesia in aged rats. (C) shows the number of cells labeled 8 days before propofol (IdU+) in young rats. (D) shows the co-expression of the immature neuronal marker (doublecortin) in the cells labeled 8 days before propofol anesthesia in young rats.

S-360.**LIDOCAINE ATTENUATES COGNITIVE IMPAIRMENT AFTER ISOFLURANE ANESTHESIA IN OLD RATS****AUTHORS:** D. Lin, J. Li, Z. Zuo**AFFILIATION:** University of Virginia, Charlottesville, VA

INTRODUCTION: Post-operative cognitive dysfunction (POCD) is a clinical phenomenon that has drawn significant attention from the public and scientific community.¹ Age is a risk factor for POCD.² However, the contribution of general anesthesia/anesthetics to POCD and the underlying neuropathology is not clear. Clinically applicable interventions for POCD have not been identified.

METHODS: Eighteen-month-old male Fisher 344 rats were exposed to or not exposed to 1.2% isoflurane in the presence or absence of lidocaine (1.5 mg/kg as a bolus and then 2 mg/kg/h during isoflurane exposure) for 2 h. Two weeks later, rats were subjected to Barnes maze and fear conditioning tests. Brain tissues were harvested for examination at 29 days after the isoflurane exposure.

RESULTS: Although animals exposed to or not exposed to isoflurane developed spatial learning, animals exposed to isoflurane had significant reference memory impairment assessed by Barnes maze. Isoflurane-exposed rats also had impaired learning and memory in fear conditioning test. These isoflurane effects were attenuated by lidocaine. Isoflurane and isoflurane plus lidocaine exposure did not change the neuronal density and expression of NeuN (a neuronal protein), drebrin (a dendritic spine protein), synaptophysin (a synaptic protein), activated caspase 3 and caspase-activated DNase in the hippocampus at 29 days after isoflurane exposure when cognitive impairment was present. Isoflurane and lidocaine did not affect the amount of β -amyloid peptide in the cerebral cortex and interleukin 1 β and tumor necrosis factor- α in the hippocampus.

DISCUSSION: Isoflurane induces learning and memory impairment, but does not cause significant neuropathological changes, in elderly rats. Lidocaine attenuates isoflurane-induced cognitive impairment.

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S-361.**INHIBITION OF VASCULAR ADHESION PROTEIN-1 PROVIDES NEUROPROTECTION FOLLOWING AN INTRACEREBRAL HEMORRHAGIC STROKE****AUTHORS:** Q. Ma,¹ N. H. Khatibi,² A. Manaenko,¹ R. L. Applegate,² R. D. Martin,² J. Zhang^{1,2}**AFFILIATION:** ¹Loma Linda University Medical Center, Department of Physiology & Pharmacology, Loma Linda, CA; ²Loma Linda University Medical Center, Department of Anesthesiology, Loma Linda, CA

INTRODUCTION: The systemic immune response plays a vital role in propagating the damage of an intracerebral hemorrhage at the site of local injury. Vascular adhesion protein-1 (VAP-1), a semicarbazide-sensitive- amine-oxidase, was found in previous studies to play a role in migration of immune cells. In the present study, we hypothesize that VAP-1 inhibition may decrease brain injury by attenuating the transmigration of immune cells to the injury site, and by doing so, reduce cerebral edema and improve neurobehavioral function in mice.

METHODS: Two VAP-1 inhibitors, LJP1586 and semicarbazide (SCZ) were given 1hr after ICH induction by either collagenase or autologous blood-injection. VAP-1 siRNA, a VAP-1 gene silencer, and human recombinant AOC3 protein, a VAP-1 analogue, were delivered by intracerebroventricular injection. Post assessment included neurobehavioral testing, brain edema measurement, quantification of neutrophil infiltration and microglia/macrophage activation, and measurement of ICAM-1, P-selectin, MCP-1 and TNF- α expression 24hrs after ICH.

RESULTS: We found that LJP1586 and SCZ reduced brain edema and neurobehavioral deficits 24hrs after ICH induction. These two drugs were also found to decrease levels of ICAM-1, MCP-1, TNF- α , and inhibit neutrophilic infiltration and microglia/macrophage activation.

DISCUSSION: In conclusion, this study shows that VAP-1 inhibition ameliorates ICH-induced brain damage in adult male mice by attenuating the adhesion and transmigration of circulating systemic immune cells to the site of local injury. By doing so, VAP-1 inhibition prevents the propagation of the local inflammatory process and in turn, reduces cerebral edema, improves neurobehavioral function and may act as a potential therapeutic target for future clinical direction.

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S-362.**DESIGN OF SPECIFIC PROTEIN-BASED INHIBITORS OF NEUTROPHIL ELASTASE TO REDUCE LUNG DAMAGE, OXIDATIVE STRESS AND IMMUNE ACTIVATION IN RESPONSE TO CARDIAC BYPASS AND ENDOTOXAEMIA**

AUTHORS: J. T. Maynes,^{1,2} M. M. Cherney,² M. A. Qasim,³ M. Laskowski,³ M. G. James²

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INTRODUCTION: Human Neutrophil Elastase (HNE) is involved in the adverse inflammatory response to anaesthesia, ventilation, cardio-pulmonary bypass (CPB) and infection/sepsis. It contributes to tissue damage, lung dysfunction/ALI and acts as an alternative pathway for fibrinolysis post-CPB.¹ Small molecule inhibition of neutrophil elastase (sivelestat, Elaspol[®]) was shown to decrease free radical generation and reduce lung injury in response to mechanical ventilation, anaesthesia and CPB and improve microcirculation and mitochondrial function in response to endotoxaemia.² We sought to design a highly specific protein-based elastase inhibitor, which would be easy to produce and administer for clinical application.

METHODS: Starting from the natural protein-based proteinase inhibitor Turkey-Ovomucoid Domain-3 (OMTKY3), we produced mutations in the substrate specificity loop to produce a high affinity HNE inhibitor.^{3,4} We then performed kinetic experiments and solved the X-ray crystallographic structures of the inhibitors bound to HNE to characterize the structural differences (2 Å resolution) and rationalize kinetic constants.

RESULTS: Inhibitor specificity for OMTKY3 is provided by the amino acid at position 18, the wild-type residue being leucine. We mutated position 18 to the other 19 naturally occurring and 5 non-naturally occurring amino acids. We determined that the binding affinity of OMTKY3 mutants to HNE increased as the number of carbon atoms in the side chain of residue 18 increased and that isoleucine had the highest affinity of all replacements for HNE. A dramatic decrease in binding occurred with an increase in chain length to phenylalanine. X-ray crystal structures of wild-type OMTKY3 and the phenylalanine-18-OMTKY3 mutant bound to HNE showed a dramatic and energy-costing rearrangement of the usually rigid enzyme, explaining structurally the fall in binding constants.

DISCUSSION: We have shown that the mutant of OMTKY3 with isoleucine in the central position in its substrate specificity loop provides the best binding to HNE and that the size of the amino acid side chain partially determines specificity as larger side chains caused significant structural rearrangements of the enzyme. This inhibitor is specific for HNE compared to other common serine proteases. This scaffold can now be used as a protein-based inhibitor for clinical applications of elastase inhibition including in lung dysfunction post-CPB and in ALI/ARDS.

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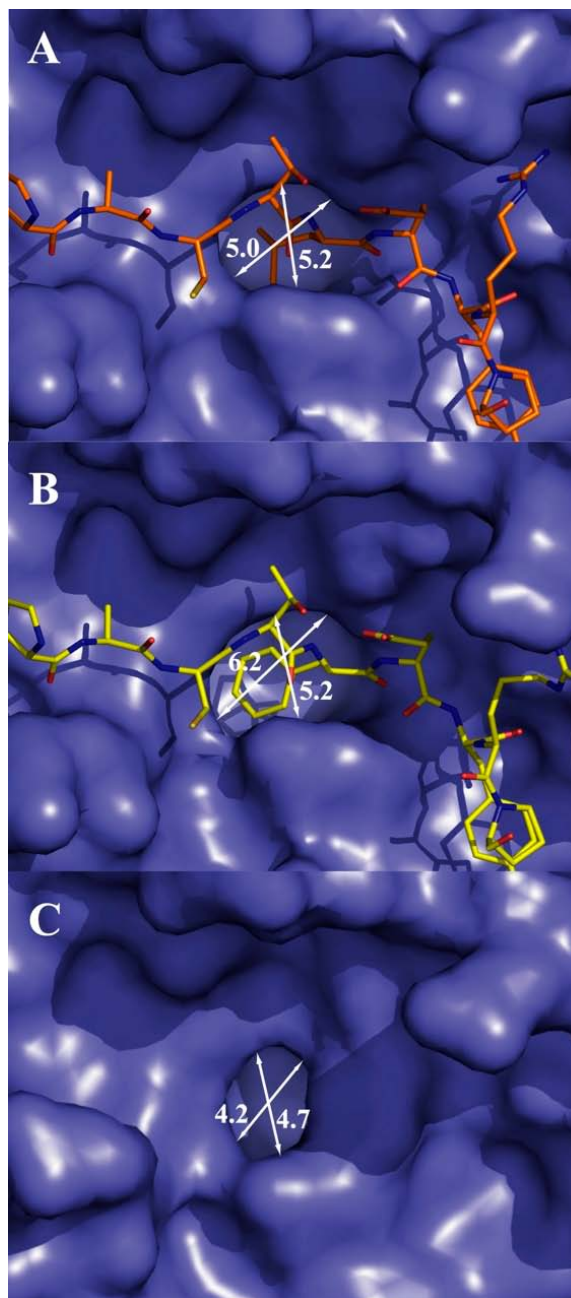


Illustration showing binding site rearrangements in HNE. (A) wild-type OMTKY3 (Leu18), (B) mutant OMTKY3 (Phe18), (C) enzyme without inhibitor, all measurements are in angstroms

S-363.**MU OPIOID RECEPTOR ANTAGONISTS INHIBIT LUNG CANCER GROWTH AND METASTASIS IN MICE****AUTHORS:** P. A. Singleton, F. E. Lennon, T. Mirzapourzadeh, J. Moss**AFFILIATION:** The University of Chicago, Chicago, IL**INTRODUCTION:** The possibility that mu opioid agonists can influence cancer recurrence is a subject of recent interest. We have previously reported that Lewis lung carcinoma (LLC) tumors do not form in mu opioid receptor (MOR) knockout mice. In this study, we investigated whether MOR antagonists (methylbuprenorphine (MBN) and naltrexone (NTX)) can inhibit LLC tumorigenicity in animal models.**METHODS:** 1.0×10^6 LLC cells were injected subcutaneously into the flank of C57BL/6 wildtype mice. Once tumors reached an average volume of 100 mm³, Alzet osmotic pumps (100 μ l, 0.25 μ l/hr) containing either MBN (n=2), NTX (n=4) or PBS (n=3) were implanted subcutaneously on the back. The pumps delivered continuous doses of drug (10 mg/kg/day) or vehicle over the course of 12 days, during which time the tumors were measured regularly and their volume was calculated. Tumor growth was normalized relative to its size at pump implantation. To characterize metastasis from primary tumors growing in mouse hind flank, lungs from PBS, MBN or NTX-treated mice were formalin fixed, 5 micron paraffin sections were obtained, hydrated and epitope retrieval performed. The sections were then histologically evaluated by H & E staining and slide images were analyzed using ImageJ (NIH) software. Stained tumors with area greater than 30,000 μ m² were quantified and the pixel variable was normalized with the parameters of the microscope magnification used.**Challenging Case Report (only complete if your submission falls into the “Challenging Case Report” category. If you select the “Challenging Case Report” category on the next step, this section must be completed.):** N/A**RESULTS:** Continuous infusion of MBN inhibited LLC primary tumor growth by ~40% and lung metastasis by ~45%. NTX inhibited LLC primary tumor growth by ~58% and lung metastasis by ~25%.**DISCUSSION:** Our data suggests that MBN has inhibitory activity in an animal model of lung cancer metastases. Additional explanation including clinical studies would be of considerable interest.**REFERENCES:** N/A**S-364.****ACTIVITY-REGULATED CYTOSKELETON-ASSOCIATED PROTEIN IS DOWN-REGULATED AFTER ANESTHESIA-INDUCED HYPOTHERMIA****AUTHORS:** R. Whittington,² F. Marcouiller,¹ N. El Khoury,¹ L. Virag,² C. W. Emala,² E. Planel¹**AFFILIATION:** ¹Université Laval, Québec, QC, Canada; ²Columbia University, New York, NY**INTRODUCTION:** Cognitive impairment following anesthesia and surgery remains a significant medical problem.¹ Synaptic plasticity plays a pivotal role in memory formation and is a process that is dependent on rapid changes in gene expression. Expression of the immediate early gene Arc (Activity-regulated cytoskeleton-associated protein) is induced by neuronal activation, dependent on NMDA receptor activation, and results in Arc mRNA being directed towards dendritic segments.² Subsequent Arc protein synthesis at synapses appears to play a significant role in the neuronal plasticity associated with learning and memory, and this is well supported by studies demonstrating that the disruption of hippocampal Arc expression impairs the maintenance of long-term potentiation as well as the consolidation of long-term memory for a spatial memory task.

Despite neurobehavioral evidence that anesthetics impair memory and learning, there is limited information regarding how clinically relevant doses of volatile anesthetics alter Arc protein expression. The purpose of this study was to determine the effect of a surgical anesthetic dose of isoflurane on hippocampal Arc protein.

METHODS: Fischer 344 received isoflurane 1 minimum alveolar concentration (1 MAC = 1.3%) for a period of 3 h. In the hypothermia studies, the temperature of the rats was not controlled during anesthesia and was allowed to spontaneously decrease. In the normothermia studies, rats exposed to isoflurane were maintained at 37°C. Hippocampal Arc RNA and protein expression were analyzed by RT-PCR, Western blotting and immunofluorescence.**RESULTS:** We found that Arc protein and mRNA were downregulated during anesthesia. This was not mediated by the exposure to isoflurane per se, but to the hypothermia consequent to anesthesia.**DISCUSSION:** In the current study, the effect of a clinically relevant dose of isoflurane on rat hippocampal Arc protein and gene expression was determined under hypothermic and normothermic conditions. We conclude that anesthesia induces an immediate and transient reduction in Arc protein levels by inhibiting Arc transcription rather than affecting Arc translation through eEF2. Importantly, we demonstrate that this effect was mediated by hypothermia consequent to anesthesia, and not by isoflurane per se.**References:**

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S-365.**PHARMACOLOGIC DISSECTION OF THE PI3K PATHWAY FOLLOWING OXIDATIVE STRESS****AUTHORS:** B. Houseman, A. Ferris, K. Shokat**AFFILIATION:** University of California - San Francisco, San Francisco, CA

INTRODUCTION: The phosphoinositide-3-kinase pathway is generally regarded as protective, mediating survival following oxidative and hypoxic stress, including organ ischemia and pre- and post-ischemic conditioning. This pathway, however, comprises at least 15 different isoforms with differing expression and tissue distribution. The p110alpha and p110beta isoforms of PI3K, for example, are ubiquitously expressed, while the p110gamma and p110delta isoforms are found principally in immune and endothelial cell types. We hypothesized that selective inhibitors of the p110gamma/p110delta pathways could preserve protective PI3K functions while limiting reperfusion injury.

METHODS: A panel of inhibitors with selectivity against different isoforms of PI3K were prepared and evaluated in cellular and animal models of oxidative stress. This panel includes several novel compounds, including a selective inhibitor of p110alpha and the first dual, selective inhibitor of p110gamma and p110delta.^{1,2} We next examined the effect of selective inhibitors in murine models of cerebral ischemia (MCA occlusion) and cardiac ischemia (LAD occlusion).

RESULTS: Proliferation and apoptosis assays revealed that the protective effects of the PI3K pathway were largely mediated by the p110alpha isoform. Compounds that targeted p110beta, p110gamma, and p110delta did not inhibit the protective effects of the PI3K pathway, while compounds that targeted p110gamma and p110delta reduced endothelial permeability and neutrophil function relative to controls. In vivo experiments using SW14 (15 mg/kg IP) showed that this drug could reduce both cerebral and myocardial infarct size, even when given after ischemia, suggesting their ability to reduce reperfusion injury.

DISCUSSION: This work shows that the p110alpha isoform mediates many of the protective effects of the pathway, while the p110gamma and p110delta isoforms reduce reperfusion damage by selective modulation of the innate immune system. This suggests that selective inhibitors of p110gamma and p110delta may show promise as therapeutics in the setting of reperfusion injury and other inflammatory responses. Studies to examine the kinetics of this inhibition are underway.

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S-366.**DECREASED SURFACE AMPA RECEPTOR EXPRESSION IN MOUSE CORTICAL NEURONS DURING PENTOBARBITAL-INDUCED ANESTHESIA****AUTHORS:** C. Carino, L. Mao, E. Fibuch, Q. Wang**AFFILIATION:** University of Missouri Kansas City, Kansas City, MO

INTRODUCTION: Ionotropic glutamate receptors, such as α-amino-3-hydroxy-5-methylisoxazole-4-propionic acid (AMPA) and N-methyl-D-aspartate (NMDA) receptors, undergo reciprocal trafficking between the surface membrane and intracellular organelles. This trafficking activity determines the efficacy and strength of excitatory synapses and is subject to modulation by changing synaptic inputs. There is evidence that anesthesia alters NMDA receptor trafficking in brain cells.¹ It is however unknown whether anesthesia also affects subcellular AMPA receptor distribution. Here we hypothesized that anesthesia may have an impact on AMPA receptor trafficking in neurons in vivo.

METHODS: Following IACUC approval, adult male C57BL/6J mice received an intraperitoneal injection of pentobarbital sodium (Nembutal, 50 mg/kg) to induce general anesthesia. Mice received a vehicle injection served as control. Mice were sacrificed by cervical dislocation at 5, 15, 120 min after drug injection (n = 4-6 per group). Brains were removed and sliced. On cortical slices, surface receptor crosslinking assays with a membrane-impermeable crosslinking agent bis(sulfosuccinimidyl)suberate (BS₃) were performed to detect changes in surface and intracellular expression of AMPA receptor subunits (GluR1-3). Data were statistically analyzed with a significant level of p < 0.05.

RESULTS: Pentobarbital at the anesthetic dose decreased the surface expression of GluR1 and GluR3 proteins with a reciprocal increase in intracellularly expressed GluR1 and GluR3 proteins in cortical neurons. In contrast, pentobarbital did not alter surface and intracellular expression of GluR2 proteins. In the time-course study, no significant change in subcellular expression of all three subunits was observed 5 min after pentobarbital injection. Significant decreases or increases in surface or intracellular pools, respectively, were noted in GluR1 and GluR3, but not GluR2, expression at 15 min. These changes returned to normal levels at 120 min. At all time points evaluated, pentobarbital did not alter basal amounts of intracellular α-actinin proteins.

DISCUSSION: Glutamatergic transmission has extensive influence over activity of the central nervous system. The loss of surface GluR1/3 during pentobarbital anesthesia usually means a reduction of the strength of excitatory synapses. This reduction may contribute to the maintenance of anesthesia. In addition, pentobarbital reduces cortical AMPA excitotoxicity. This neuroprotective effect may be mediated in part by subtracting surface AMPA receptor expression.

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S-367.**DEXMEDETOMIDINE DIRECTLY INDUCES
TAU HYPERPHOSPHORYLATION IN THE
MOUSE HIPPOCAMPUS**

AUTHORS: R. Whittington,¹ L. Virág,¹ K. Wong,¹ F. Marcouiller,² E. Planel²

AFFILIATION: ¹Columbia University, New York, NY; ²Université Laval, Quebec City, QC, Canada

INTRODUCTION: In Alzheimer's disease, tau, a microtubule-associated protein, can become aberrantly hyperphosphorylated, which can lead to the development of neurofibrillary pathology. Anesthetics can accelerate tau hyperphosphorylation through a mechanism involving protein phosphatase 2A inhibition by anesthesia-induced hypothermia.¹ However, recent pre-clinical studies have suggested that certain anesthetics can induce tau hyperphosphorylation in the absence of hypothermia;² nevertheless, the effects of dexmedetomidine on this process are unknown. Hence, the aim of this study was to determine the impact of dexmedetomidine on tau phosphorylation under normothermic conditions in vivo.

METHODS: Following institutional animal care approval, male C57BL/6/J mice (8-10 week old) received either dexmedetomidine (Dex) 300 µg/kg or 0.9% saline (control) i.p.. The Dex-treated mice were sacrificed 30 min (n=6) and 2h (n=6) after treatment and control (n=6) mice were sacrificed at 30 min. Hippocampal tissue was immediately harvested at the end of the study, and levels of total tau as well as tau phosphorylated (p-tau) at the AT8 (pSer202/pThr205),

CP13 (pSer202), PHF-1 (pSer396/pSer404) phosphoepitopes were determined using immunoblotting. Protein bands were visualized by enhanced chemoluminescence, and densitometric analysis of immunoblots was performed using MultiGauge® image analysis software. Band immunoreactivity levels for all epitopes were normalized to total tau. Statistical comparisons were made using ANOVA with Newman-Keuls post-hoc test applied when appropriate. Data are expressed as mean ± SD and P < 0.05 was deemed statistically significant.

RESULTS: Dex produced significant increases in hippocampal p-tau at the AT8, CP13, and PHF-1 phosphoepitopes 30 min (0.5h) following treatment (Fig. 1). At 30 min after Dex, p-tau increased to 183 ± 36 (AT8), 183 ± 27 (PHF-1), and 170 ± 68 (CP13) % of ctrl. Interestingly, at 2h, Dex was still associated with significant increases in p-tau at all three phosphoepitopes despite the return of the righting reflex in all of the mice. No significant changes in total tau levels were observed, and rectal temperatures were similar in all of the study groups: 37.1 ± 0.6°C (Ctl), 37.1 ± 0.5°C (0.5h), and 37.1 ± 0.7°C.

DISCUSSION: Normothermic dexmedetomidine administration directly induces tau hyperphosphorylation in the mouse hippocampus, and this effect persists following the recovery from the sedative-hypnotic effects of Dex. Further studies are warranted to determine the mechanisms underlying these phosphorylation changes as well as their neuropathological consequences.

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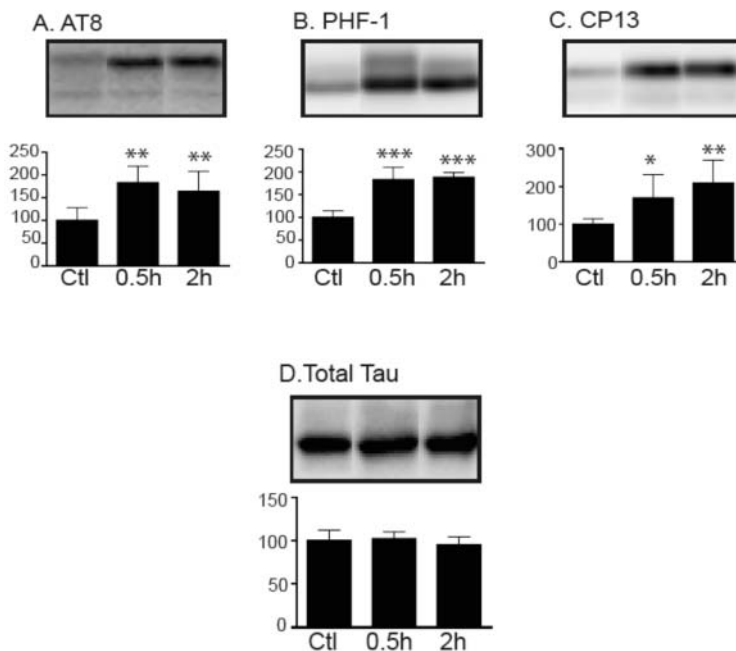


Fig.1: Tau phosphorylation (% Ctl) at the AT8, PHF-1, and CP13 phosphoepitopes (A-C) in the hippocampus of mice treated with Dexmedetomidine 300 µg/kg i.p. and sacrificed 30 min (0.5h) or 2h following treatment. Control (Ctl) mice received an equal volume of saline i.p. and were sacrificed 30 min later. Phosphorylated tau levels were normalized to total tau levels (D). Data are expressed as mean ± SD and * P < 0.05, ** P < 0.01, and *** P < 0.001 vs Ctl.

S-368.**THE EFFECTS OF KETAMINE IN DROSOPHILA RETINAS****AUTHORS:** C. CHEN,^{1,2} W. Lin,³ Y. Wu,⁴ H. Liu,⁵ B. Wu,⁶ C. Li^{1,2}

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INTRODUCTION: Ketamine, an N-methyl-D-aspartate (NMDA) receptor antagonist, is widely used in pediatric anesthesia. Overactivation of the NMDA receptor has been implicated as a factor in the pathogenesis of ischemic injury in the central nervous system¹. Some studies showed that ketamine might have neuroprotective effects after ophthalmology surgery in rabbit retinas.^{1,2} The speculation might be that the antagonist effect of ketamine attenuates the ischemic injury in the retinas. The purpose of this study was to investigate the effect of ketamine on *Drosophila* retinas by using electroretinogram (ERG) assay.

METHODS: Young wild type adult male flies (*w*(CS10), 1 day after eclosion) were fed by adding 75µl ketamine solution (600 mg/kg) six times per day in standard food. Forty minutes after final feeding, we observed the flies retinas response to light by ERG. The recording electrode was placed on the eye surface and the reference electrode was inserted in the neck of the fly.³ Flies were dark adapted for 5 minutes and stimulated by a train of five pulses of white light (2 seconds in duration), delivered at 6-second intervals. The amplitude of the on /off transient was calculated as the difference (Δ ERG) between the highest voltage reached after lights on/off and this baseline value.

RESULTS: Light on response showed that electronic potentials of control group and ketamine group were 3.7 ± 0.4 and 2.2 ± 0.2 ($p < 0.01$), respectively. When light off, the electronic potentials of control group and ketamine group were 7.4 ± 0.5 and 5.8 ± 0.4 ($p < 0.05$) respectively. The Δ ERG potentials (Fig.1) of control group and ketamine group were 23.5 ± 1.5 and 17.4 ± 1.3 , respectively ($p < 0.01$). Lower Δ ERG about 30% was observed in ketamine group compared with control group.

DISCUSSION: Ketamine has been used in pediatric anesthesia for decades. Prolonged exposure of ketamine results in neurodegeneration and neurocognitive deficits in the neonatal rodents⁴. However, recent data suggest that ketamine might have neuroprotective effect on retinas.² We used *Drosophila*, a model for studying neurodegenerative diseases⁵, to determinate the effects of ketamine by examining ERG. We suggest that ketamine may have protective effects on retinas by decreasing ERG potential in *Drosophila*. For considering the risk of ischemic injury in pediatric ophthalmology surgery, ketamine might be a better choice for general anesthesia. However, further investigation would be study effects of ketamine on retinas and neurons.

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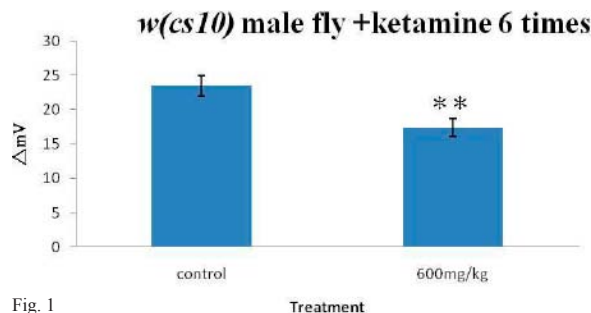


Fig. 1

S-369.**PRECONDITIONING WITH VOLATILE ANESTHETICS IN ISCHEMIC RETINAL LESION IN RATS**

AUTHORS: B. Danyadi,^{1,2} K. Szabadfi,³ D. Reglodi,¹ R. Gabriel,³ D. Trasy,² I. Batai²

AFFILIATION: ¹Anatomy, University of Pecs, Pecs, Hungary; ²Anesthesiology and Intensive Care Unit, University of Pecs, Pecs, Hungary; ³Experimental Zoology and Neurobiology, University of Pecs, Pecs, Hungary

INTRODUCTION: Volatile anesthetic agents have been recognized for their neuroprotective properties since the 1960s¹ and there is growing clinical evidence that volatile anesthetic preconditioning during surgery may prevent or attenuate perioperative ischemic injury.² However, little is known regarding the potential retinoprotective effects of preconditioning by anesthetic drugs in ischemic injury despite the known influence in the brain. The retina has excellent blood supply suiting the high energy demand. An ischemic damage in the retina leads to various degrees of visual impairment. Retinal ischemia can be modeled by permanent bilateral common carotid artery occlusion (BCCAO), causing chronic hypoperfusion-induced degeneration in the entire rat retina.³ The complex degenerating pathways offer a complex approach of neuroprotective strategies as described previously with 4 recently proven retinoprotective agents.⁴ Here we studied the degree of ischemic injury with preconditioning by isoflurane and sevoflurane in the rat retina.

METHODS: Two-month-old rats of local Wistar rat colony were subjected to BCCAO. During the operation and preconditioning rats were anesthetized with 1 MAC of isoflurane or sevoflurane. The oxygen, carbon dioxide, and anesthetic vapor concentration in the anesthetizing box was monitored with a gas analyzer. Animal housing and application of experimental procedure were in accordance with institutional guidelines under approved protocols (BA02/2000-20/2006, Univ. of Pecs). We examined 4 groups for each anesthetic: non- and preconditioning groups in control and BCCAO animals (n=7 in each group). The duration of preconditioning period was one hour and it was performed one day before BCCAO. The retinas were processed for histological evaluation after two weeks survival to determine the cell number in the ganglion cell layer and the thickness of the whole retina and that of all retinal layers.

RESULTS: In BCCAO-induced ischemic injury both isoflurane and sevoflurane preconditioning ameliorated retinal damage. Retinal thickness and the cell number in the ganglion cell layer were more retained in preconditioned animals after BCCAO compared to non-preconditioned group in the case of both anesthetics. No significant differences were detected between control groups by using different anesthetics.

DISCUSSION: These results suggest that preconditioning using volatile anesthetic agents could provide a new perspective in retinoprotective strategies.

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S-370.**CLONIDINE INDUCES SEDATION THROUGH ACTING ON THE PERIFORNICAL AREA AS WELL AS THE LOCUS COERULEUS IN RATS**

AUTHORS: H. Sakamoto, S. Fukuda, A. Yasuda, Z. Lu, J. Takata, J. Sawai

AFFILIATION: Teikyo University School of Medicine, Tokyo, Japan

INTRODUCTION: Clonidine (CLO), an α_2 agonist, has been used in clinical fields for sedation. It has been reported that CLO may induce sedation through the locus coeruleus (LC), a principal region for noradrenergic pathway. However, lesion of the LC did not suppress the sedative effect of CLO, suggesting other target site of CLO may exist for the sedative action of CLO.¹ We demonstrated that microinjection of propofol into the perifornical area (Pef) induced sedation with decreasing the rat cortical efflux of acetylcholine (Ach).² Thus, we clarified whether microinjection of CLO into the Pef and the LC might influence the efflux of norepinephrine (NE) and Ach in rats.

METHODS: The protocols were approved by the Animal Care Committee of Teikyo University. Almost 5-7 days before experiments, the EEG socket, a microdialysis cannula and a microinjection tube were installed in the brain under pentobarbital anesthesia in 64 Wistar rats. The cortical NE and Ach effluxes were detected using microdialysis. Samples were collected every 20 min and measured by HPLC. Firstly, CLO (100, 300 and 1000 $\mu\text{g/kg}$) was cumulatively injected into the peritoneal cavity and observed the changes in EEG and NE or Ach efflux. Secondly, we injected CLO (4.8 μg in 0.2 μl) or saline (0.2 μl) into the LC and observed the changes in EEG and NE or Ach efflux for 2h. Finally, CLO or saline was injected into the Pef in the hypothalamus. The data were analysed using two-way ANOVA.

RESULTS: Intraperitoneal injection of CLO induced sedation and dose-dependently attenuated either the cortical efflux of NE or Ach ($p<0.0001$). After injection of CLO into the LC, the rats became immobilized in accordance with EEG slowing. Microinjection of CLO into the LC induced a greater decrease in the cortical NE, not Ach, efflux than that after saline injection ($p<0.0001$). Injection of CLO into the Pef had the rats immobilized and induced EEG slowing. The decreases in cortical effluxes of NE and Ach after microinjection of CLO into the Pef was greater than those after saline ($p<0.0001$).

DISCUSSION: It has been reported that CLO induced sedation via NE pathway acting at the LC. Sedation and decreases in cortical Ach and NE efflux induced by intraperitoneal injection of CLO suggest that the decrease in Ach is also responsible for the sedative action of CLO. Decrease in cortical NE, not Ach, efflux after microinjection of CLO into the LC depicts that the LC is one of the target sites for CLO-induced sedation. Decreases in both Ach and NE after microinjection of CLO into the Pef may indicate that the Pef as well as the LC is responsible for the sedative action of CLO in rats.

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S-371.**ASPIRIN-TRIGGERED LIPOXIN A4 SUPPRESSES LPS-INDUCED INFLAMMATORY MEDIATORS EXPRESSION BY INHIBITING ACTIVATION OF NF-KB IN BV-2 MICROGLIAL CELLS****AUTHORS:** Y. Wang,¹ Y. Shang,¹ S. Yao,¹ Y. Wu²**AFFILIATION:** ¹Department of Anesthesiology and Critical Care, Union Hospital, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, China; ²Department of Neurology, Union Hospital, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, China**INTRODUCTION:** Microglial cells are generally considered as the immune cells of the central nervous system. The overactivation of microglia followed by overproduction of neurotoxic factors such as interleukin-1 β (IL-1 β) and tumor necrosis factor- α (TNF- α) results in deleterious, progressive neurotoxic consequences and neurodegeneration.¹ Lipoxins (LXs) and aspirin-triggered LXs (ATLs) are considered to act as 'braking signals' in inflammation.² Our previous experiments have showed that LXA4 analogue could attenuate focal ischemia induced inflammation response and inhibited the activation of microglia in vivo.^{3,4} In the present experiments, we investigated the impact of ATL on the pro-inflammatory cytokines expression induced by LPS in murine microglial BV-2 cells.**METHODS:** The BV-2 cells were treated with ATL (1, 10 and 100 nM) for 30 min prior to LPS exposure and the effects on IL-1 β and TNF- α expression were analysed by ELISA and quantitative RT-PCR. Moreover, we investigated the effects of ATL on LPS-induced nuclear translocation of NF- κ B, the degradation of I κ B- α and the DNA binding activity of NF- κ B.**RESULTS:** Stimulation of BV-2 cells with LPS (100ng/ml) induced a significant increase in the levels of IL-1 β and TNF- α in the cell-conditioned media after 24 h ($P < 0.01$). Pretreatment with ATL significantly inhibited the LPS-induced IL-1 β and TNF- α production in a concentration dependent manner. The mRNA expression of IL-1 β and TNF- α in response to LPS were also decreased by ATL. ATL (100nM) significantly blocked nuclear translocation of NF- κ B p65 examined by fluorescence microscopy and Western blotting. The LPS-induced degradation of I κ B- α in BV-2 cells was significantly reversed by 100 nM ATL. Furthermore, pretreatment with ATL markedly reduced the LPS-induced DNA-binding activity of NF- κ B.**DISCUSSION:** ATL inhibited pro-inflammatory cytokines IL-1 β and TNF- α production and mRNA expression at least in part via NF- κ B signaling pathway in LPS-activated microglia. Therefore, ATL may have therapeutic potential for various neurodegenerative diseases.**REFERENCES:**

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S-372.**STEREOSELECTIVE MEMBRANE INTERACTION OF LOCAL ANESTHETICS AT CARDIOTOXICALLY RELEVANT CONCENTRATIONS: MEMBRANE CHOLESTEROL DETERMINES THE STEREOSELECTIVITY****AUTHORS:** M. Mizogami,¹ H. Tsuchiya,² T. Ueno,¹ K. Takakura¹**AFFILIATION:** ¹Department of Anesthesiology, Asahi University School of Dentistry, Gifu, Japan; ²Department of Dental Basic Education, Asahi University School of Dentistry, Gifu, Japan**INTRODUCTION:** Bupivacaine and ropivacaine show cardiotoxic effects depending on their stereostructures. In order to find a clue to the novel mode of cardiotoxic action, apart from the conventional sodium channel blockade, we addressed whether S(-)-enantiomer, racemate and R(+)-enantiomer interact differently with biomimetic lipid membranes at cardiotoxically relevant concentrations by paying attention to chiral membrane components.**METHODS:** Biomimetic membranes were prepared with 60 mol% different phospholipids including cardiolipin and 40 mol% cholesterol to reflect the composition of major lipids in cardiomyocyte membranes.¹ Local anesthetics were reacted with the membrane preparations at cardiotoxic 5-100 μ M.^{2,3} Their potencies to interact with membranes and modify the fluidity were comparatively determined by measuring fluorescence polarization with changing membrane cholesterol and cardiolipin compositions.⁴**RESULTS:** All local anesthetics acted on lipid bilayers to increase membrane fluidity. Chiral cardiolipin was ineffective in discriminating S(-)-enantiomers from their antipodes. However, bupivacaine and ropivacaine stereostructure-dependently interacted with biomimetic membranes containing 40 mol% and more cholesterol. They showed the interaction potency being S(-)-bupivacaine < racemic bupivacaine < R(+)-bupivacaine, and S(-)-ropivacaine < R(+)-ropivacaine at the free blood concentrations to produce cardiovascular collapse (2), which agreed with the rank order of their cardiotoxic effects. Difference between stereoisomers became greater with decreasing the concentrations: the membrane interactivity relative to S(-)-bupivacaine (1.00) at 5 and 10 μ M were 104.7 ± 2.9 and 8.8 ± 0.2 for R(+)-bupivacaine, and 35.3 ± 1.9 and 4.2 ± 0.2 for racemic bupivacaine. Ropivacaine, levobupivacaine and bupivacaine interacted with biomimetic membranes in increasing order of intensity, being consistent with their relative cardiotoxicity.**DISCUSSION:** The opposite configurations allow enantiomers to be discriminated by their enantiospecific interactions with another chiral molecule in membranes. The stereoselective membrane interactivity determined by cholesterol with higher chirality may be associated with the stereoselective cardiotoxicity of local anesthetics. The concentration-dependent difference in membrane interaction of S(-)- and R(+)-bupivacaine would explain the quantitative difference in their cardiotoxic potency reported previously.**REFERENCES:**

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S-373.**THE PHARMACOKINETICS AND PHARMACODYNAMICS OF AZ3043, A NOVEL, SHORT ACTING SEDATIVE/HYPNOTIC AGENT: A PORCINE MODEL WITH SIMULATIONS****AUTHORS:** S. Obara,^{1,2} D. Beattie,³ T. D. Egan¹**AFFILIATION:** ¹Department of Anesthesiology, University of Utah, Salt Lake City, UT; ²Department of Anesthesiology, Fukushima Medical University, Fukushima, Japan; ³Theravance, Inc., South San Francisco, CA

INTRODUCTION: Propofol has a time-dependent decrement time (DT) that can be associated with delayed awakening upon prolonged infusion. We hypothesized that hypnosis mediated by AZ-3043, a positive allosteric modulator of the γ -aminobutyric acid A receptor containing a metabolically-labile ester moiety, would be associated with more rapid emergence than propofol, independent of the infusion duration. The aim of this preliminary, “proof of concept,” study was to test this hypothesis in an animal model through pharmacokinetic (PK) simulation.

METHODS: With approval of the Animal Care Committee, 5 pigs (mean 30.5 kg) were anesthetized with isoflurane and then received a 20 min infusion of AZ-3043 at 1.5 or 3 mg/kg/min. Arterial blood samples were collected for assay.

Nonlinear mixed-effects modeling (NONMEM®) was used to construct a compartmental PK model. Performance of the model was assessed graphically (e.g., individual fits, measured over predicted plots) and numerically (i.e., median prediction error, and median absolute prediction error).

The Bispectral Index parameter was used as the primary pharmacodynamic (PD) signal. NONMEM® was used to construct a PD model using an inhibitory, sigmoidal maximum-effect model (with a naïve pooled data approach).

Using the PK-PD model, simulations were performed to explore the clinical pharmacology of AZ-3043. For comparison, similar simulations were performed for propofol using PK and PD parameters from the literature.¹

RESULTS: The PK and PD of AZ-3043 were well described by the models with excellent performances in terms of bias and accuracy (model parameters are shown in the Table). The simulations of an approximately “equipotent” bolus injection followed by an infusion dosing scheme for the two drugs are displayed in Figure A. The decrement time (DT) simulations are presented in Figure B. Both simulations predict that the “back end” kinetics for AZ-3043 are expected to be very short acting compared to propofol.

DISCUSSION: Our hypothesis was confirmed. PK-PD simulation predicts that AZ-3043’s duration of action, even after prolonged infusions, will be shorter than propofol’s. AZ-3043 may therefore be useful in clinical situations in which a short acting sedative offers advantages (e.g., procedural sedation, outpatient surgery). These preliminary observations require confirmation in humans.

REFERENCES:

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Population compartmental pharmacokinetic parameters by mixed effect modeling and pharmacodynamic parameters by naïve pooled analysis

| Pharmacokinetic parameters | Estimate | CV (%) |
|----------------------------|----------|--------|
| Volumes (l) | | |
| Central | 2.84 | 24.7 |
| Peripheral1 | 5.6 | 32.4 |
| Peripheral2 | 5.37 | 34.1 |
| Clearances (L/min) | | |
| Central | 1.63 | 13.8 |
| Intercompartmental1 | 0.15 | 36.7 |
| Intercompartmental2 | 0.486 | 46.3 |
| MDPE | 0.062 | |
| MDAPE | 0.181 | |
| Pharmacodynamic parameters | | |
| E0 | 84.6 | |
| E _{max} | 0.705 | |
| Ce ₅₀ (µg/mL) | 16.7 | |
| γ | 4.42 | |
| keo (/min) | 0.242 | |

CV = coefficient of variation; MDPE = median prediction error; MDAPE = median absolute prediction error; E0 = predrug effect; E_{max} = maximal effect; Ce₅₀ = 50% effective concentration; γ = the steepness of the concentration-effect relationship; keo = first-order rate constant characterizing effect site equilibration kinetics

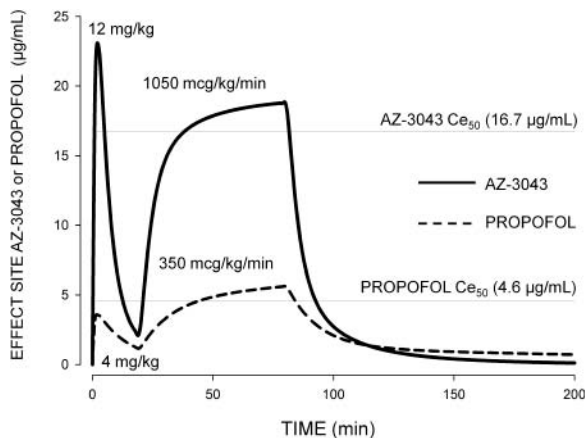


Figure A. A simulation of a total body weight based dosage of a bolus and infusion for 30 kg-pig

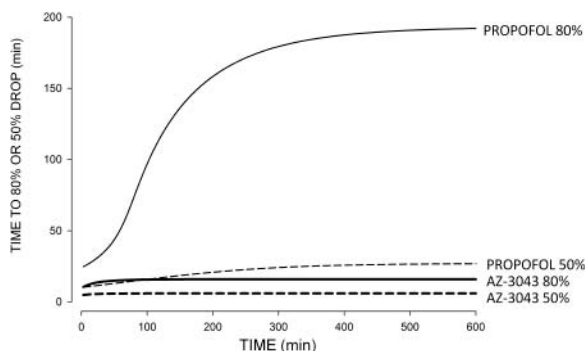


Figure B. A simulation of the time necessary to achieve a 80% or 50% decrease in effect site concentration after the termination of a continuous infusion targeting a constant concentration

S-374.**ANTAGONISM OF VERSACURIUM (CW002) - INDUCED NEUROMUSCULAR BLOCKADE BY L-CYSTEINE IS EQUALLY RAPID AT ANY POINT WITH NO CHANGE IN DOSAGE REQUIRED**

AUTHORS: J. J. Savarese,¹ M. R. Belmont,¹ H. Sunaga,¹ E. Jeannotte,² P. M. Heerd¹

AFFILIATION: ¹Weill Cornell Medical College, New York, NY; ²Albany Medical College, Albany, NY

INTRODUCTION: The new intermediate-duration neuromuscular blocker (NMB) versacurium (CW 002) is rapidly antagonized by the amino acid L-cysteine by a novel mechanism: inactivation of the NMB molecule by a chemical reaction which ultimately degrades the NMB to fragments which are > 500 times less potent than the parent compound. This mechanism of “chemical reversal” predicts that antagonism of versacurium blockade should not depend on the biological/pharmacological properties of the NMB itself, but rather simply on the laws of chemistry. We tested this hypothesis in rhesus monkeys by antagonism of versacurium blockade using L-cysteine (50 mg/kg) at four points: (1) one minute following administration of 4x ED95 (0.15 mg/kg); (2) five minutes following 4x ED95; (3) at 2% twitch height during early recovery from 4x ED95; (4) at 2% twitch height during early recovery from long infusions (60-180 min) of versacurium.

METHODS: With IACUC approval, rhesus monkeys (10-20 kg) were anesthetized with isoflurane (1.5 - 2.0%)/N₂O (70%) and O₂. Twitch, TOF, arterial pressure, heart rate, T and SpO₂ were monitored. Paired comparisons of spontaneous recovery vs. acceleration of recovery by exogenous L-cysteine (reversal) were made. Data groups were compared by t-test or ANOVA as appropriate.

RESULTS: Antagonism of versacurium at all points by L-cysteine (50 mg/kg) occurred over time intervals which did not differ significantly (Table 1), as indicated by recovery of twitch from 5% to 95% twitch height.

DISCUSSION: Chemical antagonism of versacurium blockade by L-cysteine induced inactivation of the NMB, as shown here, occurs in a uniform time frame, unaffected by the neuromuscular blocking (pharmacological) properties of the NMB but rather governed by a law of chemistry: the law of mass action. This observation suggests that biological variations such as age and disease will have very little influence on this type of antagonism.

REFERENCES:

Savarese JJ, et al.: Rapid Chemical Antagonism of Neuromuscular Blockade by L-Cysteine Adduction to and Inactivation of the Olefinic (Double-bonded) Isoquinolinium Diester Compounds Gantacurium (AV430A), CW 002, and CW 011. *Anesthesiology* 2010; 113:58-73.

Antagonism of Versacurium: Spontaneous Recovery vs. L-Cysteine Reversal

| | Spontaneous Recovery | | L-Cysteine Antagonism (50 mg/kg) | | | |
|--------------------------|----------------------|--------------|----------------------------------|-------------------------|----------------------------|-----------------------------|
| | Bolus 4x ED95 | Infusion | At +1 min after 4x ED95 | At +5 min after 4x ED95 | At 2% twitch after 4x ED95 | At 2% twitch after infusion |
| 5-95% Recovery | | | | | | |
| Recovery Time (min ± SD) | 12.3 ± 2.6 | 13.14 ± 3.64 | 1.7 ± 1.1 | 2.0 ± 0.9 | 2.1 ± 0.6 | 2.6 ± 0.4 |
| (n) | (4) | (23) | (4) | (3) | (3) | (3) |

*P < 0.05

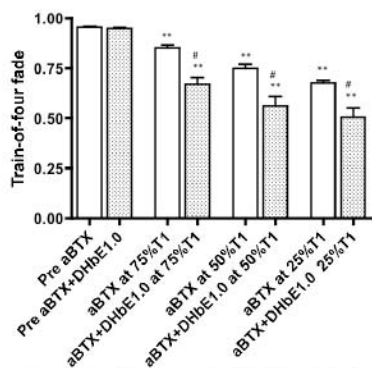
S-375.**TRAIN-OF-FOUR FADE IS NOT ALWAYS A PREJUNCTIONAL PHENOMENON AS EVALUATED BY α -BUNGAROTOXIN AND DIHYDRO- β -ERYTHROIDINE****AUTHORS:** M. Nagashima,^{1,2} T. Sasakawa,^{1,2} H. Iwasaki,² J. Martyn¹**AFFILIATION:** ¹Massachusetts General Hospital, Shriners Hospital for Children, and Harvard Medical School, Boston, MA; ²Asahikawa Medical University, Asahikawa, Japan**INTRODUCTION:** Nerve-stimulated fade in muscle is generally accepted as a prejunctional phenomenon, and decrease of twitch tension, a postjunctional effect. We tested the hypothesis that fade can be produced by postjunctional event also.**METHODS:** Male C57 black 6 mice were randomly allocated to receive: (1) 0.9% normal saline (NS) 80 μ l, (2) α -bungarotoxin (α -BTX) 0.175 μ g/g, (3) dihydro- β -erythroidine (DH β E) 1 μ g/g, or (4) α -BTX 0.175 μ g/g and DH β E 1.0 μ g/g. Fade was evaluated under anesthesia with pentobarbital in tracheostomized mechanical ventilated animals. Venous catheter was inserted into the right jugular vein for drug administration. The drugs were reconstituted with NS and adjusted to 50 μ l. Following drug administration, 30 μ l NS was administered to flush the venous catheter. TOF fade was calculated as T4/T1 ratio, where T4 and T1 are the fourth and first twitch tensions in the same train.**RESULTS:** NS 80 μ l showed no decrease of T1 height or TOF fade. Intravenous administration of α -BTX caused twitch depression and significant TOF fade at 25, 50, and 75% T1-depression compared to pre-administration value. DH β E, a prejunctional α 3 β 2 acetylcholine receptor blocker, showed no decrease of T1 height or TOF in the dose studied, but potentiated significantly ($P < 0.05$) the fade of intravenous α -BTX (Figure).**DISCUSSION:** Decrease of available postjunctional ACh receptors by α -BTX causes fade. The prejunctional effects of DH β E on fade become manifest only when the margin of safety is decreased by α -BTX. Thus, fade during repetitive stimulation is not always a prejunctional phenomenon and may also reflect decreased margin of safety due to reduction of functional postjunctional AChRs.**REFERENCES:** NA

Figure. Train-of-four fade in intravenous administration of α -BTX and/or DH β E
Following intravenous administration of 0.175 μ g/g α -BTX with and without 1.0 μ g/g DH β E, train-of-four (TOF) fade was measured. Values are expressed mean \pm SE.
** $P < 0.01$ versus pre-administration value of TOF fade. # $P < 0.05$ versus TOF fade by α -BTX at same degree of T1 depression.

Pharmacology – Clinical

S-379.**IS PREOPERATIVE GLUCOSE CONTROL
PREDICTIVE OF RISK OF RE-SALVAGE IN DIABETICS
UNDERGOING LIMB SALVAGE PROCEDURES UNDER
LOCAL ANESTHESIA?**

AUTHORS: J. Egas, R. de Guzman, N. Ceneri, N. Vadivelu, S. M. Dabu-Bondoc

AFFILIATION: Yale University, New Haven, CT

INTRODUCTION: We examined 326 surgical patients who underwent limb salvage procedures under local anesthesia to determine if preoperative glucose control can predict the risk of readmission for resalvage procedure in diabetic patients.

METHODS: Patients who underwent limb salvage surgical procedures between 2008 and 2010 in a university hospital were identified to provide demographic and clinical informations. Patients found to have diabetes mellitus were analyzed and, by using Hgb A1C <7% as the breaking point for glycemic control, diabetics were grouped into two, those with Hgb A1C <7% and those with Hgb A1C >7%. Primary outcome was incidence and rate of postoperative readmission for resalvage limb procedure. Secondary outcome measures included determination of relationships between preoperative blood glucose measurements, glucose control and postoperative readmission for resalvage.

RESULTS: Of the 326 surgical patients who underwent limb salvage procedures, 267 (82%) were found to have diabetes mellitus. From the demographic data analysis, we found that diabetics with Hgb A1C of <7% were similar to diabetics with Hgb A1C >7% in terms of mean age, ASA classification, comorbidities, anesthetic duration. The mean weight and BMI, however, were significantly higher in diabetics with Hgb A1C >7% ($p = 0.04$, and $p = .02$ respectively). Relationships between average blood sugar levels or HgbA1C levels and rates of readmission for resalvage procedures were also determined. We found a poor correlation between average preoperative blood sugar and Hgb A1C levels ($r = 0.05$, $p = 0.41$) or rates of readmission for resalvage ($r = 0.02$, $p = 0.72$). Similarly, we found a poor correlation between Hgb A1C levels and rates of readmission for resalvage ($r = 0.01$, $p = 0.80$); and between presence of PVD (peripheral vascular disease) or neuropathy and readmission for resalvage ($r = 0.03$, $p = 0.67$; and $r = 0.02$, $p = 0.70$, respectively).

DISCUSSION: From this cohort of surgical patients, preoperative glucose control using HgBA1C or preoperative average glucose levels were found not to be predictive of risk of postoperative readmission for resalvage in diabetics undergoing limb salvage procedures under local anesthesia.

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S-380.**TREATMENT EFFECT MAY BE EASIER TO DETECT IN A HIGH ENROLLING SINGLE CENTER THAN IN A MORE HETEROGENEOUS MULTICENTER ENVIRONMENT: CASE STUDY IN PONV****AUTHORS:** N. K. Singla,¹ T. J. Gan,² C. C. Apfel³**AFFILIATION:** ¹Lotus Clinical Research, Inc., Pasadena, CA; ²Duke University Medical Center, Durham, NC; ³UCSF Medical Center, San Francisco, CA**INTRODUCTION:** When performing efficacy trials great care is taken to minimize variability in order to maximize the standardized treatment effect. We hypothesized that the exclusive use of high quality, high enrolling sites in a multicenter trial may significantly reduce variability. We extracted our site specific data from a multicenter trial to compare our treatment effect with the aggregate data generated by the remaining 28 sites.**METHODS:** A total of 733 patients from 29 centers were included in the MITT analysis of a 3 arm, double blind, RCT.¹ Patients were randomized to receive prophylactic antiemetic therapy of aprepitant 40 mg, aprepitant 125 mg or ondansetron 4 mg with the primary endpoint of complete response (no vomiting and no use of rescue medication) over 24 h. In order to determine if the observed treatment effect was greater in our single center as compared to a multicenter environment, a post-hoc analysis was performed of (a) patients enrolled by our site and (b) of the remaining patients enrolled by the remaining 28 sites. For each group, we then

calculated the odds ratio for the comparison of the two aprepitant doses versus ondansetron and calculated the number of patients necessary to demonstrate a significant difference compared to ondansetron, the active control (using standard type I error of 0.05 and type II error of 0.2, i.e. 80% power).

RESULTS: Our site enrolled 95 subjects while the 28 other sites collectively enrolled 638 subjects. When the odds ratio of complete response for aprepitant (both doses) compared to ondansetron was calculated utilizing our site data exclusively, the result was significantly greater than the odds ratios calculated utilizing aggregate data from the 28 remaining sites. Because study n has an inverse non-linear relationship with the odds ratio, large differences in the calculated value of the required patients per group are apparent (table 1).**DISCUSSION:** Even though all centers in this analysis adhered to a standardized protocol, superiority of aprepitant versus ondansetron becomes apparent only in a highly controlled single center environment and not in a more heterogeneous multicenter setting. This may be a spurious finding; however we observed a similar effect in another other clinical trial.² If this is not due to chance, underlying reasons may be (a) that a single center may in general provide a more homogeneous environment and/or (b) that outcome data collected in this particular setting were of greater consistency.**REFERENCES:**

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| | Treatment Assignment | Complete response (yes/total) | Complete response (%) | Odds ratio compared to ondansetron | Patients per group needed to demonstrate difference versus ondansetron |
|-----------------------------------|----------------------|-------------------------------|-----------------------|------------------------------------|--|
| Single High Enrolling Site | Aprepitant 125 mg | 19/31 | 61.3 | 1.39 | 626 |
| | Aprepitant 40 mg | 24/34 | 70.6 | 2.1 | 134 |
| | Ondansetron 4 mg | 16/30 | 53.3 | - | - |
| Multicenter Aggregate Data | Aprepitant 125 mg | 84/208 | 40.9 | 0.99 | 298,973 |
| | Aprepitant 40 mg | 87/214 | 40.7 | 1.00 | 5,061,615 |
| | Ondansetron 4 mg | 88/216 | 40.7 | - | - |

S-381.**DOES LOW-DOSE INTRA-OPERATIVE PROPOFOL INFUSION REDUCE POST-OP NAUSEA AND VOMITING? A PILOT STUDY****AUTHORS:** P. J. Lee, D. Griesdale, T. Walker, K. V. Mayson**AFFILIATION:** Department of Anesthesiology, Pharmacology and Therapeutics, University of British Columbia, Vancouver, BC, Canada**INTRODUCTION:** The use of prophylactic antiemetic agents can significantly reduce the risk of post-operative nausea and vomiting (PONV) in high risk patients. Although propofol has anti-emetic properties, studies on low-dose infusion combined with inhalational agents have had mixed results. Our hypothesis is that intraoperative propofol infusion, used with volatile and narcotic anesthesia, reduces the frequency of PONV 1 and 24h after gynecologic surgery in high-risk patients. The purpose of this study was (1) ensure feasibility of patient enrollment and (2) generate point estimates for PONV.**METHODS:** With ethics board approval, 40 non-smoking females were randomly allocated to receive either adjuvant propofol infusion (50 mcg/kg/min) or control ("no propofol") for the duration of surgery. Patients received a standardized anesthetic of sevoflurane, fentanyl and hydromorphone. Each patient received PONV prophylaxis with dexamethasone 4 mg and ondansetron 4mg. The intraoperative anesthesiologist was blinded to the intervention as propofol was administered in a concealed fashion into either the distal portion of a separate intravenous line (group P) or directly into a reservoir bag (group C). Presence and severity of PONV and need for anti-emetic therapy were collected by a blinded observer at 1 and 24h.**RESULTS:** Twenty patients were randomized to each group. One patient in group P required further surgery and thus we were missing their data at 24 hours. There were no significant differences between the groups in terms of patient characteristics (Table 1). Overall, the incidence of PONV at 1 and 24 hrs was 17.5% (7/40) and 48.7% (19/39) respectively. Comparing the propofol to no propofol groups there were no significant differences in risk of PONV, need for anti-emetic rescue therapy, or median visual analog scale (VAS) scores for nausea (Table 1).**DISCUSSION:** The use of an adjuvant propofol infusion did not decrease the risk of PONV in high-risk women undergoing general anesthesia. The incidence of PONV was high, in line with expectations for high-risk patients treated with two prophylactic anti-emetic agents.¹ However, median VAS scores for nausea were low. This pilot study demonstrates the feasibility of recruitment for a larger study, and provides us with point estimates of PONV to allow sample size calculation.**REFERENCES:**

1. N Engl J Med 2004;350:2441-51

S-382.**A RANDOMIZED, DOUBLE BLIND STUDY TO EVALUATE EFFICACY OF PALONOSETRON WITH DEXAMETHASONE VERSUS PALONOSETRON ALONE FOR PREVENTION OF POST-OPERATIVE NAUSEA AND VOMITING IN SUBJECTS UNDERGOING LAPAROSCOPIC SURGERIES WITH HIGH EMETOGENIC RISK****AUTHORS:** J. D. Viola-Blitz, S. Didehvar, L. Franco, H. L. Pachter, E. Newman, A. Y. Bekker**AFFILIATION:** NYU SOM Anesthesiology, New York, NY**INTRODUCTION:** Postoperative (PONV) and postdischarge (PDNV) nausea and vomiting are common occurrences (50-80%) after laparoscopic abdominal or gynecologic surgery. Palonosetron (Pal), the newest 5-HT₃ antagonist, is an effective antiemetic in the setting of PONV that has advantages in treating PDNV due to its prolonged duration of action.¹ Numerous studies have demonstrated the advantages of a multimodal approach to the treatment of PONV. We hypothesized that a combination of Pal and dexamethazone (Dex) could further improve the efficacy of the treatment in comparison to Pal alone in patients at high risk for PONV.**METHODS:** After IRB approval and written informed consent, patients at high emetogenic risk scheduled to undergo laparoscopic abdominal or gynecologic surgeries under general anesthesia as outpatients were enrolled in this prospective, double blind study. Patients were randomized to receive 8 mg Dex (group 2) or an equivalent volume of saline (group 1) after induction of general anesthesia. All patients received 0.075 mg Pal. Data was collected at defined postoperative times (2, 6, 12, 24 and 72 hrs). All patients also completed an 18 question QOL-FLIE (Functional Living Index-Emesis) instrument at 96 hrs. Ordinal data was analyzed with ordinal regression analysis which included age and BMI (SPSS v18). Binary data (success/failure) were analyzed using the chi square test. P<0.05 was accepted as statistically significant.**RESULTS:** We enrolled 118 patients, ASA 1-2, with at least 3 PONV risk factors. There was no difference in patient demographics between groups. Both groups had a low incidence of vomiting at the PACU (group 1, 1.7%; group 2, 6.8%) as well as at 72 hours (0.0% both groups). Complete response (no vomiting, no rescue medication) was not different between treatment groups for any time intervals. Cumulative success rates over the entire 72 hrs were 60.4% (group 1) vs. 60.0% (group 2). Nausea scores (4 point ordinal scale) were not different between groups for any time intervals. Cumulative success scores for nausea (score = "none"; 0-72 hrs) were 43.7% for group 1, and 51.1% for group 2. For the QOL-FLIE questionnaire, group 2 showed a trend toward greater satisfaction on the QOL-FLIE scores with the greatest differences in the "Nausea domain".**DISCUSSION:** The incidence of PONV in the PACU was low compared to historical control of treatment with a short acting 5-HT₃ receptor antagonist. The combination therapy (Pal + Dex) did not significantly reduce the incidence of PONV or PDNV when compared with (Pal) alone. There was no change in comparative efficacy over 72 hrs, most likely due to the low incidence of PDNV in both groups.**REFERENCES:**

1. Anesth Analg 2008;107:439

S-383.**PERIOPERATIVE EFFECTS OF VARIOUS ANESTHETIC ADJUVANTS GUIDED BY BISPECTRAL INDEX**

AUTHORS: H. F. Khafagy, R. S. Ebied, E. S. Osman, Y. M. Samhan

AFFILIATION: Anesthesia Department, Theodor Bilharz Research Institute, Giza, Egypt

INTRODUCTION: Clonidine, a centrally acting α -2 receptor agonist, produces preoperative sedation and attenuates intraoperative stress response.¹ Magnesium could modulate anesthesia through NMDA receptor antagonism and reducing catecholamine release during sympathetic stimulation.² Ketamine is currently used at low doses as an adjunct to improve perioperative analgesia.³ Thus, this prospective, randomized, double blinded, controlled study was designed to evaluate the effects of intravenous co-administration of clonidine, magnesium or ketamine with TIVA on intraoperative hemodynamics, anesthetic consumption and postoperative analgesia and recovery guided by Bispectral Index (BIS).

METHODS: After ethical committee approval and patients' written informed consents, 120 adult patients of either sex ASA I and II scheduled for open cholecystectomy were randomly assigned to one of four groups. Group CL received clonidine 3 μ g kg⁻¹ and maintained by 2 μ g kg⁻¹ h⁻¹. Group Mg received magnesium sulphate 50 mg kg⁻¹ and maintained by 8 mg kg⁻¹ h⁻¹. Group Ket received ketamine 0.4 mg kg⁻¹ and maintained by 0.2 mg kg⁻¹ h⁻¹. Control group (CT) received the same volume of isotonic saline 0.9%. Anesthesia was induced and maintained by fentanyl, propofol and rocuronium. Propofol infusion was adjusted to keep BIS value between 45-55. Intraoperative hemodynamics, induction time, anesthetic consumption, recovery and PACU discharge were recorded.

RESULTS: Induction time, propofol requirements for induction and maintenance of anesthesia as well as intraoperative fentanyl were significantly lower with CL and Mg groups compared to Ket and CT groups ($p < 0.05$). Clonidine and magnesium could achieve hemodynamic stability during intubation and surgical incision. Patients in Mg group showed significant lower muscle relaxant consumption, delayed recovery and PACU discharge than other groups ($p < 0.05$). First analgesic requirement was significantly longer and total postoperative analgesic consumption was significantly lower in adjuvant groups versus the CT group ($p < 0.05$).

DISCUSSION: These results go in accordance with Altan et al⁴ concerning clonidine and magnesium and with Mortero et al⁵ concerning ketamine as adjuvant to TIVA. Ryu et al⁶ agreed with this study that I.V. magnesium sulphate with TIVA reduced rocuronium consumption and improved the quality of postoperative analgesia. In conclusion, clonidine, magnesium and ketamine can be useful adjuvant agents to TIVA provided careful monitoring by BIS.

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S-384.**THE INCIDENCE OF THE PROPOFOL-INDUCED YAWNING RESPONSE IS HIGHER IN MALE**

AUTHOR: K. Terasako

AFFILIATION: Shobara red cross hospital, Shobara, Japan

INTRODUCTION: The falls in arterial blood pressure seen following IV-administrated propofol may be closely related to yawning, as is often the case with spinal anesthesia. In this study the relations between occurrence of propofol-induced yawning, sex and the falls in arterial blood pressure were examined.

METHODS: Sixty adult patients [each of the American Society of Anesthesiologists physical status 1-2 and scheduled for elective surgery under general anesthesia] participated in this study. No premedicant drugs were administered. Routine monitors consisted of an automated blood-pressure cuff, electrocardiogram, and pulse oximeter. After obtaining baseline values and oxygenation through the mask, IV injection of 1.5mg/kg propofol was administered by the investigator over a 5-s period. As the only clinical end point, the occurrence of the yawning response (characterized by mouth opening) was observed continuously after the start of the anesthetic infusion. The end of the 1-min observation period represented termination of this study. Then, rocuronium (0.6mg/kg) was administered IV, and mask-assisted ventilation with 97% oxygen and 3% sevoflurane was applied until tracheal intubation. Throughout the study, mean arterial blood pressure (MAP) and heart rate (HR) were also recorded at 1-min intervals. Differences between the MAP 1-min after IV administration of propofol and baseline MAP were calculated (MAPGAP).

RESULTS: The incidence of the propofol-induced yawning response was higher in male group (52%) than in female group (21%) ($P < 0.05$) (Table). There were no significant differences among the male-yawning(+), male-yawning(-), female-yawning(+), and female-yawning(-) groups in baseline MAP, baseline HR and MAPGAP.

DISCUSSION: The incidence of the propofol-induced yawning response is higher in male than in female. The falls in arterial blood pressure seen following IV-administrated propofol have nothing to do with the occurrence rate of yawning.

References:

1. J Anesth (2007) 21:131-135

| | Yawning (+) | Yawning (-) |
|--------|-------------|-------------|
| Male | 14 | 13 |
| Female | 7 | 26 |

S-385.**DOSE-DEPENDENT EFFECT OF FENTANYL ON COUGH ATTENUATION DURING EMERGENCE FROM SEVOFLURANE GENERAL ANESTHESIA****AUTHORS:** J. Lee, Y. Yoo, J. Lee**AFFILIATION:** Yonsei University College of Medicine, SEOUL, Republic of Korea

INTRODUCTION: Fentanyl by bolus administration is expected to suppress tracheal tube-induced cough during emergence from general anesthesia through binding to its receptors in the brainstem. However, it has not been proven if fentanyl has a complication-free, dose-dependent effect on cough suppression during emergence from sevoflurane anesthesia. The purpose of this study is to evaluate the relationship between fentanyl dose and cough suppression during emergence from sevoflurane anesthesia.

METHODS: Sixty patients undergoing thyroidectomy were randomly allocated to one of four groups (F0, F1, F1.5, and F2) according to the fentanyl dose (0, 1, 1.5, or 2 mcg/kg); the study drug was administered immediately after sevoflurane was discontinued, and coughing was assessed throughout the peri-extubation period. The relationship between fentanyl dose and incidence of emergence cough was analyzed using the Cochran-Armitage trend test. Awakening time (time interval from fentanyl administration to eye opening), extubation time (time interval from fentanyl administration to extubation), respiratory rate after extubation, and length of stay in the post-anesthesia care unit (PACU-LOS) were recorded and compared using one-way ANOVA.

Results: Fentanyl suppressed emergence cough in a dose-related manner ($p = 0.002$), and the dose of 2 mcg/kg suppressed cough in 13 out of 14 patients. Awakening time (8.4 ± 1.9 min) and PACU-LOS (34.2 ± 6.9 min) in Group F2 were comparable with those in the other three groups. Respiratory rate (9 ± 2 bpm) and extubation time (11.9 ± 1.8 min) in Group F2 were comparable with those in Groups F1 and F1.5, but different from those in Group F0.

DISCUSSION: The administration of fentanyl during anesthetic recovery suppressed emergence cough in a dose-related manner in patients anesthetized with sevoflurane. In some clinical situations, bolus administration may be easier to apply, and fentanyl can be more compatible than is remifentanyl in this situation.

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Fentanyl response on cough during emergence
from sevoflurane anesthesia

| | Group F0 (n=14) | Group F1 (n=13) | Group F1.5 (n=15) | Group F2 (n=14) |
|---|--------------------|--------------------|----------------------|--------------------|
| total number of patients with grade 2 or higher cough | 12 (85.7%) | 7 (53.8%) | 6 (40%) | 1 (7.1%) |

Values are number (proportion) Group F0: saline; Group F1: fentanyl 1 mcg kg⁻¹; Group F1.5: fentanyl 1.5 mcg kg⁻¹; Group 4: fentanyl 2 mcg kg⁻¹
Grade 2 cough: more than one episode of non-sustained coughing; grade 3: sustained and repetitive coughing with head lift

S-386.**ANAPHYLAXIS TO ROCURONIUM: WHAT CAN WE LEARN FROM FDA REPORTING?****AUTHORS:** M. Van De Water,¹ L. Demma,² J. Levy¹**AFFILIATION:** 1Department of Anesthesiology, Emory University School of Medicine, Atlanta, GA; 2Emory University School of Medicine, Atlanta, GA

INTRODUCTION: Neuromuscular blocking drugs (NMBDs) are often implicated as the cause of perioperative anaphylaxis with rocuronium being the most commonly implicated agent.¹ However, many drugs are given simultaneously during induction and surgery, making it difficult to determine which drug may have caused the reaction. There is also a wide disparity between the United States (US) and European reporting of anaphylactic reactions to rocuronium with the Europeans reporting a much higher incidence.² Therefore, to evaluate the frequency of anaphylaxis from rocuronium we evaluated the Food and Drug Administration (FDA) Adverse Event Reporting System (AERS) database searching for adverse events to rocuronium.

Methods: We queried the FDA AERS database from 1999-2009 searching for reports of all adverse events to rocuronium. This database includes reports collected on a voluntary basis from both US and foreign clinicians. From this data, we compared the number of foreign versus US reports of anaphylaxis from rocuronium and evaluated the medications administered with rocuronium at the time anaphylaxis was documented.

RESULTS: For rocuronium, there were 281 cases of anaphylactic reactions out of a total of 757 adverse events reported. Of the 281 cases of anaphylaxis, 42% were from foreign sources, 33% were from the US and 25% were from unknown sources. Analyzing the simultaneous medications given with rocuronium, 91 of the 281 patients (32%) were also exposed to at least one other agent known to potentially cause anaphylaxis including antibiotics, aprotinin, latex, and other NMBDs.

DISCUSSION: Our investigation confirms that there are more frequent reports of anaphylaxis to rocuronium from foreign sources compared to US sources. This could be attributable to differences in the frequency of reporting adverse events. However, because of limitations of the FDA AERS database, the true incidence of anaphylaxis from rocuronium cannot be determined. Of note is our finding that a significant number of other medications were administered within the timeframe that rocuronium was implicated as the cause of anaphylaxis. Many of these medications included drugs known to potentially cause anaphylaxis. Because this database is based primarily on clinician reporting, these findings underscore the difficulty in determining the actual agent causing anaphylaxis in a perioperative setting.

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S-387.**EVALUATION OF ANESTHETIC FACTORS ON CHARACTERISTICS OF EMERGENCE FROM ANESTHESIA: WHY DO PATIENTS BITE THE OROTRACHEAL TUBE?**

AUTHORS: M. So,¹ H. Arima,¹ E. Suzuki,² E. Kako,¹ K. Sobue¹

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INTRODUCTION: Some patients bite the orotracheal tube at emergence from general anesthesia. This may threaten their safety, especially if they keep biting the tube after being asked not to bite. Here, we prospectively investigated the relationship between biting of the orotracheal tube by patients at emergence from anesthesia and the concentrations of anesthetic drugs and bispectral index (BIS) values.

METHODS: For 15 weeks from July 2009, all patients who underwent elective surgery under general anesthesia maintained with sevoflurane and fentanyl alone were enrolled. Exclusion criteria were use of a laryngeal mask airway or a nasotracheal tube, no extubation in the operating room, position other than supine position, and age under 20 years. The patients were assigned to one of three groups: group G1, those who did not bite the tube; group G2, those who bit the tube but stopped biting it after being asked not to bite; group G3, patients who continued to bite after being asked not to bite. The occurrence and length of time of biting were recorded. In addition, their bispectral index (BIS) values, end-tidal sevoflurane concentrations (EtSev), and predicted effect-site concentrations of fentanyl (Ce fentanyl) were investigated. Data were analyzed using the chi-square test and ANOVA. Findings of $P < 0.05$ were considered significant.

RESULTS: Of 278 cases in all, 256 cases were in G1, 11 in G2, and 11 in G3. There were no significant differences among these three groups with respect to age, gender, body mass index, or time of anesthesia. Duration of biting in G3 (111.4 ± 91.7 sec) tended to be longer than that in G2 (56.7 ± 33.9 sec). To evaluate factors related to continuation of biting, G2 and G3 were compared. Investigation of each parameter every 5 minutes up to the moment of biting revealed that BIS value in G2 was significantly increased, whereas BIS value in G3 did not increase just before biting (means: 57 to 87 in G2 vs. 73 to 82 in G3 in last 5 minutes, $P < 0.05$). EtSev in G2 was significantly decreased before biting (difference of means: 0.74 in the last 10 minutes to 5 minutes, $P < 0.05$), but no significant decrease in this parameter was observed in G3. Ce fentanyl in G3 was constantly and significantly higher than that in G2 in the last 30 min of anesthesia (1.374 in G3 vs. 0.987 in G2, $P < 0.05$).

DISCUSSION: Continuation of biting at emergence from anesthesia may be related to prolonged sedation, and not to ineffective analgesia. To avoid continuation of biting, rapid emergence from sedative anesthetics and appropriate analgesia may be required at the end of anesthesia. In addition, the timing of awakening of patients is an important factor in avoiding continuation of biting.

REFERENCES: N/A

S-388.**THE EFFECT OF DEXMEDETOMIDINE ON PROPOFOL REQUIREMENT DURING REMIFENTANIL BASED ANESTHESIA**

AUTHORS: W. Kang, J. Song, S. Kim, T. Yoon, T. Kim

AFFILIATION: Konkuk University Medical Center, Seoul, Republic of Korea

INTRODUCTION: Dexmedetomidine, potent and highly selective α_2 -adrenoceptor agonist, has been regarded to show anesthetic-sparing effect.^{1,2} The aim of the present study was to determine whether dexmedetomidine reduces propofol requirement in the remifentanil based anesthesia.

METHODS: Twenty female patients underwent elective breast surgery were randomly allocated to get dexmedetomidine ($1 \mu\text{g/kg}$ loading for 10 minutes and continuous infusion at $0.6 \mu\text{g/kg/min}$) in Group 1 ($n = 10$) or placebo (same amount of normal saline) in Group 2 ($n = 10$) at 10 minutes before anesthesia induction. Anesthesia was induced by target controlled infusion (TCI) of remifentanil (plasma concentration at 10 ng/ml) and propofol (effect site concentration at $3 \mu\text{g/ml}$). Dose of TCI-remifentanil was fixed and that of TCI-propofol was adjusted to maintain the value of Bispectral index (BIS) between 45-55 during anesthesia maintenance. Total mean infusion rates of propofol (TIR-P, $\mu\text{g/kg/min}$) were determined and their intergroup comparisons were performed.

RESULTS: TIR-P in Group 1 was significantly less than that in Group 2 ($63.9 \pm 16.2 \mu\text{g/kg/min}$ versus $96.4 \pm 10.0 \mu\text{g/kg/min}$, $P < 0.05$)

DISCUSSION: Dexmedetomidine's sedative and analgesic effects depend on different pathways: sedative effect is mediated through the locus ceruleus in the brain stem which increasing parasympathetic outflow and decreasing sympathetic outflow, while its analgesic effect is mediated through activation of $\alpha_2\text{A}$ adrenergic receptors in the dorsal horn of the spinal cord.³ The reduction of propofol requirement in the present study was consistent with those of other previous study: Dutta et al.⁴ demonstrated the effect of dexmedetomidine reduces propofol requirement about 50% in healthy volunteers.

In conclusion, dexmedetomidine reduced the requirement of propofol and might be useful adjuvant anesthetics in remifentanil based propofol supplemented anesthesia.

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S-389.**OBESITY (BODY MASS INDEX [BMI] ≥ 30 KG/M²) HAS NO CLINICALLY RELEVANT IMPACT UPON RECOVERY TIME FOLLOWING ADMINISTRATION OF SUGAMMADEX: AN UPDATED POOLED ANALYSIS OF 22 STUDIES****AUTHORS:** T. Monk,¹ H. Rietbergen,² T. Woo³**AFFILIATION:** ¹Duke University Medical Center, Durham, NC; ²MSD, Oss, Netherlands; ³Merck Research Laboratories, Rahway, NJ

INTRODUCTION: The prevalence of obesity and associated comorbidities is increasing worldwide; as a result, more obese patients are undergoing surgical procedures, presenting special challenges to the anesthesiologist. Deep neuromuscular blockade (NMB) can be beneficial throughout surgery, but the duration of action of neuromuscular blocking agents (NMBAs) may be prolonged in obese patients, with safety implications, even when patients receive NMBAs dosed on ideal rather than actual body weight.¹ A pooled analysis previously compared the efficacy of sugammadex for reversal of NMB between obese (BMI ≥ 30 kg/m²) and non-obese (BMI < 30 kg/m²) patients.² However, the number of patients undergoing reversal of deep NMB was relatively small. Here, we report the results of an updated analysis comprising 22 studies with 865 patients overall, including additional data from patients who underwent reversal with sugammadex during deep blockade.

METHODS: Data were pooled from 865 adult patients who received recommended doses of sugammadex for reversal of moderate NMB (13 clinical trials, 476 patients; sugammadex 2 mg/kg administered at reappearance of T₂) or deep NMB (7 trials, 323

patients; sugammadex 4 mg/kg administered at 1-2 post-tetanic counts [PTC]) induced by rocuronium or vecuronium, and two trials of sugammadex 16 mg/kg for immediate reversal at 3 min after administration of rocuronium 1.2 mg/kg (66 patients). All doses were based on actual body weight. The primary efficacy variable was time to recovery of the train-of-four (TOF) ratio to 0.9 after administration of sugammadex. To investigate a possible effect of obesity on recovery from NMB, the logarithm of the recovery time was analyzed using an ANOVA with independent fixed factors for study and obesity.

RESULTS: Recovery was rapid in all groups (Table), with no statistically significant differences ($P > 0.10$) in recovery times noted between non-obese and obese groups for each NMBA and depth of blockade. Only one obese patient received immediate reversal 3 min after rocuronium, and the recovery time (2.2 min) was well within the overall range of times observed for non-obese patients (0.5-14.3 min).

DISCUSSION: BMI does not have a clinically significant effect on the rapid reversal of NMB by sugammadex. Recommended doses of sugammadex for reversal of moderate and deep rocuronium- or vecuronium-induced NMB are suitable for both non-obese and obese patients, with no dose adjustment required. Only one patient with a BMI ≥ 30 kg/m² received sugammadex 16 mg/kg for immediate reversal of NMB with a recovery time well within the overall range of times observed for patients with BMI < 30 kg/m².

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Patient characteristics and recovery times according to NMBA and depth of blockade

| NMBA | Rocuronium | | Vecuronium | |
|---|----------------------|---------------------|---------------------|---------------------|
| | Non-obese | Obese | Non-obese | Obese |
| Mean (SD) age, years | | | | |
| Reversal at T ₂ | n=315 56.7 (17.1) | n=86 58.3 (15.2) | n=64 47.7 (14.3) | n=11 58.1 (15.6) |
| Reversal at 1-2 PTC | n=203 50.7 (16.8) | n=53 49.2 (14.5) | n=49 47.1 (13.8) | n=18 46.5 (14.5) |
| Reversal 3 min after rocuronium | n=65 43.6 (13.5) | n=1 19.0 (NA) | NA | NA |
| Median (range) BMI, kg/m² | | | | |
| Reversal at T ₂ | 24.9 (14.9-29.9) | 33.8 (30.0- 44.4) | 25.0 (15.2-29.9) | 33.4 (30.4-37.9) |
| Reversal at 1-2 PTC | 25.3 (16.7-29.997) | 33.8 (30.0- 60.9) | 25.2 (19.6-29.8) | 35.0 (30.1-46.0) |
| Reversal 3 min after rocuronium | 25.7 (20.0-29.3) | 31.7 (NA) | NA | NA |
| Geometric mean time (95% CI) to TOF 0.9, min | | | | |
| Reversal at T ₂ | n=307 2.1 (1.9, 2.2) | n=84 2.1 (1.9, 2.3) | n=61 2.9 (2.4, 3.5) | n=11 2.4 (1.6, 3.5) |
| Reversal at 1-2 PTC | n=203 2.2 (2.0, 2.3) | n=53 2.2 (1.9, 2.6) | n=49 3.9 (2.8, 5.3) | n=18 4.0 (2.5, 6.4) |
| Reversal 3 min after rocuronium | n=64 1.7 (1.4, 1.9) | n=1 2.2 (NA) | NA | NA |

NA=not applicable

S-390.**THE IMPACT OF ADJUNCT DEXMEDETOMIDINE USE ON OPIOID REQUIREMENTS AND HEMODYNAMIC STABILITY DURING AWAKE FIBEROPTIC INTUBATION****AUTHORS:** J. Swaniker, D. Glick**AFFILIATION:** University of Chicago, Chicago, IL

INTRODUCTION: Awake fiberoptic intubation (AFOI) allows patients to remain conscious and spontaneously ventilating during intubation and is indicated in patients with the concurrent presence of a difficult airway and a high risk of aspiration.¹ A major anesthetic concern associated with the AFOI premedication strategy is the development of respiratory depression and hypoxemia secondary to the combined administration of midazolam and fentanyl.² Dexmedetomidine, an α_2 adrenergic agonist with sedative, analgesic, and sympatholytic properties, has been proposed as a useful adjunct during AFOI.³ This investigation sought to determine if adjunct dexmedetomidine use during AFOI could reduce the amount of fentanyl needed to achieve appropriate sedation and attenuate the hemodynamic responses to intubation.

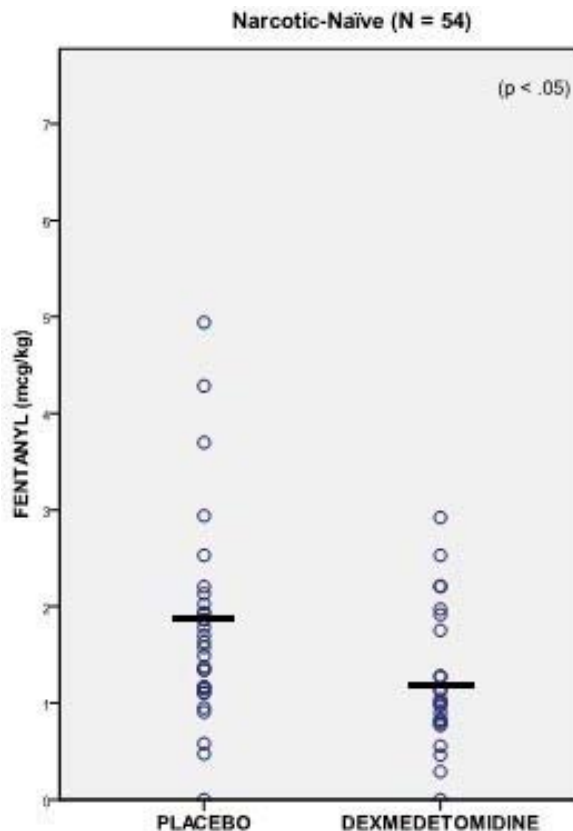
METHODS: Fifty-four (ASA II-IV) narcotic-naïve patients for whom AFOI was indicated, were enrolled in this prospective, double-blinded study. Patients were randomized to receive a continuous infusion of either 4 mcg/mL dexmedetomidine (Group D, N=25) or 0.9% saline solution (Group P, N=29) at 0.7mcg/kg/hr for at least ten minutes prior to intubation. In addition, all patients were premedicated with aspiration prophylaxis, intravenous midazolam (1-2mg), and glycopyrrolate (0.2mg). Topical lidocaine was then applied and fentanyl was administered in 50 mcg aliquots until appropriate sedation was achieved as determined by the anesthesiologist. Hemodynamic measurements were taken preoperatively and during intubation at one minute intervals.

RESULTS: Infusion times ranged from 11 minutes to 77 minutes with an average infusion time of 26 ± 11 minutes. Dexmedetomidine patients required 25% less fentanyl [$1.24 (\pm 0.73)$ mcg/kg] than those receiving the saline placebo [$1.66 (\pm 0.89)$ mcg/kg]. There was no significant correlation between infusion time of dexmedetomidine and amount of fentanyl administered. Percent increases in systolic blood pressure, heart rate, and mean arterial pressure during intubation were significantly lower in patients receiving dexmedetomidine (6.4%, 10.8%, and 7.9%) than in those receiving the saline placebo (14.5%, 24.2%, and 16.3%).

DISCUSSION: Using dexmedetomidine as an adjunct during AFOI can reduce fentanyl requirements and attenuate the hemodynamic fluctuations associated with intubation in narcotic-naïve patients. As such, adding dexmedetomidine to the AFOI premedication regiment may help prevent incidents of prolonged respiratory depression and hypoxemia as well as lessen the cardiovascular stress induced during intubation.

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S-391.**IN VIVO CASPASE 3 AND TRAIL CHANGES AS APOPTOTIC MARKERS FOLLOWING DIFFERENT ANESTHETICS**

AUTHORS: E. S. Osman,¹ H. F. Khafagy,¹ Y. M. Samhan,¹ M. Hassan,² F. El-Shanawany,² G. ElFandy¹

AFFILIATION: ¹Anesthesia Department, Theodor Bilharz research Institute, Giza, Egypt; ²Department of Clinical and Chemical Pathology, Theodor Bilharz research Institute, Giza, Egypt

INTRODUCTION: Apoptosis occurs as a cell-intrinsic suicide program finely tuned between the action of apoptosis-signaling systems; tumor-necrosis factor alpha, and the caspase system in order to maintain a normal immune response.¹ Anesthetics play an important role in immunomodulation thus influencing the process of apoptosis in various human tissues.² Since scarce studies were conducted in vivo to correlate the effect of anesthesia with the clinical practice, this study was undertaken to measure the in vivo effects of propofol, isoflurane and sevoflurane on apoptosis by measuring blood level of caspase-3 and TNF-related apoptosis inducing ligand (TRAIL) as apoptotic markers.

METHODS: After obtaining ethical committee approval and informed written consents, sixty adult patients of either sex ASA I scheduled for open cholecystectomy participated in this study. Patients were randomized to three equal groups to receive either propofol infusion, low-flow isoflurane or sevoflurane for maintenance of anesthesia. Intra-operatively, full hemodynamic, neuromuscular and core temperature were monitored. Three venous blood samples were withdrawn preoperatively, at the end of surgery and 24 hours postoperatively to measure Hb, Htc, creatinine, ALT, AST, serum TRAIL and caspase-3 levels.

RESULTS: Concerning biochemical and hematological markers, serum creatinine showed a non significant rise while Hb and Hct level showed non significant fall from preoperative level in all groups without any significant difference between groups. ALT and AST showed statistically significant rise from preoperative levels in all groups with p value <0.05 but no significant difference between groups.

DISCUSSION: Apoptotic markers showed minimal changes with isoflurane, marked variations with sevoflurane however nonspecific with propofol. Liu et al³ proved that propofol has an antiapoptotic property while Siddiqui et al⁴ found that propofol conjugate significantly induced apoptosis. Isoflurane has been mostly regarded as an agent that reduces apoptosis during short term exposure,⁵ while sevoflurane caused more apoptosis and functional disability⁶ reviving the issue of low flow sevoflurane safety and its toxic bio-products on human tissues. This study concluded that isoflurane is the superior while sevoflurane is the least effective in protecting against apoptosis in living human cells. However, it neither proves nor excludes propofol inducing apoptosis. Moreover, the affected or protected organs could not be specified.

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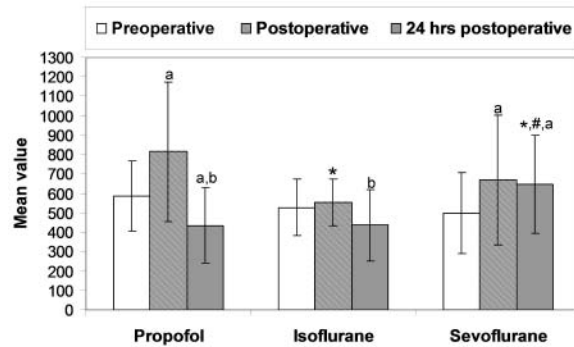


Fig 1: Mean values of TRAIL (pg mL⁻¹)

^ap < 0.05 vs. preoperative values within the same group.
^bp < 0.05 vs. immediate postoperative values within the same group.
^{*}p < 0.05 vs. Propofol group at the same timing.
[#]p < 0.05 vs. Isoflurane group at the same timing.

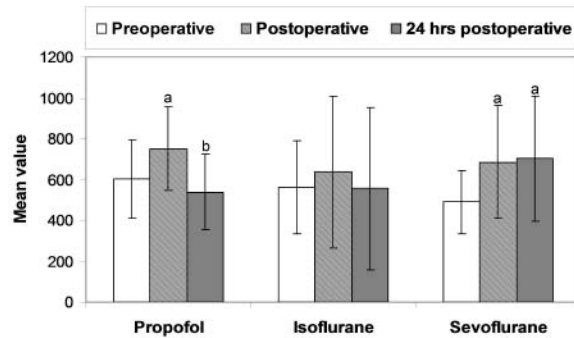


Fig 2: Mean values of caspase-3 (U L⁻¹)

^ap < 0.05 vs. preoperative values within the same group.
^bp < 0.05 vs. immediate postoperative values within the same group.

S-392.**DEXMEDETOMIDINE FOR RENAL PROTECTION DURING PARTIAL NEPHRECTOMY**

AUTHORS: P. Dalecki¹, A. Kotin¹, P. Russo², J. Coleman², W. Shi³, D. Amar¹

AFFILIATION: 1Anesthesiology, Memorial Sloan Kettering Cancer Ctr, NYC, NY; 2Surgery, Memorial Sloan Kettering Cancer Ctr, NYC, NY; 3Biostatistics, Memorial Sloan-Kettering Cancer Ctr, NYC, NY

INTRODUCTION: Renal ischemia during nephron sparing surgery for tumor could lead to renal failure. Dexmedetomidine (Dex), a selective alpha-2 agonist, has been shown to have renal protective effects in experimental animals¹ and in small studies of patients undergoing cardiothoracic surgery.^{2,3} Little data are available on the renal protective effects of Dex in patients undergoing partial nephrectomy under warm or cold (iced) temporary ischemic conditions.

METHODS: With IRB approval we compared perioperative renal function in 27 patients who received Dex during partial nephrectomy either open (OPN) (n=14) or laparoscopically (LPN) (n=13) with similar historical controls (n=27). Dex patients received a loading dose of 0.4 mcg/kg over 10 minutes after induction of anesthesia, followed by continuous infusion at 0.4 mcg/kg/h, until skin closure. Dex patients were matched with controls for gender (8 Males) and preoperative GFR (eGFR). Cold ischemia and prophylactic IV mannitol (12.5 gm) prior to renal artery clamping were employed during OPN. LPN was done under warm ischemia without use of mannitol. Nonparametric tests were used.

Challenging Case Report (only complete if your submission falls into the “Challenging Case Report” category. If you select the “Challenging Case Report” category on the next step, this section must be completed.): N/A

RESULTS: Clinical and operative data are shown in the Table. eGFR increased in both groups in PACU from preop values (repeated measures ANOVA, p=0.02, Figure). eGFR did not differ significantly in patients receiving Dex vs. controls in both OPN or LPN groups at the different study points. Preop eGFR<60 was present in 63% of the entire study population. A secondary analysis of paired proportions showed that on POD 1 control patients had a significantly higher proportion of patients whose eGFR dropped from ≥ 60 to < 60 than that of those whose eGFR increased from < 60 to ≥ 60 (p=0.04 by exact McNemar's test).

DISCUSSION: These preliminary observational data show that in patients with moderate renal dysfunction, mean eGFR did not differ based on whether intraoperative Dex was used, either during cold ischemia with prophylactic mannitol (OPN) or warm ischemia without mannitol (LPN). However, patients not receiving Dex had a greater proportion whose eGFR dropped on POD 1. Larger randomized studies are needed to evaluate whether Dex prevented this decline in eGFR, especially in patients with greater impairment in renal function.

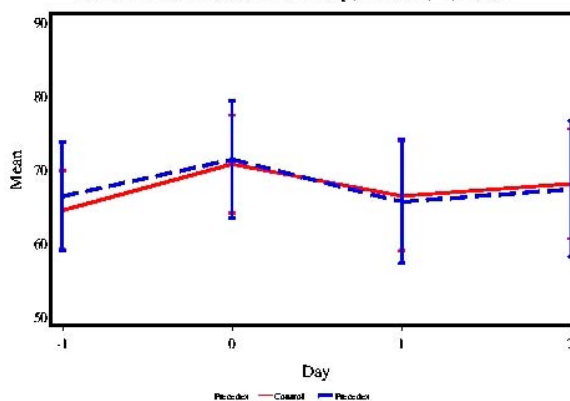
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Patient Characteristics

| Characteristics | Dexmedetomidine | | P-Value |
|------------------------------|-----------------|------------|---------|
| | No (n=27) | Yes (n=27) | |
| Age, yr. | 53±11 | 57±11 | 0.14 |
| Male(%) | 16(59) | 16(59) | 1.00 |
| BMI | 31±5 | 31±5 | 0.60 |
| LPN (%) | 13(48) | 13(48) | 0.99 |
| Right Side (%) | 15(56) | 16(59) | 0.78 |
| Renal Artery Clamp (%) | 27(100) | 22(81) | 0.05 |
| Renal Artery Clamp time, min | 34±9 | 32±8 | 0.40 |
| Cold Ischemia (%) | 14(52) | 9(33) | 0.21 |
| Surgery Duration, min | 172±59 | 169±56 | 0.81 |
| Total intra-op IV fluid, L | 3.3±0.8 | 3.1±0.8 | 0.33 |
| Intra-op urine output, mL | 289±152 | 319±200 | 0.65 |
| Estimated Blood Loss, mL | 266±199 | 286±185 | 0.70 |

Mean Estimated GFR at Preop, POD 0, 1, and 2



S-393.

WITHDRAWN.

S-394.**COMPARATIVE PHARMACODYNAMICS FOR THE REVERSAL OF THE NOVEL NEUROMUSCULAR BLOCKER CW002 WITH L- AND D-CYSTEINE****AUTHORS:** J. Malhotra, H. Sunaga, J. J. Savarese, P. M. Heerd**AFFILIATION:** Weill Cornell Medical College, New York, NY

INTRODUCTION: Previous work from our laboratory has established the potency of L-cysteine for rapidly reversing neuromuscular blockade produced by the novel non-depolarizing compound CW002.¹ A non-essential amino acid, L-cysteine has been safely administered intravenously to children and adults in both native and acetylated forms,^{2,3} and bolus doses in excess of the effective range for CW002 reversal were non-toxic in preclinical dog studies.¹ Nonetheless, L-cysteine can cross the blood-brain barrier largely via a L-specific amino acid transporter, and doses 50X higher than those projected for clinical reversal of CW002 have been found to be neurotoxic in rats.⁴ In contrast to L-cysteine, the non-endogenous D isomer of cysteine does not appear to be a major substrate for amino acid transporters, potentially obviating concerns about neurotoxicity. However, efficacy and potency of D-cysteine for reversal of CW002 is unknown. Based upon known characteristics of the chemical interaction between cysteine and CW002, we hypothesized that the potency of D-cysteine for CW002 reversal is similar to that of the L-isomer.

METHODS: Nine anesthetized male beagles received .08 mg/kg (9xED95) of CW002 followed after 1 minute by 10, 20, 50 or 100 mg/kg by L- (n=6) or D-cysteine (n=3). Each dose was given as a single experiment separated by at least 7 days. The rate and time to complete recovery of muscle twitch was determined. These data were compared to the rate of recovery from the same dose of CW002 (9xED95) antagonized by various doses of L-cysteine determined in a previous study.¹ Within each group (L- or D-cysteine), dose-related effects on recovery intervals were determined by ANOVA. Differences between groups in regard to the time to each recovery interval for each dose were compared by t-test. For all analyses, a p value < 0.05 was considered significant.

RESULTS: The times to 5, 25, 75, 95 and 100% recovery of muscle twitch following 0.08 mg/kg CW002 for both L- and D-cysteine are shown in figure 1. CW002 reversal profiles were similar for both isomers, with each exhibiting dose-related differences at 10, 20 and 50 mg/kg.

DISCUSSION: Although the small sample size limits statistical power, D-cysteine is clearly effective for reversal of CW002, with a potency similar to that of L-cysteine. Whether D-cysteine exhibits less entry into the central nervous system in the doses used for the study, and thus has potential clinical advantage over the L isomer, remains to be determined.

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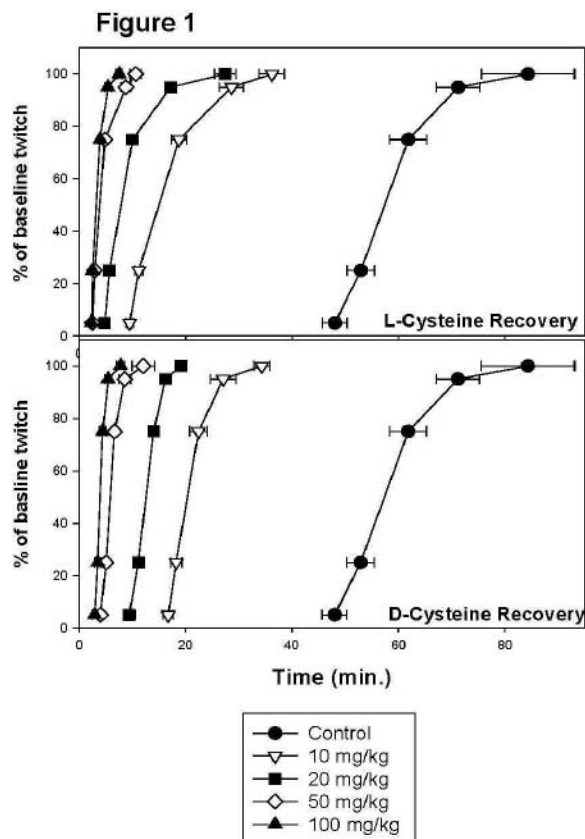


Fig. 1. The time to 25%, 75%, 95%, and 100% recovery of muscle twitch following 0.08 mg/kg (9xED95) CW002 for both L-cysteine (top panel, n=6) and D-cysteine (bottom panel, n=3)

S-395.**ISOPROTERENOL INCREASES BIS AND AROUSAL DURING CATHETER ABLATION OF ATRIAL FIBRILLATION**

AUTHORS: D. K. O'Neill, E. Rose, P. Linton, M. Hull, A. Aizer, M. Bloom

AFFILIATION: New York University School of Medicine, New York, NY

INTRODUCTION: With the increase in anesthesia utilization in the electrophysiology laboratory, there is greater potential for arrhythmia suppression during electrophysiology study. Intravenous isoproterenol is frequently used to counteract the significant anti-adrenergic impact of anesthesia, as well as induce arrhythmias and identify reconnection of pulmonary vein conduction. The effects of isoproterenol on cerebral and respiratory function during the sedated state have not been well studied. The Bispectral (BIS) Vista TM Monitor is a non-invasive device that measures electrical activity of the brain and computes a BIS value, which corresponds to a level of consciousness. The purpose of this study was to determine changes in BIS values during isoproterenol administration.

METHODS: Twenty consecutive patients underwent electrophysiology study under total intravenous anesthesia using propofol and remifentanyl infusions. Isoproterenol was infused at a rate of 5mcg/kg/min and escalated to up to 20mcg/kg/min over 20 minutes. BIS levels were recorded before and throughout isoproterenol administration.

RESULTS: Patients demonstrated significant elevation in BIS value during isoproterenol infusion. The mean difference between pre- and post- BIS values was 21.3 [5.4, 37.2] ($p = 0.00013$). The isoproterenol doses which triggered a BIS spike ranged from 10.8 mcg to 90.8 mcg. The median effective isoproterenol dose was 25.2 mcg. The median onset time for an isoproterenol stimulated BIS spike was 6.9 minutes with rates from 2 to 20 mcg/minute.

DISCUSSION: Isoproterenol significantly increases BIS values during sedated electrophysiology study. Monitoring BIS values may be helpful in assessing the isoproterenol dosage required to overcome the suppressive effects of anesthesia on arrhythmia induction, as well as the potential need for additional anesthetics to prevent patient arousal. Conversely, decreasing BIS values are known to correlate with hypotensive episodes signaling cerebral hypoperfusion. This may be relevant in cases of hemodynamically unstable tachycardias. BIS appears to be an important tool for the optimization of anesthesia when isoproterenol is administered during electrophysiology study.

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S-396.**LOCAL ANESTHETIC INHIBITS HYPERPOLARIZATION ACTIVATED CATIONIC CURRENTS**

AUTHORS: X. Chen,^{1,3} Q. Meng,² Z. Xia,² J. Liu,¹ D. A. Bayliss³

AFFILIATION: ¹Laboratory of Anesthesia & Critical Care Medicine, West China Hospital of Sichuan University, Chengdu, China; ²Departments of Anesthesiology, Renmin Hospital of Wuhan University, Wuhan, China; ³Departments of Pharmacology, University of Virginia, Charlottesville, VA

INTRODUCTION: Systemic administration of local anesthetics has beneficial perioperative properties and an anesthetic-sparing and antiarrhythmic effect,¹ although the detailed mechanisms of these actions remain unclear. In the present study, we investigated effects of a local anesthetic, lidocaine, on HCN channels that contribute to the pacemaker currents in rhythmically oscillating cells of the heart and brain.²

METHODS: Voltage clamp electrophysiological recordings were employed to examine cloned HCN subunit currents expressed in *Xenopus* oocytes and HEK293 cells under control condition and lidocaine administration.

RESULTS: Lidocaine inhibited HCN1, HCN2, HCN1-HCN2 and HCN4 channel currents at 100 μ M, and decrease in maximal current for ~30-50% inhibition in both oocytes and/or HEK293 cells; lidocaine also evoked a hyperpolarizing shift in half-activation voltage ($\Delta V_{1/2}$ of ~-10 to -14 mV), but only for HCN1 and HCN1-HCN2 channels. By fitting concentration-response data to a logistic function we estimated half-maximal (EC50) concentrations of lidocaine of ~30 to 40 μ M for the shift in $V_{1/2}$ of HCN1 and HCN1-HCN2. For inhibition of current amplitude, calculated EC50 values were ~50 to 70 μ M for HCN1, HCN2 and HCN1-HCN2 channels. In addition, lidocaine inhibited tonic HCN channel currents by ~40-55% and caused a slowing of current activation.

DISCUSSION: These results indicate that lidocaine potently inhibits HCN channel subunits in dose-dependent manner over a concentration range relevant for systemic application. The ability of local anesthetics to modulate I_h in central neurons may contribute to CNS depression while effects on I_f in cardiac pacemaker cells may contribute to the antiarrhythmic and/or cardiovascular toxic action.

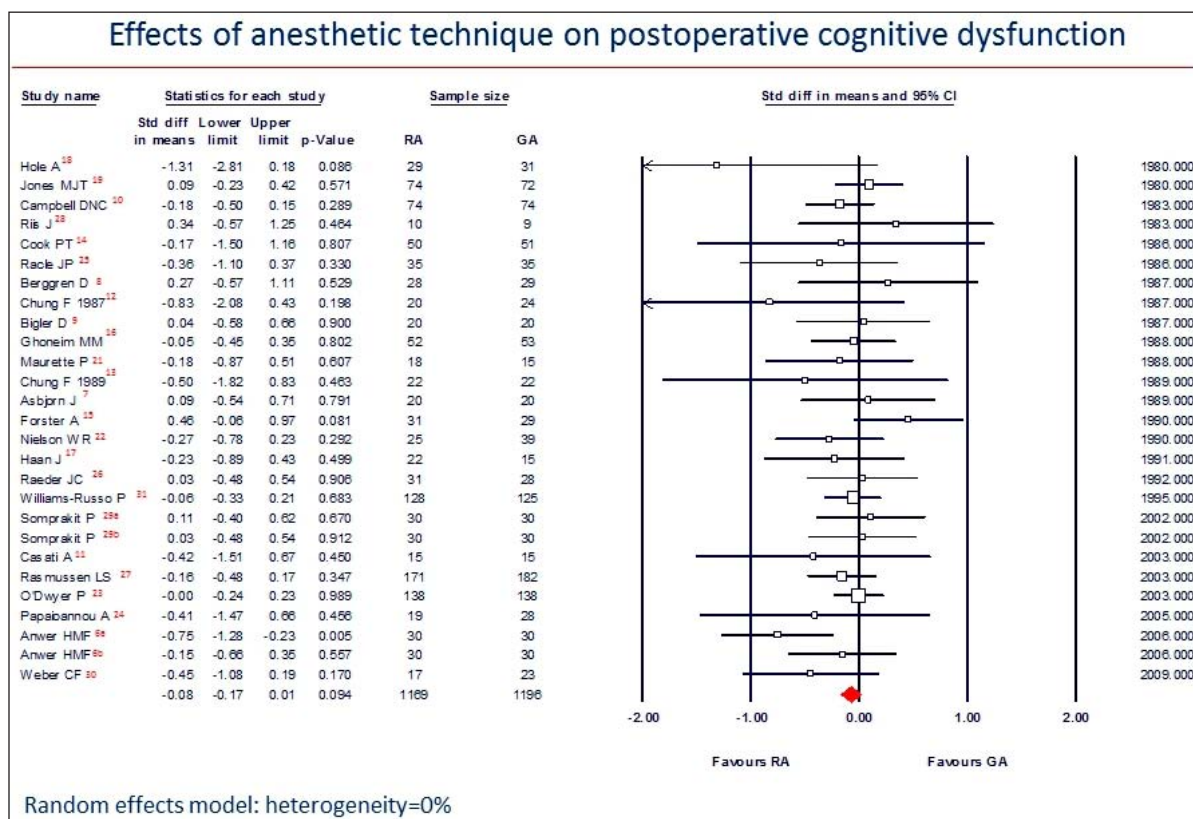
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Regional Anesthesia

S-403.**GENERAL ANESTHESIA DOES NOT CONTRIBUTE TO LONG TERM POSTOPERATIVE COGNITIVE DYSFUNCTION IN ADULTS: A META-ANALYSIS****AUTHOR:** J. Y. Guay**AFFILIATION:** Maisonneuve-Rosemont Hospital, University of Montreal, Montreal, QC, Canada**INTRODUCTION:** This is a meta-analysis evaluating the effects of the anesthetic technique (regional vs. general anesthesia) on postoperative cognitive dysfunction of patients undergoing noncardiac surgery.**METHODS:** A search for randomized controlled trials (RCT) comparing regional anesthesia to general anesthesia for surgery was done in the American National Library of Medicine's PUBMED in August 2009, in MEDLINE 1950 to July 2009, 31; EMBASE 1980 to 2009 Week 32; EBM Reviews-Cochrane Central Register of Controlled Trials 3rd Quarter 2009; PsychINFO 1806 to August Week 1, 2009; Current Contents/All Editions 1993 Week 27 to 2009 Week 33.**RESULTS:** Twenty-six RCTs including 2365 patients: 1169 for regional anesthesia and 1196 for general anesthesia were retained. The standardized difference¹ in means for the tests included in the 26 RCTs was -0.08 (95% Confidence Interval: -0.17 to 0.01; P value 0.094; I-squared = 0.00%). The assessor was blinded to the anesthetic technique for 12 of the RCTs only including 798 patients: 393 for regional anesthesia and 405 for general anesthesia. The standardized difference in means for these 12 studies is 0.05 (-0.10 to 0.20; P = 0.51; I-squared = 0.00%).**DISCUSSION:** The present meta-analysis does not support the concerns that a single exposure to general anesthesia in an adult would significantly contribute to permanent postoperative cognitive dysfunction after non-cardiac surgery.**REFERENCES:**

1. Borenstein M, Hedges LV, Higgins JPT, Rothstein HR. Introduction to meta-analysis. Padstow, Cornwall, UK: Wiley, 2009



S-404.

WITHDRAWN.

S-405.**COMPARISON OF LEVOBUPIVACAINE OR BUPIVACAINE IN ADDITION TO LIDOCAINE FOR PERIBULBAR ANESTHESIA IN CATARACT SURGERY****AUTHORS:** N. Ahmad, W. Riad, A. Zahoor, S. Jastaneiah, A. Assiri**AFFILIATION:** King Khaled Eye Specialist Hospital, Riyadh, Saudi Arabia

INTRODUCTION: The use of Levobupivacaine as local anesthetic medication is increasingly becoming popular for peribulbar block in cataract surgery due to its low cardiovascular and neurological toxicity.¹ The aim of the study was to determine the efficacy and blocking quality of 0.5% levobupivacaine versus 0.5% bupivacaine for peribulbar anesthesia in combination with lidocaine 2%.

METHODS: After approval of the local IRB and informed patients consent, 150 patients scheduled for phacoemulsification were enrolled in a prospective, randomized, double-blind study. Patients were randomly divided by computer generated numbers into two groups (75 patients each). Patients received either Bupivacaine 0.5% or Levobupivacaine 0.5%, in addition to lidocaine 2% in a ratio of 3 to 2, together with hyaluronidase 5 µg/ml as an adjuvant to increase the absorption and spreading of local anesthetic injected. The technique of anesthesia involves insertion of the needle perpendicular to the skin in infratemporal space just above the inferior orbital notch. An initial volume between 6-9 ml injected till total drop of the upper eyelid observed. Akinesia score were assessed after 10 minutes by anesthesiologist who was not aware about the medications used. If Akinesia score was 3 or more another supplementary injection of 3-5 ml was giving using the same medication mixture either medially or supero-nasal depending on the remaining movement. Degree of pain was assessed by verbal pain scale (0=no pain to 10= most severe pain) immediately after the block, intraoperatively and 4 hours postoperative. At the end of the procedure surgeon and patients were requested to rate their satisfaction (0= not satisfied -10= totally satisfied) with the technique.

Sample size calculation indicated that 75 patients in each arm are required based on 0.5 differences in the mean of final akinesia score. Numerical data were analyzed using unpaired, two tailed t-test, while Chi-square test was used for categorical data.

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RESULTS: There was no significant difference between the two groups as regards 10 min akinesia score ($P=0.27$). No. of supplementary injections ($P=0.84$), total volume of local anesthetics ($P=0.81$). Surgeons and patients satisfactions were comparable between groups ($P=0.53$ & 0.74 respectively). Verbal pain scale measured immediately after block, intraoperative and 4 hours post operative was similar in both groups ($P=0.59, 0.56$ & 0.31 respectively).

DISCUSSION: In conclusion: under the present study, Peribulbar anesthesia with Levobupivacaine 0.5% provides similar qualities of block as with Bupivacaine 0.5%, both in mixture with lidocaine 2% when used for cataract surgery.

REFERENCES:

1. European Journal of Ophthalmology, Vol.19(2), 2009, 280-4.

Table 1: Results

| | Bupivacaine | Levo-Bupivacaine |
|---------------------------------|--------------------|-------------------------|
| 10 min Akinesia score | 0.43(0.85) | 0.64(1.24) |
| No. of supplemenatry injection | 18(24%) | 17(27%) |
| Total volume of injectable | 10.45(3.25) | 10.32(3.48) |
| Pain score During block Intraop | 2.28(1.48) | 2.15(1.54) |
| 4 h Postop | 0.43(1.17) | 0.32(1.08) |
| | 0.27(0.47) | 0.67(1.15) |
| Surgeon Satisfication | 9.32(1.24) | 9.44(1.13) |
| Patient Satisfication | 8.31(1.20) | 8.37(1.28) |

Data expressed in mean(SD)& number(%)

S-406.**HAND VERSUS EYE; PSYCHOMOTOR AND VISUOSPATIAL PREDICTORS OF ULTRASOUND GUIDED REGIONAL ANESTHESIA PERFORMANCE****AUTHORS:** R. L. Johnson, H. M. Smith, S. L. Kopp, J. R. Hebl**AFFILIATION:** Mayo Clinic College of Medicine, Rochester, MN

INTRODUCTION: Ultrasound-guided regional anesthesia (UGRA) is a complex procedural skill requiring bimanual dexterity and coordination, sonographic interpretation, and the use of specialized medical imaging equipment.¹⁻³ Within the regional anesthesia literature, there are no studies examining fundamental baseline visuospatial and/or psychomotor aptitudes of learners. This pilot investigation explores the impact of baseline aptitudes on ultrasound guided procedural performance.

METHODS: After Institutional Review Board approval, 39 anesthesiology residents were enrolled in this prospective, randomized study. Subjects with prior formal UGRA training or visual, sensory, or motor impairment were excluded. Assessments were obtained in the following areas: contrast sensitivity (Pelli-Robson contrast sensitivity test), sensation (Semmes-Weinstein Monofilaments), direct hand-eye coordination (Purdue Peg Board), dexterity/fine motor skills (Crawford Small Parts Dexterity Test), visuospatial relations (Block Design Test, Trail Making Test, Digit Symbol Substitution), and projected image performance testing (Zig-Zag Test). (4-10) Participants also completed two ultrasound-guided skill tasks on a phantom model. A global performance score (Z score), compiled from individual task measurements, reflected each subject's ultrasound skill performance.

Results: 39 enrolled residents completed the study.

- Visuospatial Relation Testing (Block Design Test) predicts both ultrasound skill performance and projected image performance testing. ($p < 0.01$).
- A significant learning improvement occurred between the first and second ultrasound skill attempts (total time, needle acquisition time, number of needle redirections, and needle visualizations attempts) despite switching needle and probe hands between attempts. ($p < 0.02$)

DISCUSSION: Visuospatial relations aptitude is a more important predictor of ultrasound skill task performance than psychomotor ability. Because UGRA is reliant upon visuospatial aptitude, the Block Design test serves as an objective assessment of how well learners perform on measurements associated with UGRA. Additionally with the Block Design test strongly correlating to projected image performance, this measurement may also be linked to UGRA with additional study. Lastly, results of this study suggest a significant learning effect occurs between multiple ultrasound attempts independent of hand-dominance or muscle memory learning. This learner effect opens the possibility of future research into exercises to improve UGRA performance.

REFERENCES:

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S-407.**REGIONAL ANESTHESIA - INTERACTIVE VISUALIZATION WITH ACCESS TO PUBLISHED LITERATURE****AUTHORS:** A. Rao, P. Alfilie**AFFILIATES:** Massachusetts General Hospital, Boston, MA

INTRODUCTION: Visual representation of medical information eases the process of synthesizing information and is very useful in learning as well as teaching. Keyword search in Pubmed provides an excellent snapshot but fails to capture the landscape across the domain of interest. For example, to gain a comprehensive understanding of the rapid advancements being made in the field of regional anesthesia Pubmed needs to be queried several times over making it tedious and hence impractical. We present a method to execute a single comprehensive search, cluster articles by attributes and navigate the vast landscape of Pubmed literature in regional anesthesia using a single zoomable interface akin to Google maps.

METHODS: We integrated NCBI Entrez Programming Utilities (<http://eutils.ncbi.nlm.nih.gov/>) with a flash-based presentation editor, Prezi (<http://www.prezi.com>) and Google Maps API. Pubmed abstracts were manipulated using a suite of Perl scripts and Microsoft Excel macros to generate search results and cluster them by attributes such as location of nerve blocks (over 20 sites such as interscalene, supraclavicular, sciatic etc) technique of delivery (single shot, catheter infusion) and assessment method (neurostimulation, ultrasound) or those pertaining to pediatric patients. Wherever appropriate, abstracts and MeSH terms were searched using regular expressions. Search results were represented using a custom layout created in Prezi and Google-maps.

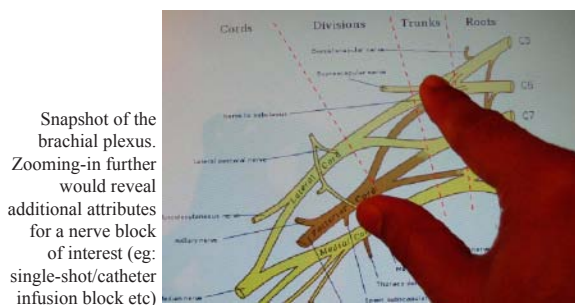
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RESULTS: Over 22,000 abstracts were recursively searched using about 50 keywords in approximately 45 minutes. Results that were represented on the custom Prezi/google-maps layout allowed users to navigate between regions of interest, zoom-in, zoom-out and review literature results for that regional nerve block of interest (eg: all abstracts for a femoral nerve block that relied on an ultrasound assessment). The maps performed well on a PC (using a mouse) and on a tablet using a touchscreen interface.

DISCUSSION: Both Google Maps API (free) and Prezi (paid/educational license) have its advantages and disadvantages. They are equally useful in creating interactive layouts. Currently the pubmed search script is run using a command line and takes about 10 minutes to setup. However, this one-time effort can utilize any number of keywords thus providing a lot of granularity and depth to the search so as to achieve a comprehensive understanding of the domain. It is our expectation that this synergy between Pubmed and Prezi/Google can be exploited to create other visual representations for doctors as well as patients.

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S-408.**REAL-TIME ULTRASOUND-GUIDED SPINAL ANESTHESIA USING TAYLOR'S APPROACH****AUTHORS:** P. J. Lee,¹ R. Tang,¹ A. Sawka,¹ C. Krebs,² H. Vaghadia¹**AFFILIATION:** ¹Department of Anesthesiology, Pharmacology and Therapeutics, University of British Columbia, Vancouver, BC, Canada; ²Department of Cellular and Physiological Sciences, University of British Columbia, Vancouver, BC, Canada**INTRODUCTION:** The role of ultrasound in placement of neuraxial anesthesia is at present limited to pre-procedure imaging and identification of anatomical structures. We describe a real-time ultrasound technique for visualization and placement of spinal anesthesia using Taylor's paramedian approach to the dura at the L5-S1 interspace.¹**METHODS:** Five unembalmed cadavers were placed in the prone position and an epidural catheter placed in the subarachnoid space at T12-L1. Methylene blue dye was infused into the subarachnoid space. A 5-2MHz, 60-mm broadband curved array ultrasound transducer (SonoSite MicroMaxx, Bothell, WA) in the longitudinal paramedian axis was used to identify the L5-S1 interspace and underlying dura. A spinal needle was inserted into the subarachnoid space under direct ultrasound guidance. Insertion was confirmed by aspiration of methylene blue. A blinded anatomist dissected the region.

With institutional ethical approval and informed consent, 10 patients undergoing knee arthroplasty were studied. While in a prone position, the optimal ultrasound image of the dura through the L5-S1 interspace was obtained from a left paramedian position. A spinal needle was advanced in plane with ultrasound guidance through the L5-S1 interspace through the dura. Upon return of cerebrospinal fluid, 15 mg of bupivacaine 0.5% with fentanyl 25 mcg were administered. Sensory block was assessed by application of ice.

RESULTS: In the cadaver study, visualisation of the dura through the L5-S1 interspace was possible in all cases (Fig.1). The subarachnoid space was punctured in all 5 cadavers from both left and right paramedian approaches. Dissection confirmed the presence of the needle tip in the subarachnoid space in each case (n=10).

Ten patients underwent spinal anesthesia. A real-time image of the spinal needle advancing through the L5-S1 interspace to the dura was obtained in all cases. Cerebrospinal fluid was aspirated and successful spinal anesthesia was obtained in all cases. Sensory dermatome levels are shown in Table 1.

DISCUSSION: Real-time ultrasound-guided insertion of a spinal needle into the subarachnoid space using Taylor's approach was successful in the cadaver study. Clear ultrasound images of the dura and the needle tip were obtained. This translated into successful spinal anesthesia in 10 patients undergoing knee arthroplasty. Further studies with patients selected for the potential difficulty of performing spinal anesthesia (eg those with spinal deformity or previous spinal instrumentation) would be beneficial.**REFERENCES:**

1. Taylor, J A. Lumbosacral Subarachnoid Tap. J Urol 1940;43: 561

Table 1. Dermatome level for anesthesia to cold sensation following subarachnoid injection

| Time After Subarachnoid Injection | Dermatome Level to Ice (Median [Range]) | |
|-----------------------------------|---|--------------|
| | Left | Right |
| 5 Min | T11 [T8-L2] | T12 [T8-L2] |
| 10 Min | T10 [T6-T12] | T10 [T6-T12] |
| Recovery | T11 [T4-L2] | T11 [T4-L2] |

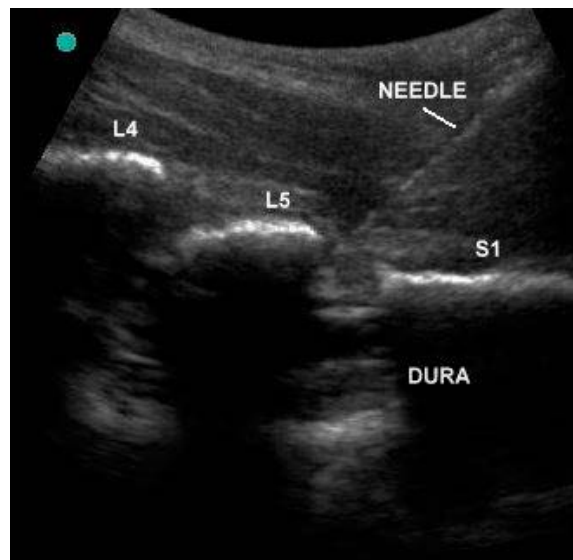


Figure 1. Ultrasound image of the right L5-S1 paramedian approach to the dura.

S-409.**REDUCTION OF THE INCIDENCE OF VENOUS THROMBOEMBOLISM BY ULTRASOUND-GUIDED FEMORAL NERVE BLOCK IN TOTAL KNEE ARTHROPLASTY****AUTHORS:** H. Takagi, Y. Asakura, H. Tsuchiya, Y. Kanayama**AFFILIATION:** Nagoya Kyoritsu Hospital, Nagoya, Japan

INTRODUCTION: Venous thromboembolism (VTE) and the subsequent development of pulmonary embolism (PE) is a major cause of post-operative mortality in total knee arthroplasty (TKA). Without an appropriate thromboprophylaxis, the prevalence rate reaches as high as 40% for VTE. Since the introduction of fondaparinux for the prevention of VTE, the risk has been reduced by less than 15%. As of July 2010, we had started a combination of ultrasound-guided femoral nerve block (FNB) on general anesthesia followed by intravenous fentanyl PCA post-operatively. We retrospectively evaluated whether the addition of FNB on general anesthesia has affected the incidence of development of VTE following TKA.

METHODS: This is a retrospective non-randomized comparative study with the patients assigned groups based on the surgery date. All anesthesia and the medical records of those who had undergone TKA between January 2009 and March 2010 were retrospectively reviewed. Forty patients were identified, among whom 15 patients underwent TKA under general anesthesia alone with sevoflurane, fentanyl, and remifentanyl followed by intravenous fentanyl PCA post-operatively (Group G). Twenty-five patients underwent under general anesthesia combined with ultrasound-guided FNB followed by intravenous fentanyl PCA post-operatively (Group F).¹ Additional rescue doses of FNB were given in group F at the ward at any time when the break through pain to PCA was observed. Except for the use of FNB, the anesthesia methods were identical between the two groups. All the patients were given once-daily subcutaneous injection of fondaparinux following 24 hours after the surgery. Detection of VTE was carried out on the third post-operative day in all patients by compression ultrasonography carried out by the cardiovascular ultrasound technicians.

RESULTS: The incidence of development of VTE was significantly lower in group F (7/15 versus 4/25; $p=0.037$). Logistic regression analysis identified the strong correlation between the use of FNB and the post-operative development of VTE ($p=0.0426$). The odds ratio of subsequent development of VTE in group G was 3.12 (95%CI; 0.57-20.56).

DISCUSSION: We have shown that the addition of FNB on general anesthesia may reduce the incidence of development of VTE following TKA. We speculate that the excellent analgesic effect of FNB facilitated the early mobilization of the patients with the aid of physiotherapists, which subsequently prevented the development of VTE.

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S-410.**NANOANESTHESIA - INTRAVENOUS ANKLE BLOCK IN THE RAT BY MAGNET-DIRECTED CONCENTRATION OF NANOPARTICLE-CONJUGATED ROPIVACAINE : DEMONSTRATION OF A NOVEL APPROACH**

AUTHORS: V. Mantham,¹ H. K. Nair,² H. Dong,³ K. Matyjaszewski,⁴ W. Lariviere⁵

AFFILIATION: ¹University of Pittsburgh School of Medicine, Pittsburgh, PA; ²University of Pittsburgh, Pittsburgh, PA; ³Carnegie Mellon University, Pittsburgh, PA; ⁴Carnegie Mellon University, Pittsburgh, PA; ⁵University of Pittsburgh School of Medicine, Pittsburgh, PA

INTRODUCTION: We tested the feasibility of producing ankle block in the rat by intravenous injection of the local anesthetic drug ropivacaine combined with magnetic nanoparticles (MNPs) and applying a magnet around the ankle. We hypothesized that the complexes would be attracted and concentrated at the ankle by the magnet, the drug would be released, act on the nerves and produce the block.

METHODS: MNP-Ropivacaine complex: It consisted of a polymer nanogel 8 mg/ml, magnetic Fe₃O₄ nanoparticles at 12 wt% of nanogels and ropivacaine 7 mg/ml. This suspension is stable in water up to 20 °C but shrinks and becomes insoluble at higher temperatures (eg. body temperature), releasing the drug. We made use of this property in our experiments. The complexes were kept at 5-10 °C until injection.

Animal experiments: IACUC approval was obtained. Sprague Dawley rats, 300-350 gm were used. Thermal sensitivity testing of the paws was done with a modified Hargreaves box. Baseline withdrawal latency was set at 8-12 seconds and a cut-off of 20 seconds imposed to prevent tissue injury. In all experiments the left paws were used as controls and the right paws for treatment. The rats were anesthetized with isoflurane. Each hind paw was tested at 10-minute intervals for 90 minutes.

Positive controls: Traditional ankle block was done with 0.8 ± 0.9 ml of 0.1% or 0.2% ropivacaine by direct ankle injections.

Magnets: A ring magnet (1" OD, 1/2" ID, 1/4" thick), and a disk magnet (7/16" x 3/16") immediately below it were placed over a 1/2" piece of 9.0 endotracheal tube.

Injection of MNP-ropivacaine complex: The magnet assembly was slipped over the paw so that the ring surrounded the malleoli and the disc overlay the dorsum of the ankle. A selected dose of the complex was injected intravenously via a 24 g tail vein cannula. The animals were awakened after the designated time and tested for anesthesia of the paw. The experiments conducted (#s 1-4) are given in the table.

Expt. # 5: MNPs alone: Two ml was injected and the magnet applied for 30 minutes.

Statistics: The results were analyzed by Repeated Measures Analysis of Variance and Dunnett's post-hoc test. A p value of < 0.05 was taken as significant.

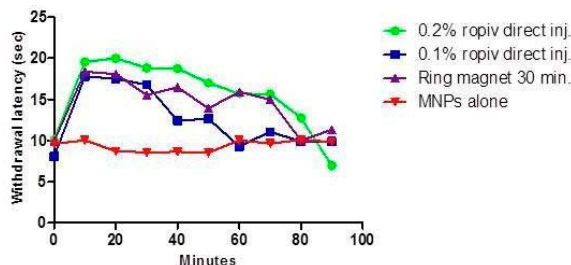
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RESULTS: Experiment # 2 showed results comparable to the traditional ankle block produced by 0.1% and 0.2% ropivacaine (figure 1). Paw withdrawal latency was highly significantly prolonged from baseline ($p < 0.01$) for 70 minutes with the ring magnet, 70 minutes with 0.2% ropivacaine and 20 minutes with 0.1% ropivacaine. Negative results were obtained with MNPs alone, the control left paw and the other magnet experiments.

DISCUSSION: We have demonstrated proof of principle.

REFERENCES: None

| Expt. # | MNP-LA dose (ml) | Magnet duration (min) | Sample size |
|---------|------------------|-----------------------|-------------|
| 1 | 2 | 15 | 6 |
| 2 | 2 | 30 | 11 |
| 3 | 2 | 60 | 6 |
| 4 | 1 | 30 | 6 |



Paw withdrawal latencies with ankle block by direct injection of 0.1% and 0.2% ropivacaine, intravenous injection of MNPs+ropivacaine with magnet application for 30 minutes, and of MNPs alone with magnet application for 30 minutes. The X-axis shows minutes after return of the animal to baseline wakefulness.

S-411.**ULTRASOUND DETECTION OF THE VASO NEVORUM OF THE POPLITEAL SCIATIC NERVE BY COLOR POWER ANGIO****AUTHOR:** S. R. Clendenen**AFFILIATION:** Mayo Clinic Florida, Jacksonville, FL

INTRODUCTION: The majority of blood to the peripheral nerves is supplied by the vaso nevorum which is often compromised in the patient with diabetic neuropathy. The observation of microcirculation in vivo is dependent on animal models using technology such as laser Doppler flow in addition to microelectrode hydrogen clearance. The Matrix X6-1 ultrasound transducer with the IU-22 platform (Philips Medical System; Andover, MA) has Color Power Angio technology for identification of vascular structures. We present the popliteal sciatic ultrasound exam in ten volunteers.

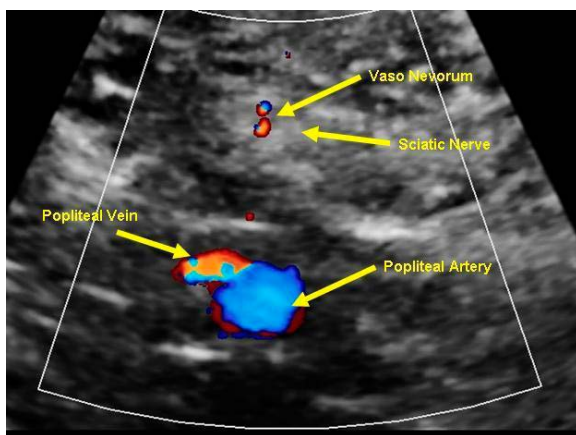
METHODS: Ten healthy volunteers (no diabetes, hypertension, peripheral vascular disease, and non-smoker) who ranged in age from 19 to 53 years with a body mass index from 15-42 were placed in the prone position. The Matrix X6-1 ultrasound probe was used to examine the popliteal sciatic nerve. The artery and tibial nerve were identified in the popliteal crease and tracked proximally until merging with the common peroneal nerve. Color Power Angio was activated to identify simultaneous pulsation of the popliteal artery and the vaso nevorum of the sciatic nerve.

RESULTS: The simultaneous pulsed color flow of the vaso nevorum and popliteal artery were identified in all ten volunteers without difficulty above the bifurcation of the popliteal sciatic nerve. In the majority of the scans the blood flow was identified in both the common peroneal and tibial nerve.

DISCUSSION: This preliminary case series demonstrated the capability of Color Power Angio to identify the vaso nevorum of the sciatic nerve. The power doppler shift is independent of Doppler-shift frequency and angles and is more sensitive to slow flow and deep vessels. Further extensive studies are needed to confirm these initial findings on healthy volunteers and then to expand to patients with vascular disease as well as diabetics peripheral neuropathy.

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**S-412.****ULTRASONOGRAPHIC EXAMINATION OF THE SCIATIC NERVE AT THE POPLITEAL FOSSA AND MID-FEMORAL LEVEL****AUTHORS:** A. A. Rhee, P. Lennox, H. Vaghadia, R. Tang, A. Sawka**AFFILIATION:** UBC, Vancouver, BC, Canada

INTRODUCTION: The sciatic nerve block provides anesthesia and analgesia for ankle and foot surgery.¹ Localizing and differentiating the sciatic nerve (ScN) or its branches from adjacent structures is crucial when performing the block.² A mid-femoral approach for the ScN block has been recently described.³ The objective of this study was to compare popliteal versus mid-femoral imaging of the ScN in order to determine the ease with which the ScN could be imaged.

METHODS: After institutional ethics approval and informed consent, 33 subjects volunteered for this prospective, single-blinded, observational study. Each volunteer underwent ultrasound examination of both legs using a high-frequency probe (6 to 13 MHz), and a SonoSite MicroMaxx[®] ultrasound unit (SonoSite Inc., Bothell, WA). A conventional ultrasound technique was used for the popliteal fossa.¹ For the mid-femoral level, a recently described midhigh approach was used.³ A total of 4 images per subject were captured. A blinded anesthesiologist assessed the quality of the images using a VAS scale with specific scoring criteria. The primary outcome variables compared were overall quality of the image and quality of the ScN image between the mid-femoral and popliteal sites. The secondary outcomes variables compared were: time to image acquisition (A sec), skin to nerve distance (B mm), popliteal crease to final image distance (C mm), the presence of a see-saw sign (D). Primary outcome variables were analyzed using the Mann Whitney U test. Secondary outcomes variables were analyzed using the student t-test and the Chi-Square Test. A p value of <0.05 was considered significant.

Challenging Case Report (only complete if your submission falls into the “Challenging Case Report” category. If you select the “Challenging Case Report” category on the next step, this section must be completed.): N/A

RESULTS: Results are reported as mean ranks, millimetres, and seconds (mean \pm SD). Quality of the overall image at the mid-femoral level (mean rank=72) was higher than the popliteal level (mean rank=56, $p<0.01$). No difference was found for quality of the sciatic nerve image, variables A, B and D between the mid-femoral level and popliteal fossa. Vertical distance from the popliteal crease (B mm) was greater at the mid-femoral site (13 ± 2.4) compared to the popliteal site (8 ± 1.5).

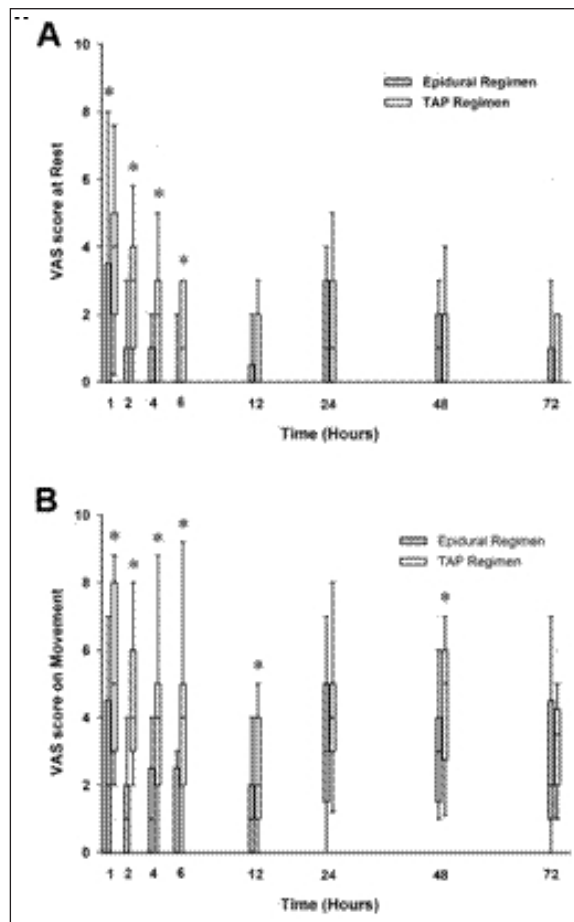
Discussion: In our study, overall quality of the image was significantly improved at the mid-femoral level compared to the popliteal fossa with no differences found in the other variables analyzed. As expected, vertical distance from the popliteal crease was greater at the mid-femoral level compared to the popliteal fossa.

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S-413.**COMPARISON OF SECURENESS OF EPIDURAL CATHETER FIXATION BETWEEN STANDARD METHOD AND DALHOUSIE UNIVERSITY METHOD****AUTHORS:** T. Hoshi, M. Tanaka**AFFILIATION:** Anesthesiology and Critical Care Medicine, University of Tsukuba, Tsukuba, Japan**INTRODUCTION:** Effect of epidural anesthesia is affected by the catheter tip position. In order to prevent epidural catheter migration, several methods for securing its placement have been reported, but there is no gold standard method.**METHODS:** We retrospectively compared two different methods to fix epidural catheter. In standard group, catheters were formed circular loop at the skin exit site and covered with Tegaderm™. Data of this group were collected between October 1st, to December 31st, 2009. Dalhousie method group were fixed with Steri-Strip™ and Tegaderm™ transparent film dressing as reported from Dalhousie University. A Steri-Strip™ is fixed along the catheter above the puncture site and onto the adjacent skin. Another Steri-Strip™ is fixed below the puncture site in the same fashion and the catheter is sandwiched between the two. Steri-Strips™ are then placed horizontally, above and below the puncture site. Data of this group were collected between June 1st, to August 31st, 2010. Epidural catheter position was recorded every day and magnitude of catheter movement at skin were compared at 2nd postoperative day.**RESULTS:** 107 cases in the standard group and 91 cases in the Dalhousie group were enrolled. In the standard group, 1.1 ± 1.3 cm moved in two days and 0.3 ± 0.6 cm in Dalhousie group ($p < 0.0001$).**DISCUSSION:** We conclude that the Dalhousie method to fix the epidural catheter is outstanding and is superior to the standard method.**REFERENCES:**

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S-414.**A COMPARISON OF CONTINUOUS EPIDURAL BASED VERSUS TRANSVERSUS ABDOMINIS PLANE (TAP) BLOCK BASED REGIMENS IN PATIENTS UNDERGOING RETROPUBLIC PROSTATECTOMY****AUTHORS:** O. Finnerty,^{1,2} J. Carney,¹ J. Laffey,^{1,3} J. McDonnell^{1,2}**AFFILIATION:** ¹Department of Anaesthesia, Clinical Sciences Institute, National University of Ireland Galway, Galway, Ireland; ²Department of Anaesthesia and Intensive Care Medicine, Galway University Hospitals, Galway, Ireland; ³Clinical Research Facility, Galway University Hospitals, Galway, Ireland**INTRODUCTION:** The transversus abdominis plane (TAP) block is an effective block for many abdominal incisions. We compared a single shot TAP block via the landmark technique with epidural analgesia over 24 hours, in patients presenting for retropubic prostatectomy via an infra-umbilical incision in a randomized controlled, single blinded, clinical trial and observed pain scores and analgesia consumption for up to 72 hours postoperatively.**METHODS:** Following approval from the IRB and written informed consent, sixty patients presenting for elective retropubic prostatectomy were randomized to receive either bilateral TAP block (n=31) or epidural analgesia (n=29), in addition to regular acetaminophen and diclofenac therapy. All patients received a standard general anaesthetic. The TAP block group received patient controlled intravenous morphine postoperatively. The epidural catheters were left in situ for 24 hours and thereafter patients received patient controlled intravenous morphine. Each patient was assessed postoperatively by a blinded investigator at 1, 2, 4, 6, 12, 24, 48, and 72 hours postoperatively.**RESULTS:** The epidural blockade reduced postoperative VAS pain scores at rest and on movement compared to patients that received TAP blockade, particularly in the first 12 hours postoperatively. Postoperative verbal analogue scores, (VAS) at rest were significantly lower with the epidural regimen at 1, 2, 4 and 6 hours $p < 0.01$, Figure 1A. VAS scores on movement were significantly lower with the epidural regimen at all time points up to 48 hours $p < 0.05$, Figure 1B. The mean (\pm SD) total morphine requirements in the first 24 postoperative hours were also reduced; 11 ± 23 mg vs. 42 ± 26 mg, $P < 0.001$. There was no significant difference overall in cumulative morphine consumption at 48 hours (mean \pm SD) $60.2 \text{ mg} \pm 43.5 \text{ mg}$ vs $71.1 \text{ mg} \pm 39.3 \text{ mg}$, $p = 0.32$, or 72 hours $81.8 \text{ mg} \pm 56.7 \text{ mg}$ vs $90.1 \text{ mg} \pm 53.9 \text{ mg}$, $p = 0.56$. The TAP block provided more a stable intra- and postoperative hemodynamic profile compared to epidural blockade. The intraoperative blood loss was not significant between the two groups; (mean \pm SD) Epidural $1112 \text{ ml} \pm 563 \text{ ml}$ vs. Tap group $919 \text{ ml} \pm 398 \text{ ml}$, $p = 0.128$. The incidence of sedation was significantly higher in patients that received the TAP block regimen (84% vs. 55%). There were no complications attributable to the TAP block.**DISCUSSION:** A multi-modal analgesia regimen incorporating epidural blockade, provided superior analgesia when compared a similar regimen incorporating TAP blockade in the first 72 postoperative hours following elective retropubic prostatectomy.**REFERENCES:** N/A

Verbal analogue scores (VAS) over 72hours postoperatively

S-415.**ULTRASOUND-GUIDED TRANSVERSUS ABDOMINIS PLANE BLOCK AFTER ABDOMINAL HYSTERECTOMY: A COMPARISON WITH MULTIMODAL ANALGESIA TECHNIQUE**

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INTRODUCTION: Numerous studies have reported excellent analgesic efficacy of the transversus abdominis plane (TAP) block in patients undergoing abdominal surgical procedures. However, the efficacy of TAP block compared with multimodal analgesia consisting of acetaminophen, ketorolac and opioids has not been evaluated. In this randomized, controlled, observer-blinded study, we evaluated the efficacy of ultrasound-guided TAP block for postoperative pain management in patients undergoing abdominal hysterectomy.

METHODS: After IRB approval, 75 consenting patients scheduled for elective abdominal hysterectomy were randomized to one of three groups. Group 1 received a TAP block and ketorolac 30 mg, IV at the end of surgery followed by ketorolac 30 mg, IV q 6 h plus acetaminophen 650 mg, PO q 6 h for 24 h postoperatively. Group 2 only received the TAP block at the end of surgery. Group 3 received ketorolac 30 mg, IV at the end of surgery followed by ketorolac 30 mg, IV q 6 h plus acetaminophen 650 mg, PO every 6 h for 24 hours postoperatively.

All patients received a standardized general anesthetic technique including antiemetic prophylaxis with dexamethasone and ondansetron. Postoperatively, all patients received intravenous patient controlled analgesia, morphine 1 mg bolus with a 5-min lockout period for rescue analgesia for a period of 24 h. After 24 h postoperatively, all patients received oral ibuprofen 800 mg q 8 h and a combination of hydrocodone/acetaminophen 5/500 mg 1-2 tablets q 6 h prn.

An investigator blinded to group allocation, documented the visual analog pain scores (0=no pain and 10=worst pain) at rest and with coughing, supplemental opioid requirements, nausea (none=0, mild=1, moderate=2, severe=3), vomiting and rescue antiemetics at 2, 6, 12, 24, and 48 h postoperatively. The data were analyzed using ANOVA with Bonferroni correction for continuous variables and Kruskal-Wallis test for categorical variables. A p value of <0.05 (*) was considered statistically significant.

RESULTS: There were no differences between the groups with respect to demographics, duration of surgery and duration of PACU stay. The VAS pain scores at rest and with coughing were similar in the three groups at all time points except for pain with coughing in the PACU (table). Also, postoperative opioid requirements; as well as nausea, vomiting and the need for rescue antiemetics were similar in the three groups.

DISCUSSION: This study suggests that the analgesic efficacy of TAP block alone was similar to that provided by a multimodal analgesia technique which included acetaminophen, ketorolac and opioids. In addition, there is no benefit of combining TAP block with a multimodal analgesic regimen.

REFERENCES: n/a

S-416.**10 ML = 17.0 HOURS OF PAIN RELIEF WITH 0.375% BUPIVACAINE WITH 1:400K EPINEPHRINE FOR SINGLE SHOT INTERSCALENE NERVE BLOCK**

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AFFILIATION: ¹New England Baptist Hospital, Boston, MA;

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INTRODUCTION: Our goal is to determine the actual duration of analgesia from a small volume of local anesthetic (LA) used for an interscalene nerve block (ISB) under direct ultrasound guidance.

METHODS: 43 single shot ISB were performed with ultrasound by two senior Anesthesiology residents under direct supervision by one attending Anesthesiologist or by the attending himself at the New England Baptist Hospital from 11/19/10 to 12/29/10. Patients underwent only one ISB pre or post-operatively. Surgeries requiring ISB were the following: rotator cuff repair, arthroscopy, and/or subacromial decompression. Each patient was called the following day of surgery; they provided the time that their shoulder pain returned in addition to any adverse effects post operatively. Exclusion criteria included: inability to contact the patient by telephone, post-operative hospitalization, or any patient requiring a 'top-off' block.

We use an in-plane technique for our ISB. Normally the upper and middle nerve trunks are visualized at the level of the cricoid. Skin, soft tissue, and the anterior scalene muscle are subsequently penetrated at a 60 degree angle with a 3.5 cm. stimuplex needle. The needle is then flattened and advanced to 12 o'clock and then 6 o'clock around the superior trunk while 10 ml of LA is injected in total to achieve circumferential spread (See Image 1).

RESULTS: Patients had a pain free period of a mean of 17.0 +/- 5.0 hours post ISB [range 8.0 to 36.0 hours, Median 16.0]. There were only 2 patients who suffered adverse effects included the following: 1. 2nd digit numbness on ipsilateral side 2. numbness of the tip of the tongue. Each patient had spontaneous resolution of their symptoms.

DISCUSSION: While our data included patients with different surgeries, ages, and timing of block, along with inability to control for narcotic dosing and timing at the patient's home, our aim was to demonstrate that a small volume of LA localized around desired nerve structures can provide a significant period of analgesia. We provide solid data that shows patients on average had 17.0 hours of pain free period post operatively with an ISB. There were no serious complications utilizing this low volume of LA with ultrasound guidance. Overall ultrasound allows the practitioner to use low volumes of LA and the ability to position needles close to nerve structures without resulting intraneural injection to achieve a quality block (1).

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WITHDRAWN.

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