

Supplement to

& ANESTHESIA & ANALGESIA[®]



Preliminary Supplement

Abstracts of Posters Presented at the
2009 Annual Meeting of the
International Anesthesia Research Society
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Health

ANESTHESIA & ANALGESIA[®]

The official scientific journal of the International Anesthesia Research Society[®], The Society of Cardiovascular Anesthesiologists, the Society for Pediatric Anesthesia, the Society for Ambulatory Anesthesia, the International Society for Anaesthetic Pharmacology, the Society for Technology in Anesthesia, the Anesthesia Patient Safety Foundation, the American Society of Critical Care Anesthesiologists, and the Society for Obstetric Anesthesia and Perinatology.

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Abstracts of Posters Presented at the International Anesthesia Research Society 2009 Annual Meeting San Diego, California March 14 -17, 2009

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IARS 2009 Annual Meeting

Abstract Presenter Presentation Schedule

Ambulatory Anesthesia

- (S-1) Kim, S., Sunday 8:00
- (S-2) O'Donnell, B.D., Sunday 8:00
- (S-3) Inagaki, Y., Sunday 8:00
- (S-4) Malhotra, R., Sunday 8:00
- (S-5) Sudhakaran Nair, G., Sunday 8:00
- (S-6) Dabir, S., Sunday 8:00
- (S-7) WITHDRAWN

Ambulatory: PONV

- (S-8) Apfel, C.C., Saturday 3:30
- (S-9) Vigoda, M., Saturday 3:30
- (S-10) Gottschalk, A., Saturday 3:30
- (S-11) Sparks, J.W., Saturday 3:30
- (S-12) Kranke, P., Saturday 3:30
- (S-13) Vigoda, M., Saturday 3:30
- (S-14) Saweris, J., Saturday 3:30
- (S-15) Diemunsch, P.A., Saturday 3:30

Bleeding/Blood Product Conservation

- (S-16) Bolliger, D., Saturday 8:00
- (S-17) Schloss, B., Saturday 8:00
- (S-18) Demiralp, G., Saturday 8:00
- (S-19) Gusakov, O., Saturday 8:00
- (S-20) Floyd, T.F., Saturday 8:00
- (S-21) Dai, Y., Saturday 8:00
- (S-22) Wong, J., Saturday 8:00

Cardiothoracic & Vascular - Basic Science

- (S-23) Harendza, T., Saturday 8:00
- (S-24) Larmann, J., Saturday 8:00
- (S-25) Dull, R.O., Saturday 8:00
- (S-26) Shim, Y., Saturday 8:00
- (S-27) Dull, R.O., Saturday 8:00
- (S-28) Zhang, L., Saturday 8:00
- (S-29) Rosenberger, D.S., Saturday 8:00
- (S-30) LIN, T., Saturday 8:00
- (S-31) Floyd, T.F., Saturday 8:00

Cardiothoracic & Vascular - Clinical - 1

- (S-32) Corniea, J., Sunday 10:30
- (S-33) Murphy, G.S., Sunday 10:30
- (S-34) El-Mottaleb, N.Abd, Sunday 10:30
- (S-35) Skhirtladze, K., Sunday 10:30
- (S-36) Namba, T., Sunday 10:30
- (S-37) Okutani, K., Sunday 10:30

Cardiothoracic & Vascular - Clinical - 2

- (S-38) WITHDRAWN
- (S-39) Wilson, J., Monday 8:00
- (S-40) Gottschalk, A., Monday 8:00
- (S-41) Mahendran, D., Monday 8:00
- (S-42) Kim, S., Monday 8:00
- (S-43) Stein, E., Monday 8:00

Cardiothoracic & Vascular - Clinical - 3

- (S-44) Asopa, A., Monday 8:00
- (S-45) Sanchez, E., Monday 8:00
- (S-46) Higashi, T., Monday 8:00
- (S-47) Yazicioglu, H., Monday 8:00
- (S-48) Kim, T., Monday 8:00
- (S-49) Wajima, Z., Monday 8:00

Critical Care Medicine & Trauma - 1

- (S-50) Klopotoski, J., Saturday 8:00
- (S-51) Dasta, J., Saturday 8:00
- (S-52) Steppan, J., Saturday 8:00
- (S-53) Pong, R., Saturday 8:00
- (S-54) Keese, M.L., Saturday 8:00
- (S-55) Li, H., Saturday 8:00
- (S-56) Warner, M.A., Saturday 8:00

Critical Care Medicine & Trauma - 2

- (S-57) Ichinose, F., Sunday 10:30
- (S-58) Navarro, L.H., Sunday 10:30
- (S-59) Larmann, J., Sunday 10:30
- (S-60) Dahms, T.E., Sunday 10:30
- (S-61) Tremblay, M., Sunday 10:30
- (S-62) Maehara, Y., Sunday 10:30
- (S-63) Choukalas, C.G., Sunday 10:30

Critical Care Medicine & Trauma - 3

- (S-64) Hino, H., Sunday 3:30
- (S-65) Shaikh, S.F., Sunday 3:30
- (S-66) Lessa, M.A., Sunday 3:30
- (S-67) Weißenbichler, S., Sunday 3:30
- (S-68) Zaidi, O.A., Sunday 3:30
- (S-69) Mudumbai, S., Sunday 3:30

Critical Care Medicine & Trauma - 4

- (S-70) Pickering, B.W., Monday 8:00
- (S-71) Choukalas, C.G., Monday 8:00
- (S-72) Okawa, H., Monday 8:00
- (S-73) Matos, J.R., Monday 8:00
- (S-74) Davenport, D., Monday 8:00
- (S-75) Rehberg, S., Monday 8:00

Economics

- (S-76) Rice, M.J., Saturday 8:00
- (S-77) Apfelbaum, S., Saturday 8:00
- (S-78) Ehrenfeld, J.M., Saturday 8:00
- (S-79) Apfelbaum, S., Saturday 8:00
- (S-80) Rebello, E., Saturday 8:00

Education & Patient Safety - 1

- (S-81) Cooper, L., Saturday 3:30
- (S-82) Cooper, L., Saturday 3:30
- (S-83) Sharma, V., Saturday 3:30
- (S-84) Brandon, M.W., Saturday 3:30
- (S-85) Cooper, L., Saturday 3:30
- (S-86) Werner, J.G., Saturday 3:30
- (S-87) Gordon, R., Saturday 3:30
- (S-88) Mackintosh, N., Saturday 3:30

IARS 2009 Annual Meeting

Abstract Presenter Presentation Schedule

Education & Patient Safety - 2

- (S-89) Gordon, R., Sunday 10:30
- (S-90) Batai, I., Sunday 10:30
- (S-91) Sidi, A., Sunday 10:30
- (S-92) Coloma, M., Sunday 10:30
- (S-93) Matos, J.R., Sunday 10:30
- (S-94) Crocker, W.D., Sunday 10:30
- (S-95) Digiovanni, N., Sunday 10:30
- (S-96) Scouras, N.E., Sunday 10:30

Education & Patient Safety - 3

- (S-97) Mudumbai, S., Monday 8:00
- (S-98) Elgart, R., Monday 8:00
- (S-99) Epstein, R.H., Monday 8:00
- (S-100) Golembiewski, J., Monday 8:00
- (S-101) McCluskey, S.A., Monday 8:00
- (S-102) Falabella, A., Monday 8:00
- (S-103) Fahy, B.G., Monday 8:00
- (S-104) Tse, J., Monday 8:00

Education & Patient Safety - 4

- (S-105) Schell, R.M., Monday 8:00
- (S-106) Mechlin, M.W., Monday 8:00
- (S-107) Urban, M.K., Monday 8:00
- (S-108) Kakinuma, A., Monday 8:00
- (S-109) Jackson, F.R., Monday 8:00
- (S-110) Ranasinghe, J., Monday 8:00
- (S-111) Fischer, B.A., Monday 8:00
- (S-112) Lowe, D., Monday 8:00

Education & Patient Safety - 5

- (S-113) Slagle, J.M., Monday 10:30
- (S-114) Rice, M.J., Monday 10:30
- (S-115) Zhao, M., Monday 10:30
- (S-116) Mraovic, B., Monday 10:30
- (S-117) Asheld, J.J., Monday 10:30
- (S-118) Kuppusamy, A., Monday 10:30
- (S-119) Sathish Kumar, S., Monday 10:30

Education & Patient Safety - 6

- (S-120) Gunn, P.W., Monday 3:30
- (S-121) Osman, E.S., Monday 3:30
- (S-122) Buvanendran, A., Monday 3:30
- (S-123) Riess, M.L., Monday 3:30
- (S-124) Batai, I., Monday 3:30
- (S-125) Matos, J.R., Monday 3:30
- (S-126) Brakke, T.R., Monday 3:30

Education & Patient Safety - 7

- (S-127) Lowe, D., Monday 8:00
- (S-128) Schell, R.M., Monday 8:00
- (S-129) Osman, E.S., Monday 8:00
- (S-130) Chinn, L.W., Monday 8:00
- (S-131) Chung, F., Monday 8:00
- (S-132) Oswald, S.L., Monday 8:00
- (S-133) Flanigan, M., Monday 8:00

Equipment & Monitoring - 1

- (S-134) Morita, M., Sunday 10:30
- (S-135) Collange, V., Sunday 10:30
- (S-136) Mireles, S.A., Sunday 10:30
- (S-137) Rodriguez, L.I., Sunday 10:30
- (S-138) Takayama, W., Sunday 10:30
- (S-139) Harrell, M., Sunday 10:30
- (S-140) Sugiura, T., Sunday 10:30

Equipment & Monitoring - 2

- (S-141) Maertens, F.M., Monday 1:30
- (S-142) Manecke, G.R., Monday 1:30
- (S-143) Breen, P.H., Monday 1:30
- (S-144) Clingan, J., Monday 1:30
- (S-145) Miura, K., Monday 1:30
- (S-146) Mora, B., Monday 1:30

Equipment & Monitoring - 3

- (S-147) Harrell, P.G., Monday 3:30
- (S-148) Liu, E.H., Monday 3:30
- (S-149) O'Hara, J.F., Monday 3:30
- (S-150) Rodriguez, L.I., Monday 3:30
- (S-151) Sakata, D., Monday 3:30
- (S-152) Ullman, J., Monday 3:30
- (S-153) Yoshida, H., Monday 3:30

Equipment & Monitoring: Airway Devices

- (S-154) Liu, E.H., Saturday 3:30
- (S-155) Liu, E.H., Saturday 3:30
- (S-156) Brandon, M.W., Saturday 3:30
- (S-157) KATO, H., Saturday 3:30
- (S-158) Peck, M.J., Saturday 3:30
- (S-159) Samuels, J.D., Saturday 3:30
- (S-160) Matsuura, N., Saturday 3:30

Equipment & Monitoring: Brain

- (S-161) Wallace, K., Saturday 8:00
- (S-162) Nakai, K., Saturday 8:00
- (S-163) Bennett, H.L., Saturday 8:00
- (S-164) King, M.R., Saturday 8:00
- (S-165) Hrelec, C.M., Saturday 8:00
- (S-166) King, M.R., Saturday 8:00
- (S-167) Skordilis, M.A., Saturday 8:00

Equipment & Monitoring: Oximetry

- (S-168) Rubin, P., Saturday 8:00
- (S-169) Hunter, C.B., Saturday 8:00
- (S-170) Rosenbaum, A., Saturday 8:00
- (S-171) Lobo, E., Saturday 8:00
- (S-172) Berman, J.M., Saturday 8:00
- (S-173) Uchida, M., Saturday 8:00
- (S-174) Iwamuro, K., Saturday 8:00
- (S-175) Critchley, L.A., Saturday 8:00

IARS 2009 Annual Meeting

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Liver/Transplantation - 1

- (S-176) Fukazawa, K., Saturday 10:30
- (S-177) Fukazawa, K., Saturday 10:30
- (S-178) Scher, C.S., Saturday 10:30
- (S-179) Canales, C., Saturday 10:30
- (S-180) Sakai, T., Saturday 10:30
- (S-181) Radpay, B., Saturday 10:30

Liver/Transplantation - 2

- (S-182) Yang, J., Sunday 3:30
- (S-183) O'Hara, J.F., Sunday 3:30
- (S-184) Findlay, J.Y., Sunday 3:30
- (S-185) Saner, F.H., Sunday 3:30
- (S-186) Janigian, D., Sunday 3:30

Liver/Transplantation - 3

- (S-187) Fukazawa, K., Monday 10:30
- (S-188) Fukazawa, K., Monday 10:30
- (S-189) Wagener, G., Monday 10:30
- (S-190) Wagener, G., Monday 10:30
- (S-191) Sampathi, V.S., Monday 10:30
- (S-192) Sundararaman, L.V., Monday 10:30

Neuroanesthesia - 1

- (S-193) Istaphanous, G., Saturday 10:30
- (S-194) Liu, J.V., Saturday 10:30
- (S-195) Haile, M., Saturday 10:30
- (S-196) Sakabe, T., Saturday 10:30
- (S-197) Bergese, S.D., Saturday 10:30
- (S-198) Martynyuk, A.E., Saturday 10:30
- (S-199) Gray, H., Saturday 10:30
- (S-200) Haile, M., Saturday 10:30

Neuroanesthesia - 2

- (S-201) Madison, S.J., Saturday 1:30
- (S-202) Madison, S.J., Saturday 1:30
- (S-203) Hemmings, H.C., Saturday 1:30
- (S-204) Schwarz, U., Saturday 1:30
- (S-205) Xiong, M., Saturday 1:30
- (S-206) Paisansathan, C., Saturday 1:30
- (S-207) McCally, C., Saturday 1:30
- (S-208) Lee, S., Saturday 1:30

Neuroanesthesia - 3

- (S-209) Rajashekara, S.M., Sunday 8:00
- (S-210) Bekker, A., Sunday 8:00
- (S-211) Pong, R.P., Sunday 8:00
- (S-212) Tadler, S.C., Sunday 8:00
- (S-213) Chen, X., Sunday 8:00
- (S-214) Camporesi, E., Sunday 8:00
- (S-215) Bhatt, A., Sunday 8:00
- (S-216) McNeer, R.R., Sunday 8:00

Obstetric Anesthesia - 1

- (S-217) Li, I., Saturday 10:30
- (S-218) Apfel, C.C., Saturday 10:30
- (S-219) Kanniah, S.K., Saturday 10:30
- (S-220) Vallejo, M., Saturday 10:30
- (S-221) Kashiwagi, K., Saturday 10:30
- (S-222) Chakraborty, I., Saturday 10:30

Obstetric Anesthesia - 2

- (S-223) Humayun, S.G., Sunday 8:00
- (S-224) Tong, C., Sunday 8:00
- (S-225) Inagaki, T., Sunday 8:00
- (S-226) Sharma, V., Sunday 8:00
- (S-227) Bezouska, C., Sunday 8:00
- (S-228) Riess, M.L., Sunday 8:00

Pain - Basic Science

- (S-229) Wickley, P.J., Monday 1:30
- (S-230) Damron, D.S., Monday 1:30
- (S-231) Yuge, R., Monday 1:30
- (S-232) Suzuki, S., Monday 1:30
- (S-233) Walker, S.M., Monday 1:30
- (S-234) WITHDRAWN
- (S-235) Walker, S.M., Monday 1:30

Pain - Clinical - Acute - 2

- (S-236) Andersen, K.V., Sunday 8:00
- (S-237) Srivastava, S., Sunday 8:00
- (S-238) Mangla, D., Sunday 8:00
- (S-239) Ben-Ari, A.Y., Sunday 8:00
- (S-240) Imanaga, K., Sunday 8:00
- (S-241) Urban, M.K., Sunday 8:00

Pain - Clinical - Acute - 3

- (S-242) White, P.F., Sunday 3:30
- (S-243) Buvanendran, A., Sunday 3:30
- (S-244) Sloan, P.A., Sunday 3:30
- (S-245) Dai, F., Sunday 3:30
- (S-246) Mangla, D., Sunday 3:30
- (S-247) Novicoff, W., Sunday 3:30

Pain - Clinical - Acute - 1

- (S-248) Candiotti, K.A., Saturday 10:30
- (S-249) Ip, H.V., Saturday 10:30
- (S-250) Fritz, W.T., Saturday 10:30
- (S-251) Ní Mhuircheartaigh, R.J., Saturday 10:30
- (S-252) Humsí, J.A., Saturday 10:30
- (S-253) McEvoy, M.D., Saturday 10:30

IARS 2009 Annual Meeting

Abstract Presenter Presentation Schedule

Pain - Clinical - Chronic

- (S-254) Kroin, J.S., Saturday 8:00
- (S-255) Eckmann, M.S., Saturday 8:00
- (S-256) MacDougall, P., Saturday 8:00
- (S-257) Wright, A., Saturday 8:00
- (S-258) Buvanendran, A., Saturday 8:00
- (S-259) Rebel, A., Saturday 8:00
- (S-260) Clanton, C., Saturday 8:00
- (S-261) Kroin, J.S., Saturday 8:00

Pediatric Anesthesia - 1

- (S-262) Pestieau, S.R., Saturday 1:30
- (S-263) Deutsch, N., Saturday 1:30
- (S-264) Deutsch, N., Saturday 1:30
- (S-265) Marchand, J.E., Saturday 1:30
- (S-266) Pestieau, S.R., Saturday 1:30

Pediatric Anesthesia - 2

- (S-267) Jimenez, N., Saturday 3:30
- (S-268) Valois, T., Saturday 3:30
- (S-269) Naguib, A.N., Saturday 3:30
- (S-270) Naguib, A., Saturday 3:30
- (S-271) Lyew, M.A., Saturday 3:30
- (S-272) Schwarz, U., Saturday 3:30

Pediatric Anesthesia - 3

- (S-273) Loepke, A.W., Sunday 3:30
- (S-274) WITHDRAWN
- (S-275) Radpay, B., Sunday 3:30
- (S-276) Kakavouli, A., Sunday 3:30
- (S-277) Moore, R.P., Sunday 3:30
- (S-278) Taghon, T.A., Sunday 3:30

Pharmacology - Basic Science - 2

- (S-279) Ní Mhuircheartaigh, R.J., Monday 10:30
- (S-280) Antognini, J., Monday 10:30
- (S-281) Lin, J., Monday 10:30
- (S-282) Zuo, Z., Monday 10:30
- (S-283) Singh, J., Monday 10:30
- (S-284) Shao, X.M., Monday 10:30

Pharmacology - Basic Science - 3

- (S-285) Zaugg, M., Monday 1:30
- (S-286) Ring, L.E., Monday 1:30
- (S-287) Montoya G., J.V., Monday 1:30
- (S-288) Camporesi, E., Monday 1:30
- (S-289) Luo, Y., Monday 1:30
- (S-290) Xue, Q., Monday 1:30

Pharmacology - Basic Science - 1

- (S-291) Wagner, C., Saturday 10:30
- (S-292) Herold, K.F., Saturday 10:30
- (S-293) Asakura, Y., Saturday 10:30
- (S-294) Nagashima, M., Saturday 10:30
- (S-295) Do, S., Saturday 10:30
- (S-296) Ito, T., Saturday 10:30

Pharmacology - Clinical - 1

- (S-297) Okamoto, S., Monday 10:30
- (S-298) Stalker, D., Monday 10:30
- (S-299) McKay, R., Monday 10:30
- (S-300) David, M., Monday 10:30
- (S-301) Steinberg, D., Monday 10:30
- (S-302) Edelman, G., Monday 10:30
- (S-303) Steinberg, D., Monday 10:30
- (S-304) Kakinohana, M., Monday 10:30

Pharmacology - Clinical - 2

- (S-305) Steinberg, D., Monday 1:30
- (S-306) Tyler, J., Monday 1:30
- (S-307) Dabir, S., Monday 1:30
- (S-308) Gottschalk, A., Monday 1:30
- (S-309) WITHDRAWN
- (S-310) Jules-Elysee, K.M., Monday 1:30
- (S-311) Morioka, N., Monday 1:30
- (S-312) O'Neill, D.K., Monday 1:30

Pharmacology - Clinical - 3

- (S-313) White, P.F., Monday 3:30
- (S-314) Steinberg, D., Monday 3:30
- (S-315) Rakic, A.M., Monday 3:30
- (S-316) Baumann, D.O., Monday 3:30
- (S-317) Kuwabara, A., Monday 3:30
- (S-318) Tani, M., Monday 3:30
- (S-319) Steinberg, D., Monday 3:30
- (S-320) qian, y., Monday 3:30

Regional Anesthesia - 1

- (S-321) WITHDRAWN
- (S-322) Hiller, D.B., Monday 10:30
- (S-323) O'Donnell, B.D., Monday 10:30
- (S-324) Chelly, J.E., Monday 10:30
- (S-325) Buvanendran, A., Monday 10:30
- (S-326) Ladlie, B.L., Monday 10:30
- (S-327) Chelly, J.E., Monday 10:30

Regional Anesthesia - 2

- (S-328) Mariano, E.R., Monday 1:30
- (S-329) Nader, N.D., Monday 1:30
- (S-330) Grant, S., Monday 1:30
- (S-331) Komai, M., Monday 1:30
- (S-332) Asakura, Y., Monday 1:30

Ambulatory Anesthesia

S-1.**A PROSPECTIVE, RANDOMIZED, DOUBLE-BLIND, PLACEBO-CONTROLLED STUDY EVALUATING THE EFFICACY OF DEXMEDETOMIDINE FOR SEDATION DURING ORTHOPEDIC PROCEDURES****AUTHORS:** S. Kim¹, K. Candiotti², S. Bergese³, P. M. Bokesch⁴, A. Bekker⁵;**AFFILIATION:** ¹Anesthesiology, NYU School of Medicine, New York, NY, ²University of Miami, Miami, FL, ³The Ohio State University Medical Center, Columbus, OH, ⁴Hospira, Lake Forest, IL, ⁵NYU School of Medicine, New York, NY.**INTRODUCTION:** The current multicenter study examined the efficacy of Dexmedetomidine (DEX) as a primary sedative during monitored anesthesia care (MAC) in patients undergoing orthopedic procedures. The efficacy of DEX was measured by comparing the number of patients who did not require rescue doses of midazolam (MDZ) during the procedure (primary outcome). The total dose of rescue fentanyl required for treatment was also compared (secondary outcome).**METHODS:** The study protocol was approved by the local IRB. Ninety seven subjects undergoing orthopedic procedures to be performed under MAC were randomized in a 2:2:1 ratio to receive either DEX 1.0mcg/kg load (DEX1), DEX 0.5mcg/kg load (DEX 0.5), or a placebo (PLB) over a 10 minute period. The infusion rate of DEX in study patients was 0.6mcg/kg/hr. Patients randomized to placebo were started a 0.9% normal saline infusion at an equivalent rate. The level of sedation achieved was assessed by a blinded observer after 15 minutes of study drug infusion using the Observer Assessment of Alertness/Sedation Scale (OAA/S). The observer measured the OAA/S every 5 minutes along with hemodynamic and respiratory data (BP, HR, RR and SpO₂) until the conclusion of the procedure. The target OAA/S score during the study was ≤4. If after 15 minutes of study drug the OAA/S was >4, the DEX infusion was increased to a maximum of 1.0mcg/kg/hr or if the OAA/S ≤3, DEX was decreased to a minimum of 0.2mcg/kg/hr. In patients randomized to placebo, a 0.9% normal saline infusion was increased or decreased at an equivalent rate. After titration of the DEX or placebo infusion, subjects with OAA/S >4 received rescue midazolam 0.5mg IV incrementally. Local anesthesia or a peripheral nerve block was administered prior to incision. If the subject complained of pain after 15 minutes of study drug infusion, rescue fentanyl (25mcg IV) was given incrementally.**RESULTS:** Fifty six percent of patients in the DEX 1 group and 39.5% of patients in the DEX 0.5 group did not require any additional midazolam during the procedure (Table 1). In contrast, all patients in the placebo group required supplemental midazolam. The total dose of rescue fentanyl was significantly higher for patients in the PLB group than either DEX 0.5 or DEX 1 groups. There were no serious adverse hemodynamic or respiratory events requiring intervention in either DEX or placebo groups.**DISCUSSION:** DEX 1 mcg/kg and DEX 0.5mcg/kg were efficacious for sedation in patients undergoing orthopedic procedures under MAC. Patients in both DEX groups had significantly lower requirements for rescue MDZ and rescue fentanyl compared to placebo. Our data suggests that DEX is a safe and effective sedative in patients undergoing orthopedic procedures and decreases fentanyl requirements.**Table 1. The perioperative use of MDZ and fentanyl.**

Table 1. The perioperative use of MDZ and fentanyl. *Pearson Chi-square test					
	DEX 0.5 mcg/kg n (%)	p-value*	DEX 1 mcg/kg n (%)	p-value*	Placebo n (%)
N	38		39		20
MDZ not required	15 (39.5)	0.001	22 (56.4)	<.001	0
Mean MDZ, mg (SD)	1.9 (2.40)	<.001	1.0 (1.73)	<.001	5.6 (3.65)
Fentanyl, mcg (SD)	51.4 (55.80)	<.001	37.8 (49.63)	<.001	138.8 (94.76)

S-2.**THE INTRODUCTION AND EVALUATION OF THROUGHPUT AND CAPACITY DRIVEN 'WORK-PRACTICE CHANGES' FOR A STAND-ALONE SOFT TISSUE TRAUMA OPERATING THEATRE****AUTHORS:** B. D. O'Donnell¹, K. Walsh², G. Iohom², G. D. Shorten²;**AFFILIATION:** ¹Anaesthesia and Intensive Care Medicine, Cork University Hospital, Cork, Ireland, ²Cork University Hospital, Cork, Ireland.**INTRODUCTION:** Operating room (OR) time is an expensive and limited resource. Deliberate system design [1], anesthesia room use [2], patient parallel processing [3], and regional anesthesia (RA)[4] have been shown to improve operating room performance and capacity. Decreasing non-operative time (NOT) improves OR performance [5]. We designed a collaborative process involving nurses, orderlies, surgeons and anesthesiologists to introduce a series of work practice changes (WPCs). The objective of the study was to determine the impact of the WPCs on OR throughput (our hypothesis being that an increase of 20% would result).**METHODS:** With Institutional Ethics Committee approval, a package of WPCs was introduced to a 'stand-alone' OR, catering for plastic surgery soft-tissue trauma and burns patients. The WPCs included additional attending anesthesiologist hours, one full time equivalent (FTE) perioperative nurse, improved interdisciplinary communication channels, agreed day start and finish times, walking ambulatory patients to the OR, task parallel processing, use of RA, recovery room fast-track protocols, and streamlined pre-operative patient processing ensuring 'readiness for surgery'.

Baseline data were collected for eight weeks prior to and eight weeks following the introduction of the WPCs.

RESULTS: All WPCs were successfully implemented except: i. employment of an additional peri-operative nurse (due to national financial and staffing constraints) and ii. patient parallel processing was not possible due to i. Anesthesia, including performance of RA, was administered sequentially in the OR.

Data were collected for a total of 16 weeks involving a total of 248 surgeries (135 baseline; 113 intervention). Group characteristics and secondary outcome measures are detailed in Table 1. Although ACT and RR duration were reduced, there was no improvement in NOT 55.6 (33.1) Vs 52.3 (29.8) minutes mean (SD) p=0.48; operating room throughput 4.4 (1.4) Vs 4.2 (1.1) cases per day p=0.6 or in daily cases cancelled 3.5 (2.8) Vs 4.1 (2.4) p=0.38 in baseline and intervention phases respectively. The duration of surgery as a proportion of the duration of the working day not increase 41% (11) Vs 39.5% (11) p=0.6 from baseline to intervention phase.

DISCUSSION: This study failed to deliver the expected improvement in OR throughput. The inability to employ one extra perioperative nurse limited the investigators ability to parallel process patients. Increased OR throughput was not achieved by introducing cost-neutral WPCs. Improved efficiency may be achieved by introducing and appropriately evaluating interdisciplinary OR system changes permitting the conduct of anesthesia outside the OR [4,6]. It is likely that an increase in suitably trained staff is required to realise certain of these benefits.**References**

1. Anesthesiology 2005;103:406-18.
2. Anesthesiology 2005;103:401-5.
3. Anesthesiology 2005;103:391-400.
4. Anesthesiology 2005;102:1001-7.
5. Surgery 2006;140:509-16.
6. Anesthesiology 2008; 109:25-35.

Table 1 Group Characteristics and Secondary Outcome Measures.

Table of Contents		Baseline	Intervention	Significance
● Variable				
Variable				
Age (years)		24.3 (19.8)	29.4 (15.6)	NS
Gender (M:F)		89:46	83:30	NS
ASA Status (n)				
	I	92	83	NS
	II	26	20	NS
	III	4	10	NS
Nurse Staff Numbers (Daily Whole-Time Equivalents)		3.5 (2.9)	4.2 (2.4)	NS
Theatre Set-up Time (min)		34.6 (38.8)	33.2 (27.1)	NS
Anesthesia Controlled Time (min)		15.4 (9.6)	11.9 (6.2)	P = 0.001
Theatre Turnover Time (min)		11.6 (13.3)	9.5 (5.6)	NS
Recovery Room Duration (min)		30 (20.5)	20 (17.7)	P = 0.001
Non-operative time		55.6 (34.1)	52.3 (29.8)	NS
Duration of Surgery (min)		51.6 (39.6)	51.8 (47.9)	NS
Duration of Individual Measured Delay (min)		56.9 (49.6)	48.1 (45.5)	NS
Daily Measured Delays (min)		130.9 (73)	118 (71.9)	NS

All data presented as Mean (SD)

S-3.

COMPARISON OF DEXMEDETOMIDINE WITH A COMBINATION OF MIDAZOLAM AND KETAMINE IN MONITORED ANESTHESIA CARE FOR AESTHETIC FACIAL SURGERY

AUTHORS: Y. Inagaki¹, K. Sogabe²;

AFFILIATION: ¹Anesthesiology and Critical Care Medicine, Tottori University Faculty of Medicine, Yonago, Japan, ²Renaissance Aesthetic Medical Center, Kobe, Japan.

Dexmedetomidine (DEX), an alpha 2 adrenoceptor agonist, had been used in office-based anesthesia and its efficacy was provided recently (1). However, that report did not revealed a standard infusion rate of DEX to maintain appropriate sedation level during aesthetic facial surgery in monitored anesthesia care (MAC). We conducted this prospective study to clarify the standard infusion rate of DEX and to compare a previous sedation technique with midazolam and ketamine (MK) on suitability for MAC.

[METHODS] After obtaining approval of our hospital Ethics Committee, forty-five consenting female patients who underwent eyelid surgery, liposuction of face and face lifts were assigned to two study groups according to patient's decision. The patients received no preanesthetic medication. Routine monitoring was used. Patients in the DEX group (n=27) were infused intravenously (iv) at a rate of 4 µg/kg/h until sedation level attained to OAA/S score 3 and thereafter the infusion rate was reduced to 0.4 µg/kg/h. Patients in the MK group (n=18) received iv midazolam 2 mg and 0.2 mg/kg of ketamine. Local anesthesia was done using 1% lidocaine with epinephrine 1:200,000 after patient's sedation level attained to OAA/S 3. The infusion rate of DEX was decreased by 0.1 µg/kg/h when OAA/S was <3 and increased when OAA/S was >3. The patients were given 1 mg of midazolam when their OAA/S was >3. Patient's OAA/S score was evaluated every 10 min after local anesthesia by an independent nurse. Their pain level was also measured using verbal rating scale (VRS) from 0 (no pain) to 100 (worst pain imaginable) at the same time. Pentazocine 15 mg was iv injected when VRS of pain was above 40. The infusion of DEX was discontinued at the end of surgery. We evaluated the following items; time to OAA/S 3, requirements of midazolam and DEX to maintain OAA/S 3, total doses of pentazocine, time to OAA/S 1 after the end of surgery, incidence of adverse effects (PONV and somnolence), and time to discharge. Data was analyzed by Mann-Whitney test. A P value <0.05 was considered statistical significant.

[RESULTS] Patients' profile was similar in the two study groups. Times to OAA/S 3 were also similar. Median infusion rate of DEX was 0.3 µg/kg/h (range: 0.2-0.6 µg/kg/h) and median midazolam injection was 1 mg (0-4 mg). Requirements of pentazocine was significantly less (p<0.001) in the DEX group than in the MK group. Times to OAA/S 1 and discharge were shorter (p<0.01) in the DEX group than in the MK group. Incidence of adverse effects was less (p<0.01) in the DEX group.

[CONCLUSION] Use of DEX for aesthetic facial surgery was more suitable for MAC than a combination of midazolam and ketamine.

[REFERENCE] 1) Plast Reconstr Surg 121: 269, 2008

S-4.**DOES PREMEDICATION WITH MIDAZOLAM DELAY DISCHARGE IN DAY SURGICAL PATIENTS? A SYSTEMATIC REVIEW OF THE CURRENT EVIDENCE****AUTHORS:** R. Malhotra;**AFFILIATION:** Anaesthesia and Critical Care, Southmead Hospital, Liverpool, United Kingdom.

INTRODUCTION: Adult day surgery is set to expand in future years and maintaining patient throughput is essential. Premedication with midazolam can reduce anxiety in day case patients (1) but this must not be at the cost of delayed discharge due to sedation. The aim of this systematic review is to assess whether premedication with midazolam delays discharge in adult day surgical patients.

METHODS: The databases Medline, Embase and Pubmed were searched for trials involving the use of midazolam as premedication for day surgery. All randomised controlled trials comparing midazolam with placebo before general anaesthesia in adult day surgery were included. Trials that did not use time to discharge from hospital as an endpoint were not included. Only three trials (1,2,3) were identified that fulfilled the inclusion criteria. Paper copies of all three were obtained and reviewed.

RESULTS: The three trials showed that there was no statistically significant difference in time to discharge after day surgery following midazolam and placebo premedication. All included trials assessed midazolam against a placebo, were double-blinded and were stated as randomised, although two trials (2,3) did not state the method of randomisation. No trial calculated sample sizes needed to show a difference in time to discharge between the intervention group and the placebo group. One trial (1) gave data for time to discharge from hospital (placebo-group = 84 minutes, midazolam-group = 94 minutes), whilst two trials (2,3) merely stated that there was no statistically significant difference in times but gave no data. Direct comparison of the trials is hampered by the variation in midazolam dosage and route of administration, as well as the anaesthetic technique used. The use of opiates pre-operatively and intra-operatively varied amongst the trials. No trial documented re-admission rates following discharge from hospital.

DISCUSSION: The current evidence suggests that the use of midazolam as a premedication does not result in a delay in discharge after day surgery in adults. However, there is a paucity of suitable trials and a lack of data confirming no delay in discharge from hospital. Most trials use psychometric function tests and discharge from the post-operative recovery room as end-points. A delay in discharge from hospital after midazolam premedication may preclude its usage by anaesthetists and is thus an important and valid end-point. Further large-scale trials are needed to assess this issue. At present, it is difficult to confidently answer the above question, as the evidence base is not sufficient enough.

REFERENCES:

1. Anesthesiology (1989); 71 (4): 495-501
2. Anesthesia and Analgesia (2002); 95 (6): 1601-1606
3. Anesthesia and Analgesia (1997); 85 (2): 301-303

Summary of data from included trials

Included Trial(Reference number)	Number of patients	Type of day surgery	Dose of midazolam	Route of Administration	Time before surgery (minutes)	Delay in discharge
1	150	General Surgery	5 mg	IM	30-60	No
2	45	Gynaecology	7.5 mg	PO	60-90	No
3	30	Laparoscopic Sterilization	0.04 mg/kg	PO	10	No

S-5.**THE USE OF THE GUM ELASTIC BOUGIE FOR INSERTING THE PROSEAL LARYNGEAL MASK AIRWAY ENSURES ALIGNMENTS OF THE DRAINAGE TUBE WITH THE ESOPHAGEAL OPENING****AUTHORS:** G. Sudhakaran Nair¹, V. Chinnappa², H. E-D El-Beheiry², J. Wong², F. Chung²;**AFFILIATION:** ¹Anesthesia, Toronto Western hospital, University of Toronto, Toronto, ON, Canada, ²Toronto Western hospital, University of Toronto, Toronto, ON, Canada.

INTRODUCTION: In clinical practice, the tip of the drain tube of the PLMA(proseal laryngeal mask airway) may not align with the esophageal opening leading to unreliability of its gastroesophageal drainage function. We hypothesize that in adult patients, placement of the PLMA guided over a GEB(gum elastic bougie) previously inserted in the esophagus will lead to a more accurate alignment of the tip of the drain tube with the upper esophageal opening than placement of the PLMA with the curved metal introducer (IT) provided by the manufacturer.

METHODS: Seventy-five adult patients were randomly allocated to have the PLMA inserted using the GEB or IT techniques. The IT technique was performed according to the manufacturer's instructions. The GEB technique involved priming of the PLMA drain tube with a GEB, placing the GEB into the esophagus and 'rail-roading' the PLMA over the GEB into the oropharynx. If the patient could be adequately ventilated, the alignment of the tip of the drain tube and the esophageal opening was verified by a fiberscope introduced through the drain tube. Proper alignment was defined by the visualization of esophageal mucosa after the free passage of the fiberscope > 35 cm into the drainage tube. The fiberscope was also introduced through the airway tube to identify the glottic structures. The sample size was adequate to detect 25% difference between the two groups pertaining to successful alignment with power=0.8 and $\alpha=0.05$. Non-parametric and parametric tests were used as necessary.

RESULTS: There were no differences in the demographics between the two groups. Both techniques led to adequate ventilation and successful placement of the PLMA.

The table below shows that the GEB technique was more successful ensuring the alignment of the tip of the drainage tube with the upper esophageal opening.

	Introducer Technique	Bougie Technique
Overall time for insertion (s)	29.7 \pm 17.6 (n = 38)	47.8 \pm 17.7 * (n = 37)
Esophageal mucosa seen through the drainage tube	31/38 (81.6%)	36/37 (97.3%) *
Structures seen through airway tube	28/38 (73.7%)	37/37 (100 %) *
Anterior & posterior fornices	9/38 (23.7%)	0/37 (0 %) *
Anterior or posterior fornix	10/38 (26.3%)	0/37 (0 %) *
Arytenoids only seen	7/38 (18.4%)	1/37 (2.7 %) *
Esophageal mucosa		

* Indicated statistical significance (p<0.05).

DISCUSSION: The GEB is superior to the IT technique in ensuring the precise alignment of the tip of the drain tube of the PLMA with the upper esophageal opening thus preserving the gastroesophageal drainage function. The results also illustrate that adequate ventilation of a patient with a PLMA does not guarantee the proper positioning of the drainage tube.

S-6.

THE INCIDENCE OF POSTANESTHESIA SHIVERING IN WOMEN AND RELEVANT FACTORS

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AFFILIATION: ¹Anesthesiology, Tracheal Disease Research Centre, National Research Institute of Tuberculosis and Lung Disease-Dr. Masih Daneshvari Hospital, Shaheed Beheshti University, MC., Tehran, Iran, Islamic Republic of, ²National Research Institute of Tuberculosis and Lung Disease-Dr. Masih Daneshvari Hospital, Shaheed Beheshti University, MC., Tehran, Iran, Islamic Republic of, ³Lung Transplantation Research Centre, National Research Institute of Tuberculosis and Lung Disease-Dr. Masih Daneshvari Hospital, Shaheed Beheshti University, MC., Tehran, Iran, Islamic Republic of.

INTRODUCTION: The incidence of postanesthesia shivering varies between 5 and 65 % (1) and along with nausea and vomiting, patients report that shivering is an unpleasant and uncomfortable postoperative complication (2). In addition, it may induce a variety of physiological adverse effects. Gender is also thought to contribute to the development of shivering following surgery (3,4). This prospective descriptive and cross sectional study was performed to find out the incidence of postanesthesia shivering in women and to reveal the influence of several clinical variables on its incidence.

METHODS: This study was carried out in 448 female patients ranked ASA 1 or 2 who underwent gynecologic operations under general, regional or sedation anesthesia techniques over a 7 month period. The patients' demographics, the surgical and anesthetic data were recorded as well. Also, preoperative and postoperative tympanic membrane temperatures as well as the occurrence of postanesthesia shivering were assessed for each patient.

RESULTS: Of the 448 women, 83(18.9%) experienced shivering. Statistical analysis showed that several variables significantly impact on postanesthesia shivering development: the minor versus major and moderate operations, the conscious sedation versus general and spinal anesthesia techniques reduced the incidence of shivering postoperatively. While the use of halothane and N₂O for maintenance of general anesthesia, and intravenous administration of atropine and prostigmine to antagonize the muscle relaxants, as well as the intraoperative administration of larger volume of intravenous crystalloid fluids were associated with increased postanesthesia shivering. Logistic regression analysis identified 3 significant risk factors for increased postanesthesia shivering: The use of halothane for maintenance of general anesthesia, intraoperative larger volume of intravenous crystalloid solutions and the spinal anesthesia technique.

DISCUSSION: Postanesthesia shivering is traditionally attributed to intraoperative hypothermia. However, its occurrence is unpredictable suggesting that other mechanisms than heat loss may contribute to its development (5, 6). All of our female patients entered the recovery room slightly hypothermic (with a mean core temperature of 35.8 ± 0.78). Furthermore, there was equal reduction of body temperature in shivering and nonshivering patients. Our data confirm that not all women who do not shiver are necessarily normothermic. In conclusion, in women the risk of shivering increased with the use of halothane for maintenance of general anesthesia, the intraoperative administration of larger crystalloid solutions and the spinal anesthesia technique. Our data confirm that the perioperative mild hypothermia was unrelated to the incidence of shivering in women.

REFERENCES; 1) Anaesthesia 1992; 47: 845-48. 2) Anesth Analg 1999; 89:625-28. 3) J Post Anesth Nurs 1992; 7: 94-100. 4) Acta Anaesthesiol Scand 1984; 28: 138-43. 5) Anesthesiology 2002; 96:467-84. 6) Br J Anesth 2000; 84:615-28.

S-7.

WITHDRAWN

S-8.**POSTDISCHARGE NAUSEA AND VOMITING: AN UNDER-RECOGNIZED PROBLEM AFTER AMBULATORY ANESTHESIA**

AUTHORS: C. C. Apfel¹, S. Shi², A. Kovac³, A. Shilling⁴, L. John⁵, B. Philip⁶;

AFFILIATION: ¹Anesthesia & Perioperative Care, UCSF, San Francisco, CA, ²UCSF, San Francisco, CA, ³University of Kansas, Kansas, KS, ⁴University of Virginia, Charlottesville, VA, ⁵Mayo Clinic, Scottsdale, AZ, ⁶Harvard Medical School, Boston, MA.

INTRODUCTION: Nausea and vomiting are well recognized complications after surgery.^{1,2} A small survey reported that post-discharge nausea and vomiting was distressful to 35% of patients,³ yet there is to date no large scale survey that quantified the magnitude of the problem for patients after discharge following ambulatory surgeries. Therefore, we sought to determine the incidence of postoperative and post-discharge nausea and vomiting after general anesthesia, to characterize its risk factors and - if possible - to develop a simplified risk model that can be used to tailor prophylactic antiemetic interventions prior to patients' discharge home.

METHODS: With IRB approval and informed consent we conducted a prospective survey to obtain pre-, intra-, and postoperative data from adult patients who underwent elective surgery under general anesthesia in academic and non-academic hospitals. The primary endpoint was the occurrence of postdischarge nausea and vomiting within 48hrs after anesthesia (PDNV).

Considering the frequent use of prophylactic ondansetron, we expected a PDNV incidence of 15%. Our own simulation studies suggested that about 2,000 patients would be needed to develop a predictive model with 4-5 independent predictors if the odds ratio is about 2.

RESULTS: We obtained pre-, intra-, and postoperative data from 2172 adult outpatients with the following characteristics (95% CI or interquartile range): age 49.5±15.4 years, body mass index 28.5±0.16 mg/kg², 64.7% females, 84.8% non-smokers, 30.2% with a history of PONV, 79% caucasian, 10.4% african-american, 5.5% latino, 3.4% asian and 1.7% other ethnicities. Average surgery and OR times were 1.06±0.8 and 1.06±0.8 hrs. The most frequent procedures (>5%) were: 11.6% gynecological, 11.1% arthroscopy, 10.4% breast, 8.8% ENT, 8.3% D/C, 6.7% cystoscopy, and 6.4% other orthopedic surgery.

The incidence of PDNV was 37.1%. The incidences of nausea and vomiting were 19.8% and 3% in the PACU, 36.7% and 11.9% postdischarge, and 44.1% and 11.9% over the 48hrs period. Ondansetron and dexamethasone were given to 77.3% and 48.3% of patients. Preliminary multivariable analysis of two centers identified the following independent predictors (odds ratio): expected nausea (but not history of PONV, 1.53), age (0.76 per decade), female sex (2.08), surgery time (1.19 per hour), postoperative fentanyl (1.66 per 100 mcg), and nausea in the PACU (2.80). History of PONV, non-smoking status, intraoperative antiemetics, types and approaches of surgery were not significant predictors.

DISCUSSION: Our results showed a substantial incidence of postdischarge nausea and vomiting after ambulatory anesthesia. History of PONV and non-smoker were not independent predictors for PDNV when postoperative fentanyl and nausea in the PACU were taken into consideration. The data will be used to develop a predictive model to identify patients who may suffer from nausea and/or vomiting following hospital discharge.

REFERENCES:

1. *Anesthesiology*; 77:162-84, 1992.
2. *JAMA*; 287(10):1233-6, 2002.
3. *Anesth Analg*; 80(5):903-9, 1995.

S-9.**INCIDENCE OF RISK FACTORS FOR POSTOPERATIVE NAUSEA AND VOMITING IN PATIENTS PRESENTING FOR ELECTIVE SURGERY**

AUTHORS: M. Vigoda¹, M. Wormack², K. Candiotti², D. Lubarsky²;

AFFILIATION: ¹Anesthesiology, University of Miami, Miami, FL, ²University of Miami, Miami, FL.

INTRODUCTION: If untreated, up to one third of patients having surgery will develop post operative nausea and vomiting (PONV). [1] Previous studies suggest that patients are concerned about PONV even more than postoperative pain.[2] Apfel's commonly used risk factor profile includes 3 preoperative patient-related factors for PONV (i.e., female gender, non-smoker, and a history of motion sickness or prior PONV). [3] While postoperative opioid administration is the fourth risk factor, this is not necessarily known at the time of preoperative evaluation. We determined the incidence of risk factors for PONV in the population of patients presenting for elective surgery.

METHODS: All patients seen in our ambulatory preoperative clinic who are scheduled for elective surgery, have an electronic history and physical recorded during their preoperative visit. We reviewed the preoperative records of 11,203 patients who underwent elective surgery between Jan 07 and Oct 08 and determined the incidence of PONV risk factors known prior to surgery.

RESULTS: After reviewing 11,203 preoperative records, we determined that 14% of patients had 0 risk factors, 40% had 1 risk factor, 42% had 2 risk factors and 4 % had 3 risk factors.

DISCUSSION: While PONV is of great concern to patients, the incidence of PONV risk factors in a general surgical population may not be well recognized by anesthesiologists. When evaluated preoperatively, almost 50% of patients are at moderate to high risk (i.e., 2 or 3 risk factors). Because some patients will receive opioids postoperatively, the risk factor profile will change, with a certain proportion of patients moving into the next highest classification increases. Assuming 50% of patients receive postop opioids, 71% will be a moderate risk for PONV and 25% will be at high risk. If 75% receive postop opioids, 36% will be at high risk for PONV. Rather than considering the occasional patient to be at risk for PONV, perhaps we should consider that most patients are at risk and that it is the occasional patient that is NOT at risk for PONV.

Incidence of Risk Factors for PONV for Elective Surgery

			Estimated change in distribution of % of patients in risk categories based on probability of receiving postop opioids	
Risk Category	Number of Risk Factors when seen in clinic	Percentage of Patients in this Category	Assuming 50% of patients receive postop opioids	Assuming 75% of patients receive postop opioids
Low	0	14%	7%	3.5%
	1	40%	27%	20.5%
Moderate	2	42%	41%	40.5%
	3	4%	23%	32.5%
High	4	Not applicable	2%	3%
		100%	100%	100%

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S-10.

SYSTEMIC LIDOCAINE DECREASES PERIOPERATIVE OPIATE REQUIREMENTS AND DOES NOT PROLONG RECOVERY TIME IN AMBULATORY SURGERY PATIENTS

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INTRODUCTION: Systemic lidocaine modulates inflammatory responses, improves postoperative analgesia, bowel function and leads to a significantly reduced postoperative stay^{1,2}. Pain, nausea and vomiting (PONV) remains a common reason for delay in discharge especially in the ambulatory setting. The goal of this study was to determine the effect of IVlidocaine on time for discharge from PACU in ambulatory surgery patients. Secondary outcome measures were the effect on post-operative pain and PONV.

METHODS: Following IRB approval 67 patients were enrolled in this prospective double blinded study and randomized either to receive lidocaine (2 mg/kg/h) or placebo infusion. Anesthetic management during surgery was standardized for lidocaine bolus (1.5mg/kg), opioid use (fentanyl as required, morphine up to 0.15 mg/kg); ketorolac up to 30 mg IV and PONV prophylaxis (dexamethasone up to 0.1 mg/kg). After surgery, patients were monitored in PACU and lidocaine infusion was discontinued after one hour. Pain was assessed by a visual analog scale (VAS), and treated with either fentanyl (0.5-1 µg/kg) or morphine (0.01-0.02 mg/kg). Nausea was treated using ondansetron 4 mg. If persistent, a second-line drug of choice was used. Discharge readiness was assessed by the modified Aldrete score of ≥8. Follow-up telephone calls were made 24 hours later. Data were analyzed by t-test, chi-square or Fisher-exact-test and are presented as mean±SD.

RESULTS: Demographic data, type and duration of surgical procedures were comparable between groups. 11 patients were withdrawn without analyzing of data. Intraoperative opiate use was significant less in the lidocaine group as compared with the placebo group, in PACU and during total study period (table 1). At 24 hours, opioid consumption was no significant differently. Patients in the lidocaine group reported less pain in PACU (3.1 ±2.04 vs. 4.5 ±2.85, p=0.043). 24 hr later there were no differences in pain score (4.1±1.76 vs. 4.0±2.38, p=0.97). In the subgroup of patients undergoing nonabdominal surgery there was also a trend toward lower pain in PACU (2.3±2.07 vs. 3.7±2.22, p=0.2). 24 hours after surgery these patients reported pain scores of 3.3±1.89 vs. 3.8±2.11; p=0.64. Additionally, opioid consumption in OR was significantly less in this subgroup for patients receiving lidocaine and during the whole study period. In PACU and 24 hour after surgery the amount of opioid use was not significantly different. No differences could be observed with respect to PONV and readiness for discharge (133±58 min vs. 135±55 min, p=0.89). No serious adverse events were recorded.

CONCLUSION: Perioperative IVlidocaine leads to a significant reduction of opiate requirements in the ambulatory setting for different kinds of surgery as well as abdominal as nonabdominal surgery, but a decreasing in time to discharge was not observed.

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Table 1:

Total study group	IVlidocaine group	Control group	P value
Opioid consumption [mg]			
OR	20.52±10.55	30.15±16.59	p=0.017
PACU	8.72±9.54	15.93 ±10.95	p=0.015
24 hr after surgery	7.60±8.23	8.36±8.57	p=0.75
Total study period	36.98±19.03	54.43±18.00	p=0.001
Subgroup nonabdominal surgery			
OR	21.75±8.81	36.78±17.94	p=0.049
PACU	4.75±6.67	14.24±11.21	p=0.054
24 hr after surgery	6.64±5.96	6.86±7.23	p=0.95
Total study period	33.14±15.89	57.88±21.45	p=0.017

S-11.

A PERIOPERATIVE AMBULATORY APPROACH FOR AN ADULT PATIENT WITH UNREPAIRED CONGENITAL HEART DISEASE, EISENMENGER SYNDROME, AND DEVELOPMENTAL DELAY IN NEED OF VISION PRESERVING SURGERY

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A 38 year old developmentally delayed female with trisomy 21, unrepaired common AV canal defect leading to Eisenmenger's Syndrome, secondary polycythemia, IDDM, and hypothyroidism presented for phaeoemulsification and intraocular lens surgery to preserve vision in her only functional eye. She presented cyanotic with a baseline SpO₂ of 78% on room air, preserved left ventricular function and dyspnea with exertion. She was medically maximized on furosemide, digoxin, bosentan, levothyroxine, metoprolol, fexofenadine, ASA and insulin SQ therapy. Her elderly parents would only consent to surgery if the patient was allowed to leave the hospital the same day.

Within the main operating room, utilizing a non-rebreathing mask and standard ASA monitors, the patient underwent intravenous sedation consisting of a Precedex® infusion, ketamine and fentanyl. The surgery team performed a retrobulbar block and then completed corrective surgery in less than sixty minutes. Following discontinuation of the intravenous sedatives, the patient awoke and quickly returned to her baseline level of cognitive function. She tolerated the procedure well and was discharged to home after 3 hours. Follow-up phone call 24 hours after the procedure revealed an appreciative patient and parents without any concerns over their daughter.

Balancing the complexity of this patient medical condition along with her challenging developmental and emotional state, we decided to proceed with an approach of ambulatory surgery. Given her unrepaired congenital heart condition, she was at high risk for complications during and after the utilization of potent anesthesia medications. A thorough understanding of her pathophysiology and the pharmacologic principles of the sedative medications used in this case allowed for a successful surgery and preservation of this patients vision in keeping with the parents desire for ambulatory surgery.

S-12.**DROPERIDOL HAS CLINICALLY SIMILAR EFFICACY AGAINST BOTH NAUSEA AND VOMITING**

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INTRODUCTION: Postoperative nausea and vomiting (PONV) is a frequently used term if a patient experiences nausea and/or vomiting after surgery, yet both symptoms are biologically distinct endpoints. It would thus not be surprising if a drug to relieve these symptoms - generally called antiemetics - were more effective against vomiting (emesis is vomiting or retching) - than against nausea or vice versa which might be important when combining antiemetic in certain clinical scenarios. Droperidol has been described to be more efficacious against nausea as opposed to vomiting, yet this was based on a systematic review with comparisons across studies.(1) We have recently conducted a clinical trial with droperidol as one of the randomized factors that is large enough to compare the efficacy of droperidol for the prevention of nausea and for the prevention of vomiting.

METHODS: We analyzed data from 1734 patients undergoing inhalational anaesthesia who were randomly assigned to receive a combination of six interventions, one of which was 1.25 mg droperidol versus placebo.(2) Patients were monitored for nausea and vomiting for the first 24 h after surgery. The time, severity, and characteristics of any nausea or vomiting was recorded on standardized forms. Rescue anti-emetic medication was provided according to the study protocol. For the purpose of this study a 20% difference in the relative risks for the two outcomes was considered clinically relevant.

RESULTS: Patient characteristics and patient-related risk factors were similar in the two groups. Postoperative nausea was reduced from 21.5% (372/1733) in the placebo group to 16% (277/1733) in the droperidol group, corresponding to a relative risk of 0.75 (CI 95% 0.66, 0.84), or a relative risk reduction of 25%. Vomiting was reduced from 7.8% (135/1734) in the placebo group to 5.9% (102/1734) in the droperidol group, corresponding to a relative risk of 0.76 (CI 95% 0.59, 0.96), or a relative risk reduction of 24%. The relative risks of 0.75 and 0.76 were clinically similar and confidence intervals of nausea included the point estimate for vomiting and vice versa.

DISCUSSION: We conclude that droperidol prevents postoperative nausea and postoperative vomiting equally well.

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S-13.**ANALYSIS OF INTRAOPERATIVE ANTI-EMETIC PROPHYLAXIS FOR PATIENTS PRESENTING FOR ELECTIVE SURGERY**

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INTRODUCTION: Up to 20% - 30% of the general surgical population will experience postoperative nausea and vomiting (PONV).[1] The Apfel classification system uses 4 easily identifiable risk factors to estimate the probability of PONV (i.e., female, non-smoker, history PONV or motion sickness and postoperative opioids). [2] We analyzed the intraoperative anti-emetic treatment based on a patient's risk factors to determine how well the SAMBA guidelines for prophylactic PONV therapy are followed. [1]

METHODS: All patients scheduled for elective surgery have a history and physical electronically recorded during their preoperative visit. We reviewed the preoperative and intraoperative records of 11,203 patients (1/1/07-10/23/08). Based on their preoperative risk factors, we determined the number of intraoperative anti-emetic medications administered to patients, relative to their risk factor profile.

RESULTS:**Analysis of Intraoperative Anti-Emetic Treatment Based on Preoperative PONV Risk Factors**

	Medications				
	0	1	2	3	Total
0 risk factors	46.5%	43.4%	9.3%	0.8%	100.0%
1 risk factor	41.8%	46.5%	10.8%	0.9%	100.0%
2 risk factors	31.6%	51.1%	15.4%	1.9%	100.0%
3 risk factors	24.2%	41.8%	25.7%	8.3%	100.0%

DISCUSSION: Because we did not include postoperative opioid administration in our analysis, our risk factor analysis underestimates the complete Apfel risk factor stratification. Nonetheless, adherence to PONV guidelines appears poor. Patients with 0 risk factors (possibly increased to 1 for postop opioids) should not necessarily be treated, although 54% (43.5% + 9.3% + 0.8%) received antiemetics. In fact, 10% were treated with 2 or more medications. Only 34.0% (25.7% + 8.3%) of patients with 3 Apfel risk factors were treated appropriately.

We recommend a multi-institutional study to determine if these treatment patterns are representative of current practice for the general surgical population.

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S-14.

COMPARISON OF NEWER METHOD OF INTUBATION VIA THE GLIDESCOPE V/S OLDER METHOD OF LARYNGOSCOPY

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INTRODUCTION: Numerous studies have reported the favorable efficacy and safety of the Glidescope for orotracheal intubation in patients with easy and difficult intubation (1-3). However, there is no enough available published data on the efficacy and techniques of using the GlideScope in difficult intubation.

METHODS: 50 patients, scheduled for elective surgery requiring the orotracheal intubation, were included in this study. All patients were predicted to have difficult laryngoscopy by recording the Mallampatti class (III & IV).

Group I: Glidescope intubation.

Group II: Macintosh laryngoscope.

The laryngeal view was estimated by the classification of Cormack-Lehane. Then a lubricated pre-curved regular styletted tracheal tube in a "hockey stick shape" was inserted from the right side of the mouth with the tip directed to the right side, and when it is confirmed to have passed the vocal cord, the tracheal tube is then rotated counterclockwise 90° in a horizontal plane bringing it parallel to the GlideScope blade. The intubating stylet was gently withdrawn from tracheal tube by an assistant and the tracheal tube was then advanced downwards until 2 cm after the entire cuff disappeared from sight. In Group II, The Macintosh laryngoscope was used for intubation.

RESULTS: Group I, were successfully intubated from the first attempt with the times required for full visualization of the glottis and for the successful intubation were 12.4±8 s (with a range of 8 to 55 s) and 29.3±6 s (with a range of 20 to 48 s).

The Cormack-Lehane classification indicated that this group of patients their grades were I (8 patients) and II (17 patients). Only two patients showed mild blood stain on the Glidescope blade. All laryngeal views obtained by the Macintosh laryngoscope were classified as grade III (19 patients) and IV (6 patients). The times described above for group I were 27.8±6 s (with a range of 21 to 56 s) and 77.2±7 s (with a range of 45 to 110 s) for this group. In 5 patients, in this group, successful intubation was done after the second attempt. Only, one patient suffered pharyngeal injury. The time changes showed a significant difference between the two groups ($P<0.001$).

DISCUSSION: Our results indicated that using the Glidescope in a predicted cases of difficult intubation with the introduction of the lubricated "Hockey Stick" configuration endotracheal tube on the right side of the mouth with the tip of the endotracheal tube bevel facing to the right side of the mouth, will allow 100% visualization of the glottis with minimal trauma and short duration for intubation.

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S-15.

AKATHISIA AFTER PONV PROPHYLAXIS WITH DROPERIDOL IN DAY-CASE SURGERY; A PILOT STUDY

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INTRODUCTION. Akathisia is a psychoneuromotor phenomenon mainly induced by neuroleptics. Postoperative akathisia induced by droperidol (DHB) as an antiemetic is poorly evaluated. The only controlled trial assessed this disorder on the basis of subjective symptoms reported during a telephone interview. Our pilot study is aimed at the observation of the incidence of postoperative akathisia after administration of DHB, using a standardised and validated scale: the Barnes Akathisia Rating Scale (BARS), the final goal being the calculation of the number of subjects needed for a controlled randomised trial (CRT) on akathisia after PONV prophylaxis with DHB.

METHODS. After institutional approval and informed consent, 51 consecutive female patients, ASA grade 1 - 2, were recruited in this observational pilot study. All were scheduled for minor day-case gynaecological surgery. Patients with known psychiatric or neurological disorders, or on potentially akathisia inducing or correcting medication were not included. Antiemetic prophylaxis was left to the clinical judgement of the anaesthesiologist in charge. Akathisia assessment was performed before discharge using the BARS. A score ≥ 2 is considered as clinically significant. Continuous variables were analyzed with analysis of variance and qualitative variables with the Chi 2 / Fisher test. The number of subjects needed for a CRT was calculated with the G Power 3.0 software.

RÉSULTS. One patient was withdrawn for surgical re-operation. Among the 50 other, 18 received prophylactic DHB before the end of surgery (DHB group). In the DHB group, 13 subjects received DHB 1.25 mg and 5 DHB 0.625 mg. The 32 other patients did not receive DHB (non DHB group). Demographic data and anaesthesia were comparable across the DHB and non DHB groups. The global incidence of akathisia (BARS ≥ 2) was 0.111 (2/18) in the DHB group and 0 in the non DHB group. Incidence of akathisia was 0.153 (2/13) in the DHB 1.25 mg sub group and 0 in the DHB 0.625 mg sub group. The total number of subjects was too small to allow for statistical comparison. Based on the observed incidence, the number of subjects to include in a CRT aimed at the evaluation of akathisia after DHB prophylaxis of PONV is estimated at 106 (α risk = 0.05 and β risk = 0.20).

DISCUSSION. It is essential to use a standardized diagnostic tool to evaluate drug induced akathisia in order to extract the specific symptoms out of the variety of signs a patient may present in the postoperative period. None of the 5 patients treated with 0.625 mg DHB showed akathisia. This leads us to consider assessing a possible dose-effect in the planned CRT. Akathisia should also be evaluated when PONV is treated with other neuroleptics.

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Bleeding/Blood Product Conservation

S-16.

FIBRINOLYSIS-PRONE CLOT FORMATION AFTER SEVERE HEMODILUTION AND FIBRINOGEN SUBSTITUTION: AN *IN VITRO* STUDY

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INTRODUCTION: In massive hemorrhage, the substitution of fibrinogen is presumably the key step to manage dilutional coagulopathy,^{1,2} because the critical decrease in fibrinogen (<100 mg/dL) occurs earlier than other coagulation factors.³ Thromboelastometric techniques have been proven to be useful in monitoring and managing the effect of impaired coagulation system during hemodilution.^{1,2} However, the impact of fibrinolysis that often accompanies hemorrhage on clot stability is less well studied.

METHODS: After written informed consent, citrated blood was drawn from six healthy volunteers. Blood was diluted to 70% with natural saline and adjusted with allogeneic type-matched red blood cell concentrate to restore hematocrit to about 24%. Aliquots of 1 mL diluted blood were incubated with 0, 1.5, and 3 mg fibrinogen (Haemocomplettan® P, CSL Behring, Marburg) and with or without 0.15 µg of tissue plasminogen activator (tPA; Alteplase®, Genentech, South San Francisco). Thrombelastography using ROTEM™ (Pentapharm, Munich) was performed, and the following parameters were collected: maximal clotting formation (MCF, in mm) defined as the maximal amplitude of the tracing; lysis onset time (LOT, in sec) defined as the time needed for clot firmness to decrease by 15% of MCF; and lysis time (LT, in sec) defined as the time needed for clot firmness to decrease by 90% of MCF. All measurements were performed twice. Undiluted whole blood (WB) was used as control.

RESULTS: Addition of tPA reduced MCF significantly in the samples supplemented with no fibrinogen (31 ± 8 mm vs. 8 ± 2; $P < 0.001$), and with 1.5 mg/mL (31 ± 8 mm vs. 8 ± 2; $P < 0.001$), and 3 mg/mL fibrinogen (52 ± 9 mm vs. 31 ± 5; $P < 0.001$), whereas there was no difference in the control with undiluted whole blood (60 ± 4 mm vs. 57 ± 3; $P = 0.164$). LOT and LT were 224 ± 64 sec and 442 ± 221 sec, respectively, for diluted blood with no fibrinogen substitution, 413 ± 71 sec and 616 ± 142 sec ($P < 0.001$ vs. WB), respectively, for substitution with 1.5 mg/mL fibrinogen ($P < 0.001$ vs. WB), 565 ± 153 sec and 983 ± 589 sec, respectively, for substitution with 3 mg/mL fibrinogen ($P < 0.001$ vs. WB), and 1805 ± 440 sec and 2565 ± 688 sec, respectively, for WB.

CONCLUSION: Previous *in vitro* studies indicated that thromboelastometric parameters, especially MCF, become normal or nearly normal after fibrinogen substitution.^{1,2} However, our model showed that the clots even in the highest substitution dosage with fibrinogen were prone to fibrinolysis. This finding suggests that addition of an antifibrinolytic agent might be helpful in restoring clot stability after massive hemorrhage.

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S-17.

THE IMPACT OF APROTININ, RENAL FUNCTION, AND PERIOPERATIVE RISK FACTORS ON MORTALITY: A RETROSPECTIVE SINGLE CENTER ANALYSIS

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INTRODUCTION: After the publication of a NEJM study in 2006 brought into question the safety of aprotinin, significant controversy has surrounded its use (1). Recently, aprotinin has been removed from the market after another large clinical trial documented an increased mortality risk associated with the drug (2). The ongoing debate about aprotinin's safety prompted us to examine clinical outcomes from our own institution asking two specific questions. First: what effect does aprotinin have on mortality when controlling for preoperative kidney function? Second: what effect does the drug have on mortality rates one year later?

METHODS: To answer these two questions, IRB approval was obtained for a retrospective case-control study to evaluate adults undergoing complex cardiac surgery between 2003 and 2005. Complex surgery was defined as repeat CABG operations and combined valve and CABG surgery. Of 1600 cases, 250 were systematically randomized by the department of statistics to one of three groups based on 24 hour preoperative kidney function. These groups were defined as mild (SCr <1.3mg/dl), moderate (SCr = 1.3-2 mg/dl), and severe dysfunction (SCr >2 mg/dl). Then each of these was further stratified into drug and no drug groups. Out of 250 patients, 135 (54%) received aprotinin drug and 115 (46%) received no aprotinin drug. Twenty data points were collected including preoperative and postoperative kidney function, estimated GFR calculations (using age and gender), demographics, medical comorbidities, intraoperative variables, and one year mortality. Only 186 had complete data sets and were ultimately entered for univariate analysis. Those variables which were found to significantly impact mortality ($p > 0.25$) were then incorporated into a multivariable logistic regression model to determine odds risk ratio for our primary outcome variable: all cause one year mortality.

RESULTS: Mortality risk did appear to increase with poorer renal function at entry; however preoperative eGFR did not change the odds ratio of death between drug versus no drug. Hence, there was no detectable interaction between aprotinin and preoperative kidney function. Final multivariable logistic regression model showed adjusted odds of death in the aprotinin-treated patients was 5.92 times higher than those not receiving aprotinin (95% CI: [2.16-16.13], p -value = 0.0006). Diabetes, prime volume, transfusion requirement, and urine output during bypass all appeared to significantly increase mortality risk as well.

DISCUSSION: Our data shows a significant increased risk of mortality associated with aprotinin use. The principal means by which aprotinin increases mortality is not fully understood. One possible mechanism that has been suggested relates to its antifibrinolytic effects. Alternatively, because aprotinin is non-selective, it may inhibit other unintended but important biologic mediators (2). Regardless, our results, like others, advocate that use of aprotinin is not prudent.

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S-18.

ANESTHETIC MANAGEMENT OF AN ELECTIVE ABDOMINAL AORTIC ANEURYSM REPAIR WITH PREOPERATIVE EPIDURAL CATHETER PLACEMENT, COMPLICATED BY INTRAOPERATIVE COAGULOPATHY

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INTRODUCTION: Epidural catheters confer important intraoperative and postoperative benefits. The complexity of epidural catheter management increases whenever a patient develops a coagulopathy or requires anticoagulation. We present an elective abdominal aortic aneurysm (AAA) repair case with potentially catastrophic outcomes secondary to epidural catheter placement before developing intraoperative disseminated intravascular coagulation (DIC).

CASE REPORT: A 69 year-old female with a past medical history of hypertension, coronary artery disease and unidentified alcoholism, presented for an operative repair of AAA. A combined regional and general anesthesia technique was planned. Upon general anesthesia induction, epidural anesthesia was initiated with 10 ml of 0.5% Ropivacaine and the dose was titrated to provide an adequate sensory block level at T6. Heparin was administered intravenously before aortic cross clamping. Later in the case, diffuse bleeding started mainly from the surgical site. Coagulation values which were within normal limits preoperatively, were reported as fibrinogen level of 69 mg/dL, platelets 77,000/ml and ACT >999 seconds. Platelets, fresh frozen plasma, cell saver autologous blood, packed red blood cells and ε-aminocaproic acid were administered. The epidural catheter was not used after the diagnosis of DIC. Upon reestablishing normal coagulation status, catheter was removed on postoperative day three.

DISCUSSION: Besides DIC, dilutional coagulopathy or silent coagulation disorders are few of the possibilities which explain abnormal coagulation values (1). Our patient had a list of probable etiologies for coagulopathy in which DIC was the most probable. (2). Along with replacement of coagulation factors, platelets and packed red blood cells, we administered Protamine and ε-aminocaproic acid to provide hemostasis. After the ε-aminocaproic acid, the bleeding was reduced (3).

A.S.R.A. provides guidelines for regional anesthesia in the anticoagulated patient (4). We avoided three risk factors for spinal hematoma formation per guidelines. We also decided not to use epidural analgesia because of the patient's critical condition and possibility of recurrent coagulopathy. We did not seek an imaging study secondary to the patient's ability to move extremity during frequent neurochecks.

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S-19.

MASSIVE BLOOD LOSS IN A PATIENT WITH PAGET'S DISEASE DURING LAMINECTOMY

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66 y/o male with Paget's disease presented for decompressive Laminectomy. The procedure was attempted a week ago, but it was postponed secondary to excessive bleeding from the surgical site. The night before the procedure, venous embolization was performed by IR to minimize risk of increased bleeding. Two large bore peripheral IV's and an A-line were placed preoperatively. Cell-saver was arranged. Once the bone resection started, profuse bleeding was noted. Two hours into the procedure, the blood loss increased to 2L/hour. The massive transfusion protocol (MTP) was activated. The procedure took 10hrs. Estimated Blood Loss = 17 liters. The patient received a total of: Cellsaver = 6L; PRBC = 13 units; FFP = 11; Platelets = 15 and Crystalloids = 17L.

Although, the presence of a difficult airway is a major concern, bleeding can pose a major challenge, due to the hypervascularization of the bone. Use of the MPT allowed proper resuscitation of the patient. The patient had an uncomplicated post operative hospital stay and was discharged to home.

DISCUSSION: Paget's disease of bone is characterized by excessive osteoblastic and osteoclastic activity, resulting in abnormally thick but weak bones. Complications involve bones (pain), joints (arthritis), and the nervous system (nerve compression, paraplegia).

Patients with evidence of peripheral nerve compression, radiculopathy, or spinal cord compression require decompressive surgery. Involvement of the cervical and thoracic spine may predispose to myelopathy (Figure 1).

Decompression of spinal stenosis should be implemented promptly after failure of antiPagetic therapy. Surgery may fail to reverse the neurological deficit completely and may be associated with serious complications such as dangerously profuse, if not massive, bleeding and a mortality rate of 11%. Preoperative assessment of bone vascularity by means of radionuclide studies of bone blood flow in the affected spinal region is a reliable, simple and reproducible test. In order to decrease potential bleeding during surgery, when there is an increased vascularity in the affected region, a course of medical treatment should be given until the blood flow in the bone is normal. In an emergency, embolisation of the region may be indicated. Because of the expected torrential bleeding during laminectomy, the use of a cell saver is also suggested.

Usually evaluation of the patients with Paget's disease coming to OR is concentrated on airway exam. These patients are known to have a higher rate of difficulties associated with airway management, secondary to anatomical disproportion caused by the disease process. Only some surgical literature mentions excessive bleeding complications. There is limited experience with these group of patients in Anesthesia field. It is crucial to be aware of hemorrhagic complication, and to prepare adequately. Close interaction with the surgical team is crucial. Appropriate preoperative evaluation and preparation are needed.

S-20.

ANEMIA & CEREBRAL MOLECULAR HYPOXIA SENSING IN THE CHRONICALLY HYPERTENSIVE RAT

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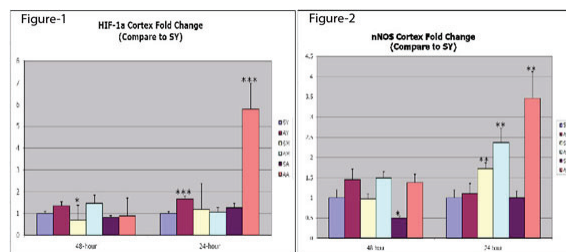
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INTRODUCTION: Anemia complicates major surgery and may be a contributor to cognitive impairment. The Spontaneously Hypertensive rat (SHR) suffers from chronic hypertension cerebrovascular disease. We have recently documented an age dependent cognitive impairment with acute isovolemic anemia in this model. The Hypoxia Inducible Factor (HIF) is the 'master regulator' of the transcription of a host of genes that function to limit injury from hypoxia. Up-regulation of hypoxia responsive genes serves as a sensitive marker of hypoxia. We test the hypotheses that 1) anemia elicits an intrinsic hypoxic response, and 2) that aging with chronic hypertensive cerebrovascular disease predisposes to hypoxia with acute anemia.

METHODS: With IACUC approval, under 2% isoflurane, Young (Y, 3 mo), Mature (M, 9-12 mo), and Aged (A, 15 mo) SHR underwent isovolemic (A) or sham (S) hemodilution protocols. Animals were recovered for 24 or 48 hours prior to sacrifice and brain recovery. The study cohort consisted of 12 groups x 10 animals ea. Cortical and hippocampal samples were obtained with mRNA analysis via Sybr Green RT-PCR. Eleven mRNA levels (HIF-1 α , HIF-2 α , eNOS, iNOS, nNOS, PGK1, CAIX, EPO, EPO-R, Glut-1, and VEGF) were measured at 24 or 48 hrs post treatment.

RESULTS: For groups, the first letter refers to treatment (A-anemia vs. S-sham), and the second letter refers to age group (Y, M, or A). Final hemoglobin for the A groups was 5.1 ± 0.4 g/dl vs. 12.3 ± 0.82 g/dl for the S groups. Anemia elicited statistically significant hypoxia-related gene transcription in all groups (AY, AM, AA), with AM and AA animals demonstrating much more extreme and statistically significant increases in multiple mRNA levels in all regions and time points relative to the AY group. In cortex, mRNA levels in the AA group were particularly elevated relative to AY (7/11 @ 24 hrs, 4/11 @ 48 hrs) ($p < .05$). In hippocampus, mRNA levels in the AM group were particularly elevated relative to AY (4/11 @ 24 hrs, 8/11 @ 48 hrs) ($p < .05$). Representative mRNA levels for HIF-1 α and nNOS are below.

DISCUSSION: 1) Isovolemic anemia elicits molecular evidence of associated cortical and hippocampal hypoxia. 2) Anemic-hypoxia was found to be much greater in cortex and hippocampus with aging and long standing hypertensive cerebrovascular disease. We offer pathophysiological evidence supporting the potential need for an altered and elevated transfusion threshold in the aged with chronic hypertension and cerebrovascular disease. The age-dependent pattern of this anemic-hypoxia matches the aged-dependent pattern of cognitive impairment that we have previously demonstrated with acute isovolemic anemia, and supports a role for anemia in perioperative cognitive impairment.



S-21.

USE OF WHOLE BLOOD COAGULATION THROMBOELASTOGRAPHIC PROFILE FOR PREDICTING POSTOPERATIVE DEEP VEIN THROMBOSIS AFTER MAJOR SURGERY

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INTRODUCTION: The predictive accuracy of rotation thromboelastometry (ROTEM) for postoperative thromboembolic events is highly variable (1). Of the parameters, maximum clot firmness (MCF) and the area under curve (AUC) are expected to better correlate with hypercoagulability (2). We evaluated the risk of postoperative deep vein thrombosis (DVT) and determined if there were significant pre- and/or postoperative differences in the standard ROTEM parameters between DVT and non-DVT patients undergoing major surgery.

METHODS: After ethics committee approval, 81 consenting patients scheduled for major joint replacement (n=34) or cancer resection (n=47) surgery were studied. The ROTEM® Analyser with the EXTEM reagent was used to determine five thromboelastographic parameters [clotting time (CT), clotting formation time (CFT), MCF, α -angle, AUC] on whole blood (WB) immediately before surgery (T_0), end of surgery (T_1) and day-3 after surgery (T_2). Evidence of DVT formation was sought using compression ultrasound and Doppler imaging of the deep venous system of both lower extremities up to proximal external iliac vein before and after surgery. Repeated measures analysis of variance and post-hoc t-tests were performed.

RESULTS: Data from Chinese patients, age 63.2 ± 10.3 years, 38 males and 43 females were presented. 34 (42%) patients developed DVT postoperatively. Baseline ROTEM parameters between the DVT and non-DVT groups were similar; however, patients with cancer showed preoperative hypercoagulability compared to non-cancer patients (increased alpha and MaxVel in EXTEM, $p=0.047$ and $p=0.035$ respectively). As there was a significant interaction between the presence of pre-existing cancer and two parameters: α -angle and AUC ($P = 0.01$ and 0.02 respectively), patients were subgrouped to cancer and non-cancer patients. A posthoc analyses in the cancer patients showed no changes in any of the parameters examined between DVT and non-DVT groups from T_0 to T_1 and from T_1 to T_2 . However, in non-cancer patients, the mean change in alpha between DVT and non-DVT groups was significantly different from T_0 to T_1 (6, 95% confidence interval: 0 to 12) [Fig. 1A]; the mean change in AUC between DVT and non-DVT groups was also significantly different from T_1 to T_2 (-585, 95% confidence interval: -1152 to -18) [Fig. 1B].

DISCUSSION: Perioperative changes of ROTEM parameters α -angle and AUC were of predictive value for developing DVT, but only in non-cancer surgery patients undergoing major joint replacement surgery. These preliminary findings suggest that non-cancer patients who had faster propagation of WB clot formation and higher maximum clot firmness of the established WB coagulum over the perioperative period had a greater risk of developing DVT after surgery. Cancer patients showed preoperatively hypercoagulability, but no significant perioperative changes of ROTEM parameters between the DVT and non-DVT patients.

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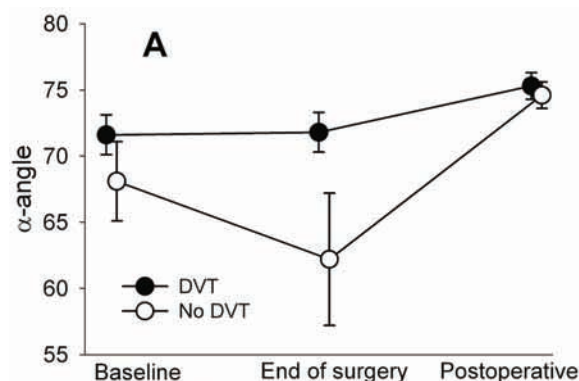


Figure 1A: Mean (95% confidence intervals) α -angle between DVT groups over time in patients without cancer.

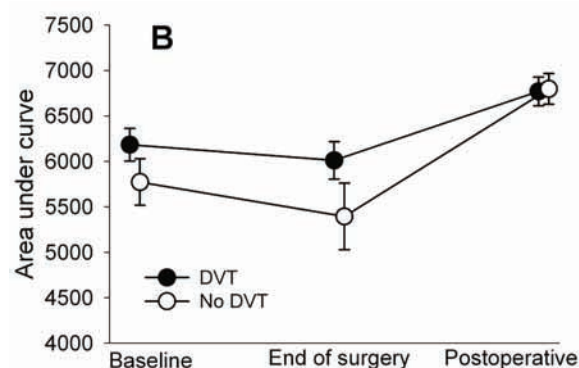


Figure 1B: Mean (95% confidence intervals) area under curve between DVT groups over time in patients without cancer.

S-22.

A RANDOMIZED CONTROLLED TRIAL OF TOPICAL TRANEXAMIC ACID FOR POSTOPERATIVE BLOOD LOSS IN TOTAL KNEE ARTHROPLASTY

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INTRODUCTION: Tranexamic acid (TA) has been shown to decrease blood loss following total knee arthroplasty (TKA)¹. The systemic administration of TA, however, carries the risk of thromboembolic events. In TKA, this is of greater importance, as the patients are at higher risk of thromboembolic events. This study aims to evaluate the role of topical application of TA to reduce perioperative blood loss in patients undergoing a unilateral primary TKA.

METHODS: This is a randomized, double-blind, placebo-controlled clinical trial with three arms. Research Ethics Board approval and informed consent were obtained from all participants. Adult patients undergoing unilateral primary TKA were randomized to: 1) TA 1.5 g or 2) TA 3.0 g or 3) placebo. A tourniquet was used and standard surgical techniques were applied. After the components were cemented, a sterile solution containing TA (1.5 or 3.0 g in 100 cc saline) or placebo (100 cc saline) were applied into the open joint and left in place for 5 min. Excess solution was subsequently suctioned and the joint was immediately closed without any irrigation. Perioperative blood loss was calculated using the difference between pre- and postoperative day 3 hemoglobin (Hb) values. On postoperative day two, Doppler ultrasound was done. Blood transfusion rate, postoperative pain scores, hospital stay, and range of motion were compared between the three groups. Analysis of variance (ANOVA), Chi² test and non-parametric statistics were applied where appropriate. A p value less than 0.05 was considered significant.

RESULTS: Forty-two patients were randomized. Five patients had missing postoperative day 3 Hb values, therefore, 37 patients were included in the per-protocol analysis for the efficacy outcomes. For safety outcomes, all 42 patients were included in the intention-to-treat analysis. Patients in all groups had similar demographic and preoperative hemoglobin values (Table 1). The calculated blood losses were significantly lower in the treatment groups versus the placebo group (Fig 1, p = 0.044). However, post-hoc analysis showed no statistical significance (p = 0.055). The postoperative Hb (day 3) values were significantly higher in the TA groups compared to placebo. (Table 1, p = 0.027). There was no difference between the groups in terms of other efficacy outcomes (postop pain, hospital stay, range of motion, and blood transfusion rate). There were no thromboembolic events detected by Doppler ultrasonography. No other complications were found in any group.

CONCLUSIONS: Topical application of 3g TA can reduce postoperative blood loss by a clinically significant amount i.e. about 750 mL, and result in higher postoperative Hb values in TKA. There were no complications or thromboembolic events following topical application of TA.

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	TA 1.5g n=13	TA 3.0 g n=12	Placebo n=17	P value
Age (year)	69 ± 11	67 ± 9	67 ± 11	.148
Gender (female/male ratio)	10/3	7/5	13/4	.507
BMI (Kg/m ²)	31 ± 6	31 ± 5	33 ± 6	.530
ASA (I/II/III)	1/7/5	0/11/1	0/12/5	.218
Surgery duration (min)	78 ± 13	78 ± 14	78 ± 11	.992
Tourniquet time (min)	81 ± 13	81 ± 14	81 ± 11	.997
Preop Hb (g/L)	140 ± 11	138 ± 16	137 ± 11	.774
Postop Hb on day 3 (g/L) †	99 ± 14	107 ± 12	93 ± 10	.027
% of postop Hb drop †	29 ± 6 %	21 ± 12 %	32 ± 8 %	.024
Total calculated blood loss (ml) †	1680 ± 381	1422 ± 487	2170 ± 979	.044
Postop pain intensity (VAS)	2.7 (0-9)	2.3 (0-7.2)	3 (0-8)	.995
Hospital stay duration (day)	4 (4-6)	5 (4-6)	5 (3-6)	.279
Preop ROM	110 (90-130)	110 (95-135)	107 (70-140)	.949
Postop day 2 ROM	83 (50-95)	75 (65-90)	80 (60-109)	.405

Values are mean ± SD, ratio or median (minimum-maximum), ROM: range of motion (flexion), VAS: visual analogue scale. ASA: American Society of Anesthesiologists. TA: tranexamic acid. BMI: body mass index.
† The data of five patients were missing, 37 patients were included in the per-protocol analysis.

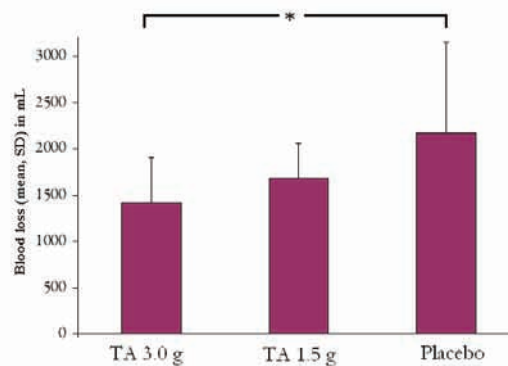


Figure 1- Total calculated blood loss among the three groups of the study. * indicates p value as 0.05, other post-hoc analyses showed non-significant p values. The p value for ANOVA (between three groups) is 0.04.

Cardiothoracic & Vascular - Basic Science

S-23.

SYNDECAN-4 REGULATES LEUKOCYTE RECRUITMENT DURING LPS INDUCED ACUTE LUNG INJURY

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INTRODUCTION, The pathophysiology of pulmonary inflammation leading to acute respiratory distress syndrome remains elusive. Its mortality remains high. Syndecan-4 (Syn4), a transmembrane heparan-sulfate proteoglycan is mainly expressed in monocytes and endothelial cells and is 40fold upregulated after intratracheal LPS or CCL2-administration in monocytes recruited into the alveolar air space. Deletion of Syn4 increases mortality in systemic LPS-induced shock because of a suppressed Syn4-dependent transforming growth factor- β release, which in turn reduces interleukin-1 β (IL-1 β) release. We here examined the role of Syn-4 in pulmonary inflammation using Syn4-deficient mice (Syn4^{-/-}).

METHODS, Syn4^{-/-} and C57BL/6 wild-type (WT) mice were anesthetized with isoflurane (spontaneously breathing 2 Vol% in room air). LPS (15 μ g; *E.coli* serotype 0111:B4) in 50 μ l normal saline or vehicle (sham) were intratracheally instilled. After 24h, anesthesia was re-induced and blood was drawn from the infrarenal aorta for blood gas analysis. Bronchoalveolar lavage (5 ml) was taken for determination of differential cell counts and flow cytometric analysis of leukocyte subpopulations. Saline-perfused lungs were excised and divided: Snap frozen and homogenized for real-time PCR studies of cytokines and adhesion molecule expression or paraformaldehyde-fixed and paraffin-embedded for histological and immunohistochemical evaluation (CD68, PMN).

RESULTS, Pulmonary LPS instillation in Syn4^{-/-} mice led to an increased inflammatory response in lung tissue 24h after treatment compared to WT. Expression of proinflammatory cytokines like IL-6 and TNF α was elevated 1.4-fold and 8-fold, respectively (n=8) in Syn4^{-/-} lung tissue compared to WT. Immunohistochemical analysis of Syn4^{-/-} lungs challenged with LPS revealed 2-fold higher PMN counts (124.7 \pm 15.4 vs. 59.6 \pm 11; p<0.05) and 3-fold increased monocyte counts (9 \pm 2.2 vs. 2.9 \pm 0.9; p<0.05) compared to wild-type lungs. These data correlated with an impaired gas exchange, as Syn4^{-/-} mice had lower arterial pO₂ (107.2 \pm 27 vs. 142 \pm 15.8 mmHg, n=8, p<0.05). Lactic acidosis (6.33 \pm 1.93 vs. 9.06 \pm 3.69 n=8) was compensated by hyperventilation and hypocarbia in WT mice that was (with similar spontaneous respiratory rates) and higher lactate not observed in Syn4^{-/-} (27.8 \pm 7.26 mm Hg vs. 43.6 \pm 12.08, n=8) resulting in a mildly lower pH in Syn4^{-/-} (7.31 \pm 0.09 vs. 7.35 \pm 0.08). Numbers of monocytes as determined by cytospin and flow cytometry were only slightly increased in the BAL fluids of Syn4^{-/-} mice (1.6fold) relative to wild-type, with no differences between groups regarding alveolar PMN counts. However, expression of ICAM-1, an endothelial adhesion molecule was reduced to 48% in Syn4^{-/-} mice.

DISCUSSION, We demonstrate an anti-inflammatory role of Syn4 in lung tissue injury resulting in an accumulation of proinflammatory cells and cytokines in the lung impairing gas exchange. The discrepancy between higher numbers of recruited and transmigrated leukocytes suggests a Syn4 dependent modulation of leukocyte-endothelial or -epithelial transmigration. ICAM-1 has been endighted to play a role in leukocyte extravasation. Diminished endothelial ICAM-1 expression and attenuated intraalveolar migration of proinflammatory cells could thus explain this phenotype.

S-24.

IN-VIVO IMAGING OF FTY720 MEDIATED MACROPHAGE EGRESSION FROM ATHEROSCLEROTIC PLAQUES IN APOE DEFICIENT MICE

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INTRODUCTION: Pharmacological interventions to rapidly stabilize rupture prone, macrophage (M ϕ) rich atherosclerotic lesions could reduce cardio-vascular events peri-operatively. M ϕ egress from plaques by reverse transmigration through ECs or via lymphatic vessels (1) is hampered in an atherogenic milieu (2). High density lipoproteins (HDL) via their sphingosine-1-phosphate (S1P) content reduce monocyte adhesion to ECs and inhibit M ϕ accumulation at sites of inflammation (3). Short-term effects of S1P-signaling on M ϕ accumulation in and M ϕ egression from plaques have not been studied. We tested the effect of a two-day FTY720 treatment, an S1P analogue, on M ϕ content *in-vivo* using Fluorescence-Mediated-Tomography (FMT) (4) in the apoE model. *In-vitro* we examined FTY720's effect on M ϕ adhesion to and basal-to-apical migration through ECs.

METHODS: After animal-care committee approval ApoE deficient (ApoE) mice were used after 16 weeks on western diet. For FMT studies, 5x10⁶ peritoneal M ϕ s labeled with near infrared fluorescent dye (DiR) were injected IV in a subgroup on day 0 to load plaques with fluorescent exogenous M ϕ s. On day 2 and 3 FTY720 (1 μ g/g b.w.) was administered IP. FMT was used prior to treatment and after 48hrs to assess baseline M ϕ load and its changes in a ROI placed over aortic valve and arch. M ϕ s (CD68) and lipid content (Oil-red O) were stained on aortic-arch cryosections. Before M ϕ adhesion assays murine ECs (fEnd.5) were incubated (4h) with FPLC-separated LDL and HDL from FTY720 or vehicle treated apoE mice to study effects on pro/anti-adhesive properties. To assess reverse transmigration ECs were grown on the lower side of Transwell inserts (Corning, Belgium) before M ϕ s were added to the upper compartment. Basal-to-apical transmigration (2d) depending on FTY720 (5 or 50ng/ml) was quantified using confocal microscopy. Data were tested using Mann-Whitney-U test for significance (p<0.05).

RESULTS: Mean-fluorescence-intensity associated with aortic M ϕ s in FMT decreased in FTY720 treated mice by 35% and increased in controls by 50% (day 3 vs. day 1, n=4, p<0.05). FTY720 reduced CD68- and Oil-Red O-positive lesion area by 16% and 26% respectively (FTY720 vs. Ctrl, n=9, p<0.05) with unchanged plaque size. *Ex-vivo* LDL augmented M ϕ adhesion to ECs (215 \pm 30, % of Ctrl., p<0.01, n=6). HDL reduced LDL's pro-adhesive effects (215 \pm 30 vs. 120 \pm 8, % of Ctrl, LDL+vehicle vs. LDL+HDL, p<0.05, n=6). FTY-HDL further decreased M ϕ adhesion (120 \pm 8 vs. 86 \pm 8, % of Ctrl, LDL+HDL vs. LDL+FTY-HDL, p<0.05, n=6). 50ng/ml FTY720 increased M ϕ basal-to-apical migration (330 \pm 43, % of Ctrl., p<0.05, n=5).

CONCLUSIONS: FTY720 improves HDL function by augmenting their anti-inflammatory potential. *In-vitro* FTY720 induces basal-to-apical migration of M ϕ s through an EC monolayer. *In-vivo* M ϕ and lipid content of atherosclerotic lesions is reduced after very brief FTY720 treatment of ApoE^{-/-} mice.

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S-25.

PULMONARY MECHANO-TRANSDUCTION AND LUNG FLUID BALANCE

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INTRODUCTION: We investigated the influence of lung endothelial mechano-transduction on lung fluid balance and tested the hypothesis that components of the glycocalyx participate in lung barrier regulation.

METHODS: The isolated perfused rat lung preparation was used to derive the whole lung filtration co-efficient (K_{lc}) as a function of left atrial pressure (P_{LA}), pulmonary artery pressure (P_a) and pulmonary capillary pressure (P_c). We performed detailed analysis of the P_{LA} vs. K_{lc} relationship over a pressure range of 7, 10, 12 and 15 cm H₂O using two protocols: Protocol 1: Double Pressure Pulse: baseline K_{lc} was assessed at $P_{LA} = 7.5$ cm H₂O in all lungs and then a second step to $P_{LA} = 7, 10, 12$ or 15 cm H₂O was performed. The ratio of K_{lc2}/K_{lc1} was plotted as function of P_{LA} . Protocol 2: Single Pressure Pulse: P_{LA} was stepped from 0 to 7 or 15 cm H₂O. We tested the role of nitric oxide and reactive oxygen species in pressure-induced barrier dysfunction, in both protocols, using L-NAME, D-NAME and TBAP. The role of the glycocalyx in mechano-transduction was tested using heparanase. Detailed analysis of tissue mechanics and hemodynamics were performed to quantify the role of altered barrier function in lung fluid balance. Preliminary data suggest that extra-alveolar vessels maybe the primary site of mechano-transduction induced pulmonary edema.

RESULTS: Protocol 1: In ventilated, perfused rat lungs, the ratio of K_{lc2}/K_{lc1} was unchanged following step increases in P_{LA} to 7, 10 and 12 cm H₂O. When P_{LA} was increased to 15 cm H₂O, K_{lc} increased 7-fold. This response could be completely attenuated with L-NAME and was independent of changes in vascular pressures and tissue mechanics. TBAP had no effect on K_{lc} at any pressure. Protocol 2: K_{lc} at $P_{LA} = 15$ cm H₂O was significantly greater than K_{lc} at 7 cm H₂O and L-NAME completely blocked this increase. The increase in K_{lc} at $P_{LA} = 15$ cm H₂O in the double pressure protocol, compared to $P_{LA} = 15$ cm H₂O in single step protocol, suggest a priming of mechano-transduction pathways. The role of the glycocalyx in barrier function and segmental participation in barrier function were investigated.

DISCUSSION: Our results demonstrate that lung endothelial mechano-transduction leads to increase in K_{lc} and enhanced pulmonary edema beyond what would be predicted based on a Starling model. Nitric oxide appears to be the primary mediator of endothelial barrier dysfunction in the lung. Non-linear dynamics in the permeability vs. pressure relationship suggest a re-evaluation of Starling Principle in understanding hydrostatic pulmonary edema. Our results have important implications for understanding congestive heart failure, fluid overload, diastolic dysfunction and VILI.

S-26.

ATTENUATION OF ISOFLURANE-INDUCED POSTCONDITIONING IN SENESCENT HEARTS IS ASSOCIATED WITH FAILURE TO ACTIVATE RISK PATHWAY

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INTRODUCTION: Experimental evidences have indicated that volatile anesthetics administered at the onset of reperfusion protect heart against ischemia-reperfusion injury through activating RISK (reperfusion injury salvage kinase) pathways. However, the cardioprotective effect is not apparent in clinical situations. Age can be one of important reasons for the discrepancy between clinical and experimental data, because most experimental researches are performed in young, healthy animals and clinical investigations in aged patients. We investigated the cardioprotective effect of isoflurane administered at the onset of reperfusion in senescent rat in vivo and activation of RISK pathway to address a possible mechanism underlying age-related differences.

METHODS: Male Sprague Dawley rats were randomly assigned from their respective age groups (young, 10-14 wk; old, 20-24 mo) to receive either 0.9% saline (control), i.v. or isoflurane (1MAC) for 3 min before and 2 min after reperfusion (ISO postC). Barbiturate-anesthetized rats were subjected to a 30 min coronary occlusion followed by 2 h reperfusion. The western blot analysis was used to assess the phosphorylation of Erk 1/2, Akt, and its downstream target GSK 3 β at 15 min after reperfusion.

RESULTS: Brief administration of isoflurane 3 min before and 2 min into early reperfusion reduced infarct size (56 \pm 8% of left ventricular area at risk, mean \pm SD) compare to control (68 \pm 4%) in young rats, whereas isoflurane did not in old rats (56 \pm 8% in ISO postC and 56 \pm 10% in control, respectively). The phosphorylation of Erk 1/2, Akt, and GSK 3 β was increased in young ISO postC group but not in old ISO postC group compare to the control group in the respective age group.

CONCLUSION: We demonstrated that isoflurane postconditions the heart in young rats, but not in senescent rats. Failure to activate RISK pathway may contribute to attenuation of isoflurane-induced postconditioning effect in senescent rats.

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S-27.

NOVEL BIOMIMETIC POLYMERS ENHANCE GLYCOCALYX-MEDIATED BARRIER FUNCTION IN LUNG ENDOTHELIAL CELLS

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INTRODUCTION Acute changes in lung capillary permeability continue to complicate procedures such as cardio-pulmonary bypass, solid organ transplant, and major vascular surgery and precipitates the more severe disease state Adult Respiratory Distress Syndrome (ARDS). To date there is no treatment targeted directly to the lung microvasculature. We hypothesized that biomimetic polymers could be used to enhance barrier function by increasing the thickness and/or density of the endothelial glycocalyx. To this end, copolymers of N-(2-hydroxypropyl) methacrylamide and methacrylamidopropyl trimethylammonium chloride (poly(HPMA-co-TMA)), possessing positive charges, have been developed as an infusible therapy to target the lung capillary glycocalyx in order to mechanically enhance the capillary barrier and turn off pressure-induced mechano-transduction.

METHODS Polymeric constructs were tested for cytotoxicity and functionality using MTT assays and hydraulic conductivity measurements, respectively. Bovine lung endothelial (BLMVEC) monolayers were exposed to increasing concentrations of polymer (0.1-20 mg/mL) for 90 minutes and were tested for cell viability using an MTT assay.

Cultured BLMVEC monolayers were exposed to poly(HPMA-co-TMA) or HPMA under conditions of increasing hydrostatic pressure. Hydraulic conductivity (Lp) was normalized to baseline Lp at 10 cm H₂O prior to polymer administration.

RESULTS Cytotoxicity studies demonstrate that poly(HPMA-co-TMA) has minimal effect on cell viability compared to inert HPMA. Viability decreased slightly with increasing polymer concentration however percent cell viability did not drop below 95% for any treatment. Both HPMA and poly(HPMA-co-TMA) attenuated pressure-induced increases in Lp. When unbound polymer was removed prior to increasing hydrostatic pressure, poly(HPMA-co-TMA) significantly decreased Lp compared to HPMA alone. Control measurements are recorded at 10 cm H₂O then monolayers are treated with poly(HPMA-co-TMA) [P] or HPMA [H] and subjected to step increases in hydrostatic pressure. In control monolayers that are not exposed to polymer, normalized Lp values for 15 and 20 cm H₂O are 3 and 15 times higher than those at 10 cm H₂O, respectively.

DISCUSSION Decreases in L_p across endothelial monolayers in the presence of poly(HPMA-co-TMA) is evidence of a dampening of mechanotransduction-induced barrier dysfunction. We show the potential for biomimetic polymers targeted to lung endothelium that enhance epithelial-endothelial barrier function thereby attenuating a major component of vascular inflammation.

S-28.

TRAMADOL PROTECTS MYOCARDIUM AGAINST ACUTE ISCHEMIC INJURY VIA MODULATION OF NF- κ B MECHANISM IN RATS

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INTRODUCTION: The aim of this study was to investigate the cardioprotective effect of tramadol in myocardial protection and its mechanism, especially in interfere with the expression and activation of nuclear factor kappaB(NF- κ B).

METHODS: Male Sprague-Dawley rats were randomized into four groups: (1) the sham group: putting through thread, but without ligation of left anterior descending coronary artery, (2) the T + CAO group, pretreatment with tramadol(12.5mg/kg weigh) 15 minutes before coronary artery occlusion(CAO), (3) CAO group. The hearts were excised, and the left ventricle was sectioned into 5-6 slices for TTC staining to observe the infarct size. Expression of NF- κ B and its mRNA were measured by immunohistochemistry and real time RT-PCR. Isolated nuclei of ischemic myocardium were analyzed by flow cytometry to determine activation of NF- κ B.

RESULTS: Expression of NF- κ B mRNA and protein was significantly increased in rat myocardium after CAO 6 hours in the CAO animals and was decreased in tramadol pretreated CAO animals. Flow cytometry assay revealed ischemic injury induced activation of NF- κ B and pretreatment with tramadol attenuated the activation of NF- κ B. CAO for 6 hour induced marked myocardial infarction by 44 \pm 7% (AI/AAR) in the animals while pretreatment with tramadol only caused a myocardial infarct size of 31 \pm 8%. The difference between the two groups is statistically significant ($P<0.05$).

DISCUSSION: We observed, in this study, that acute myocardial ischemia/infarction could cause significant increase in the expression and activation of NF-kappaB, which is in accordance with previous report (1). Blocking the NF- κ B transcriptional activity in vivo, by inhibiting proinflammatory genes expression, results in a reduction of the extent of myocardial infarction (1-3). The findings may suggest that NF- κ B plays an important role in the pathology of myocardial injury in ischemic insult. Therefore the regulation of NF- κ B activation may be a novel and future strategy for myocardial protection. We also found, in this study, that tramadol may possess cardioprotective property via modulation of expression and activation of NF-kappaB.

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S-29.

MATRIX METALLOPROTEINASES AND ECG CHANGES IN HYPERHOMOCYSTEINEMIA

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INTRODUCTION: Aging is associated with higher Homocysteine (Hcy) levels. And Hyperhomocysteinemia (HHcy) is associated with thromboembolic events and atrial fibrillation in humans (1). Identifying patients at risk for thromboembolic events in the pre- and perioperative period is critical for patients' postoperative outcome. Anesthesiologists involved in care of elderly patients are aware of this responsibility. Hcy is a sulfur-containing amino acid byproduct in the metabolism of Methionine (Met). Met is an essential amino acid, demethylation releases methyl groups for DNA and RNA production. Met rich products are protein rich products such as meat, eggs, milk but also legumes. Vitamin B6 and B12 are necessary catalysts in the metabolic pathway. Vitamin deficiency can lead to Hcy accumulation, as well as high intake, renal insufficiency and inherited enzymatic effects. We hypothesize that Hcy induces matrix metalloproteinases (MMPs) which leads to extracellular matrix (ECM) remodeling. Remodeling is followed by conduction system disturbances. Myocardial geometry changes and electrical conduction disturbances are detectable in ECG and echocardiography.

METHODS: Male C57BL6J mice, 12 weeks of age were fed for 12 weeks with Hcy rich diet. ECG was monitored in freely moving mice with an implanted telemetric ECG device for five days. 2D transthoracic echocardiography was performed to assess ventricular diameter changes in M-Mode. Immunoblotting was used for quantification of MMPs and tissue inhibitors of matrix metalloproteinases (TIMPs). Hcy blood levels were measured with high pressure liquid chromatography (HPLC).

RESULTS: ECG showed peaked P waves and loss of P waves in Hcy treated animals. Echocardiography showed left and right ventricular diameter changes in systole and diastole. Immunoblotting showed an increase in MMP 2 and MMP9 expression in Hcy diet animals compared with controls.

DISCUSSION: Hcy induces sinoatrial conduction disturbances and atrial enlargement in telemetric monitored freely moving mice. Matrix remodeling plays a major role in geometry changes and coordinated conduction of electrical current in the cardiac conduction system. Induction of MMPs is responsible for initiating these changes. Geometry changes alone cannot explain ECG changes in sinoatrial conduction. Hcy might have direct neurotoxic effects on the conduction system. These findings can be translated to clinical practice to raise awareness about the risk of cardiac rhythm disturbances and eventually thromboembolic events in patients with high Hcy levels.

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S-30.

DECREASED PLASMA RANTES CONCENTRATIONS DURING CONVENTIONAL ON-PUMP AND ON-PUMP BEATING-HEART, BUT NOT OFF-PUMP CORONARY ARTERY BYPASS GRAFTING SURGERY

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INTRODUCTION: RANTES (regulated on activation, normal T cells expressed and secreted), a potent chemoattractant chemokine, is originally secreted by lymphocytes. Low serum RANTES concentrations are associated with poor outcome in septic shock patients. Decreased levels of RANTES and lymphocyte depletion have been observed in patients following cardiopulmonary bypass (CPB). Off-pump cardiac surgery causes less systemic inflammation. The data of RANTES after off-pump cardiac surgery are scarce. The present study was designed to determine the RANTES levels in patients undergoing conventional on-pump, on-pump beating-heart, or off-pump cardiac surgery.

METHODS: After obtaining the approval of the ethics committee and written informed consents, thirty-three patients undergoing elective coronary artery bypass grafting (CABG) surgery with hypothermic conventional on-pump (n=14), normothermic on-pump beating-heart (n=13) or normothermic off-pump technique (n=6) were included in this study. Blood samples were collected before and at 2 hours after beginning CPB or applying off-pump technique and analyzed for RANTES concentrations. Data were presented as mean \pm SEM.

RESULTS: The plasma levels of RANTES in patients with conventional on-pump and on-pump beating-heart CABG decreased significantly at 2 hours after the start of CPB ($3,300 \pm 400$ pg/mL and $3,500 \pm 400$ pg/mL, both $P < 0.001$, compared with $8,400 \pm 1,100$ pg/mL and $7,100 \pm 700$ pg/mL before CPB, respectively), while the RANTES levels in patients with off-pump CABG did not ($5,200 \pm 1,300$ pg/mL, $P=0.15$ at 2 hours after application of a stabilization device, compared with $7,900 \pm 1,100$ pg/mL before applying the stabilization device).

DISCUSSION: The present study demonstrated that CPB itself, but not hypothermia, causes a decrease of plasma RANTES concentrations. It indicates that off-pump CABG provides less immunosuppression than that by on-pump beating-heart surgery.

S-31.

PHENOTYPING AGING OF THE SPONTANEOUSLY HYPERTENSIVE RAT BRAIN USING 3D DIFFUSION TENSOR IMAGING AT 9.4T: A PRELIMINARY STUDY

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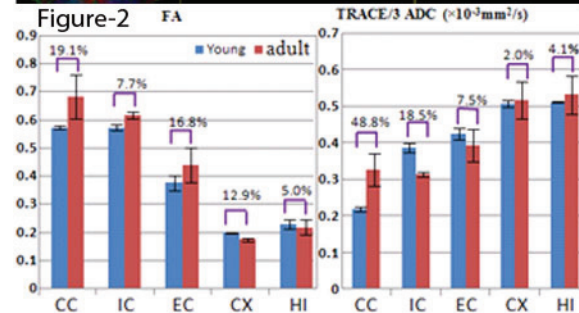
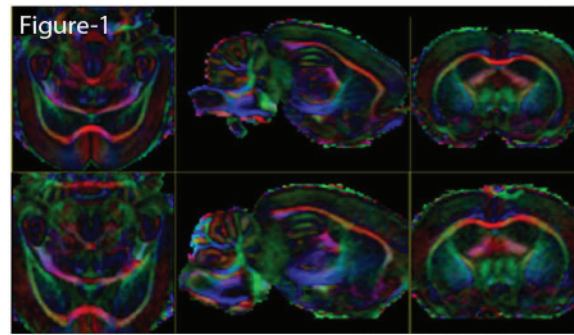
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INTRODUCTION: The Spontaneously Hypertensive Rat (SHR) is phenotypically characterized by hypertension by age 4 months, with cerebrovascular changes evidenced by age 6 months. At 6 months, although volume loss and gliosis in WM regions occurs, this has not been associated with qualitative modifications in myelinated fibers. The SHR is widely used in research for its similarities with humans suffering from hypertension related disease. MRI-based phenotyping of the SHR brain may offer further insight into stroke and cognitive impairment in this strain and its appropriateness for comparative investigations into human disease.

METHODS: Two young (~ 3 months) and two adult (~ 10 months) rats (SHR) were used for this pilot study. Due to the long scanning time of acquiring high resolution DTI images, following sacrifice, animals were perfused using 4% paraformaldehyde and brains extracted. Imaging was performed using a Bruker Biospin 9.4T (Bruker, Ettlingen, Germany) spectrometer. Diffusion-weighted images (DWIs) along nine independent diffusion-encoding directions (six directions with $b=1400\text{s/mm}^2$, three with $b=750\text{s/mm}^2$) were acquired using the 3D multiple-spin echo DW sequence.

RESULTS: DTI calculations were performed using DTIStudio (<https://www.mristudio.org/>). Two diffusion indices of FA (fractional anisotropy) and Trace/3 ADC (apparent diffusion coefficient) were employed to measure the anisotropic and isotropic diffusivities within five representative volumes of interest (VOIs): corpus callosum (CC), internal capsule (IC), external capsule (EC), cerebral cortex (CX), and hippocampus (HI). Figure 1 shows the FA weighted color maps (red: left-right, green: dorsal-ventral, and blue: cranial-caudal) of a young rat (1st row) and an adult rat (2nd row). Quantitative comparisons of FA and Trace/3 ADC are listed in Figure 2.

DISCUSSION: In this preliminary study, we used a 3D-DTI technique with relatively high-resolution, at high magnet field, to investigate the microarchitectural changes in brain tissues between the young and adult SHR. White matter changes were visualized by the diffusion anisotropy maps and fiber tracking. Quantitative analyses showed that the 10 month old SHR had higher FA values within selected white matter tracts, but lower ADC values in some gray matter regions, relative to the 3 month old rats. The direction of the FA changes with aging at 10 months in the SHR is consistent with higher level organization, or at least preservation of WM tract integrity, as well as increased or preservation of dendritic branching within gray-matter regions. A more complete analysis of the SHR brain with multiple ages and voxel based analyses will be presented.



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S-32.

CONTINUOUS MEASUREMENT OF CARDIAC OUTPUT FROM AN ENDOTRACHEAL CARDIAC OUTPUT MONITOR IN PATIENTS UNDERGOING CARDIAC SURGERY

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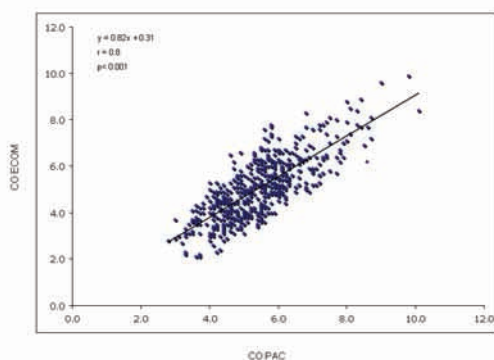
INTRODUCTION: Cardiac output (CO) monitoring is a valuable diagnostic modality used for assessing cardiac function. Pulmonary artery catheter (PAC) thermodilution (TD) measurement remains the gold standard for perioperative CO monitoring, however, PAC-associated morbidity emphasizes the need for a safe, reliable, and non-invasive alternative.

An existing technology, thoracic electrical bioimpedance (TEB), provides accurate measurements but is limited by the signal to noise ratio, as electrical current (1–4 mA at 20–100 kHz) is affected by several anatomical structures in the thoracic cavity. A novel device, the endotracheal cardiac output monitor (ECOM), delivers a stable current (2 mA at 100 kHz) specifically to the ascending aorta, minimizing the signal from other vascular structures and records impedance changes associated with systolic ejection. The aim of this study is to evaluate the accuracy of the ECOM device compared to PAC TD measurements in adult patients undergoing cardiac surgery.

METHODS: IRB approval and informed patient consent was obtained from 29 adult patients undergoing cardiac surgery. All study patients were intubated with ConMed 7.5mm ID ECOM modified endotracheal tubes (ETT) with 7 silver ink-penned plastic electrodes that allow for impedance measurements. In addition, a PAC was placed *via* the internal jugular approach per routine care. PAC TD CO and CI measurements and ECOM measurements were collected simultaneously for comparison at four time points: post-induction; immediately prior to the initiation of cardiopulmonary bypass (CPB); immediately after separation from CPB; and following sternal closure. In order to compare PAC TD and ECOM CO and CI results, bias and precision statistics were performed and data were displayed as Bland-Altman plots.

RESULTS: Analysis of 542 paired data sets of ECOM and TD measurements showed a difference of means (bias) of 0.19 L/min/m² with ± 0.42 L/min/m² precision for CI. Analysis of 381 paired data sets of ECOM and TD measurements excluding patients with moderate to severe AR showed a difference of means (bias) of 0.23 L/min/m² with ± 0.41 L/min/m² precision for CI. Analysis of 161 paired data sets of patients with moderate to severe AR showed a difference of means (bias) of 0.08 L/min/m² with ± 0.44 L/min/m² precision for CI. There is a linear correlation between ECOM and TD CO ($r=0.8$, Figure 1).

DISCUSSION: Preliminary results indicate that ECOM CO and CI continuous measurements are highly accurate when compared with TD measurements in patients who undergo cardiac surgery. The use of ECOM was safe in these patients and there were no noted complications.



S-33.

CHOICE OF INTRAOPERATIVE OPIOID CAN INFLUENCE QUALITY OF POSTOPERATIVE RECOVERY IN PATIENTS UNDERGOING ELECTIVE CARDIAC SURGERY WITH CARDIOPULMONARY BYPASS

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INTRODUCTION: Early experimental and clinical data suggest that morphine possesses several unique properties which may impact outcomes after cardiac surgery. The administration of morphine can induce protection against ischemia and reperfusion injury.^{1,2} In contrast, fentanyl does not appear to produce a cardioprotective effect.^{3,4} Data also suggests that morphine has unique anti-inflammatory properties, which are not shared by other clinically-used opioids,^{5,6} and may attenuate the inflammatory response to cardiopulmonary bypass.⁷ The aim of this clinical investigation was to determine whether the choice of intraoperative opioid (morphine or fentanyl) influences early recovery after cardiac surgery with cardiopulmonary bypass (CPB).

METHODS: Ninety patients undergoing cardiac surgery with CPB were enrolled in this randomized, double-blinded trial. Patients were randomized to receive either morphine (40 mg) or fentanyl (600 µg) as part of a standardized opioid-isoflurane anesthetic. Quality of recovery was assessed using the QoR-40 questionnaire preoperatively and on postoperative days 1–3. During the first three postoperative days pain was measured using a 100-mm visual analogue scale (VAS) and use of intravenous and oral pain medications (morphine and Vicodin) was quantified. Hemodynamic parameters, hospital and ICU length of stay, duration of tracheal intubation, postoperative febrile reactions, and organ morbidities were evaluated.

RESULTS: Complete data were collected on 84 subjects. Global QoR-40 scores were significantly higher in the subjects receiving intraoperative morphine compared to patients administered fentanyl on postoperative days 1 (173 vs. 160, $P<0.0001$), 2 (174 vs. 164, $P<0.0001$), and 3 (177 vs. 167, $P<0.001$). Significant differences between groups were observed in the QoR-40 dimensions of emotional state, physical comfort, and pain (all $P<0.01$ – 0.0001). Postoperative VAS pain scores were significantly lower in the morphine group 15 minutes and 4 hours post-extubation and on postoperative days 1 and 2 (all $P<0.01$). Requirements for intravenous and oral pain medications for the first 3 postoperative days were significantly less in the morphine group (all $P<0.001$). The incidence of postoperative febrile responses was also reduced in the morphine group (4.7%) compared to the fentanyl group (56.1%, $P<0.001$). No differences between groups were noted in duration of tracheal intubation, ICU and hospital LOS, or postoperative complications.

DISCUSSION: In patients undergoing elective cardiac surgery with CPB, postoperative recovery is enhanced when morphine is administered intraoperatively as part of a balanced anesthetic technique. We hypothesize that morphine beneficially influences pain, emotional state, and physical comfort during the early postoperative period through an attenuation of the inflammatory response to CPB.

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S-34.**SERUM ADIPONECTIN AND LEPTIN AS PREDICTORS OF THE PRESENCE AND DEGREE OF CORONARY ATHEROSCLEROSIS**

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INTRODUCTION: Recently, the adipocyte derived proteins; adiponectin and leptin, has been found to be associated with obesity, type 2 diabetes, insulin resistance, hyperinsulinemia, dyslipidemia, smoking and the presence of coronary artery disease. However, the association of these proteins with the degree of coronary atherosclerosis has not been well elucidated.

METHODS: Seventy consecutive patients performing diagnostic coronary angiography in our catheterization laboratory for the investigation of coronary artery disease (CAD) were recruited. The control group included 20 consecutive patients who were non-diabetics, non-hypertensives, with no history of a previous acute coronary syndrome, having normal ECG, of matched age, sex, body mass index (BMI), and waist/hip ratio, performing coronary angiography for stable angina with inadequate exercise test results, and proved to have a completely normal coronary angiography. All cases and control were subjected to complete history and clinical examination including 12 lead ECG, measurement of BMI, and hip/waist ratio. Fasting blood glucose, full lipogram, serum adiponectin, and serum leptin were measured. Angiographic evaluation of coronary atherosclerosis was performed by assessing three atherosclerotic indices; severity (transverse disease), extent (longitudinal disease), and pattern (lesion complexity).

RESULTS: The independent predictors of the atherosclerosis lesion severity were larger waist/hip ratio (beta, 0.34), followed by higher LDL-cholesterol (beta, 0.32), low serum adiponectin level (beta, -0.23), older age (beta, 0.19), higher leptin level (beta, 0.17), current unstable angina (beta, 0.17), and finally previous MI (beta, 0.14). This model is a good one as indicated from the model adjusted r^2 (50%). For the extent of atherosclerosis index lower serum adiponectin level was by far the most important independent predictor (beta, -0.45), followed by higher LDL-cholesterol (beta, 0.23), older age and previous MI (beta, 0.21 for both), while higher serum leptin level was only a univariate predictor. The model adjusted r^2 was 65%. For the atherosclerosis pattern index, the independent predictors were previous MI (beta, 0.31), lower serum adiponectin level (beta, -0.29), larger waist/hip ratio (beta, 0.26), higher serum leptin level (beta, 0.24), older age (beta, 0.22), and higher fasting blood glucose level (beta, 20). The model adjusted r^2 was 62%.

DISCUSSION: Both serum adiponectin and leptin might pay an important pathogenic role not only in the occurrence but also in the severity, extent and lesion complexity in CAD patients.

S-35.**INFLUENCE OF DIFFERENT VOLUME REPLACEMENT THERAPY TO THE RENAL FUNCTION DURING THE CARDIAC SURGERY**

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INTRODUCTION: Renal dysfunction is one of the most serious complications after cardiac surgery with cardiopulmonary bypass (1). Association between kidney damage and pump priming and/or different intravascular volume replacement is controversial. Therefore, effects of hydroxyethylstarch (HES) 130/0.4 6%, Human Albumin (HA) 5% and Ringer's Lactate (RL) on renal function during and after cardiac surgery were compared.

METHODS: Sixty patients undergoing elective first-time coronary artery bypass grafting (CABG) with cardiopulmonary bypass were randomly assigned to receive either HES (n=20), HA 5% (n=20) or RL (n=20). One thousand five hundred mL of each solution was added to the pump priming. Fluid management until the first postoperative day (POD1) was guided by central venous pressure (CVP: between 10-12 mmHg). Patients received up to 50 mL/kg/d of the respective study solutions. For additional volume replacement RL was employed in each group. Serum creatinine, fractional excretion of sodium (FENa), alpha-1 microglobulin (alpha-1 MG), colloid osmotic pressure (COP), and protein and albumin/creatinine ratios were measured after induction of anesthesia (baseline), at the end of surgery and on the morning of POD1. Creatinine clearance and microalbumin were determined on POD1. Additionally, fluid input, urine output, and fluid balance at the end of surgery and on POD1 were compared. ANOVA was used for statistical analysis (Sigma Stat 2.03, San Jose, CA, USA). A P-value of < 0.05 was considered significant. Data are given as means \pm SD.

RESULTS: Values determined at the above-mentioned two or three timepoints are depicted in Table 1. There were no statistically significant differences between groups as well as between timepoints when creatinine clearance and microalbuminuria were evaluated.

Table 1.

	Baseline	End of Surgery	POD 1
Serum creatinine (mg/dL)			
HES	0.95 \pm 0.20	1.00 \pm 0.20	0.9 \pm 0.20 *
HA 5%	0.98 \pm 0.20	1.10 \pm 0.20 †	1.0 \pm 0.30
RL	0.96 \pm 0.10	0.95 \pm 0.10 #	0.9 \pm 0.20
FENa (%)			
HES	1.0 \pm 0.5	3.1 \pm 3.3	1.4 \pm 0.6
HA 5%	1.4 \pm 2.8	2.7 \pm 2.0	1.8 \pm 0.9
RL	1.7 \pm 2.1	2.6 \pm 3.0	1.5 \pm 0.9
Alpha-1 MG (mg/L)			
HES	5 \pm 11	18 \pm 21	9 \pm 11
HA 5%	2 \pm 4	31 \pm 34	10 \pm 11
RL	3 \pm 6	29 \pm 60	6 \pm 8
COP (mmHg)			
HES	22 \pm 2	18 \pm 3	17 \pm 3
HA 5%	22 \pm 3	18 \pm 3	18 \pm 2
RL	21 \pm 3	13 \pm 2	14 \pm 2
Urine protein/Creatinine ratio (mg/g)			
HES	102 \pm 68	251 \pm 187	104 \pm 43
HA 5%	138 \pm 171	313 \pm 178	148 \pm 81
RL	198 \pm 359	299 \pm 189 #	123 \pm 74 #
Urine albumin/creatinine ratio (mg/g)			
HES	15 \pm 20	31 \pm 44	13 \pm 13
HA 5%	15 \pm 23	60 \pm 62	38 \pm 46
RL	74 \pm 249	50 \pm 57	23 \pm 28
Fluid input (mL)			
HES	5188 \pm 825 \$	6066 \pm 2203	5351 \pm 2262
HA 5%	6043 \pm 1539	6540 \pm 2461	5351 \pm 2262
RL	6823 \pm 1319		
Urine output (mL)			
HES	704 \pm 279	2363 \pm 1127	2538 \pm 998
HA 5%	644 \pm 307	1673 \pm 654#	
RL	848 \pm 415		
Fluid balance (mL)			
HES	3368 \pm 770	3299 \pm 1937	2182 \pm 2009
HA 5%	4037 \pm 1283	4466 \pm 2353 #	
RL	5063 \pm 1342 #		

* = P < 0.05 POD1 vs. baseline and end of surgery; † = P < 0.05 end of surgery vs. baseline and POD 1; # = P < 0.05 RL vs. HA 5%; \$ = P < 0.05 RL vs. HES

DISCUSSION: These findings show none of the tested fluids was associated with impaired renal function. Not unexpectedly, the RL group required more volume to keep CVP in the desired range that resulted in a more positive fluid balance. HES, the cheaper alternative of the two volume expanders appears to be safe in this instance and does not seem to cause any harm when a total daily volume of 50 mL/kg is not exceeded.

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S-36.

EFFICACY OF DIRECT INTERCOSTAL NERVE BLOCK IN STANDARD THORACOTOMY WITHOUT EPIDURAL ANALGESIA

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INTRODUCTION: To achieve early post-operative ambulation, epidural anesthesia/analgesia is widely used in thoracic surgery especially that with wide incision standard thoracotomy. On the other hand, in cases in which epidural catheter placement is contraindicated, post operative pain would be treated solely with IV-PCA which may prevent early ambulation. In our institution, direct single shot intercostal nerve block has been performed at the end of operation by the surgeon to decrease the amount of IV-PCA. However, the efficacy of the block to achieve early ambulation is not known. To determine this, the post-operative recovery profile of the patients with intercostal block was retrospectively compared with that with epidural analgesia.

Method: Medical records of patients who underwent lung surgery with incision more than 12cm wide during the year 2006 to 2008 were examined and parameters including required time for walk and oral intake, respectively, required amount of NSAID analgesic and complaint of shoulder pain were recorded. The records were grouped into those in which epidural catheter was used (group E), and those in which intercostal nerve block was performed instead of epidural analgesia (group I). In group I, intercostal nerve blocks were performed with 3ml of 1% ropivacaine for each of 3 adjacent intercostal spaces at the end of surgery. Post-operatively, patients in group I were treated with IV-PCA containing fentanyl, doroperidol and lidocaine. Patients in group E were treated with PCEA containing fentanyl and ropivacaine. Statistical analyses including chi-square analysis, Mann-Whitney's U-test and Student's t-test between the groups were performed using a computer software, Statcel v 2.0.

RESULTS: As shown in the table, required time for walk and oral intake, required NSAID amount was not significantly different. On the other hand, number of patients who complained of shoulder pain was significantly larger in group E. No complication related to analgesia procedures was not recorded in either of the groups.

DISCUSSION: Single shot direct intercostal nerve block provided as excellent post-operative analgesia as epidural analgesia. Rather, the block seemed to be superior in terms of shoulder pain. Intercostal nerve block wears off in several hours even if long lasting local anesthetic is used. Effect of continuous epidural block may also decrease in hours as shown in (1). Phrenic nerve damage is implicated in post thoracotomy shoulder pain (2,3). Because PCEA does not cover phrenic nerve pain, IV-PCA may be a better analgesic procedure for thoracotomy. In conclusion, single shot intercostal nerve block is as effective as continuous epidural analgesia. We must consider this block when epidural analgesia is contraindicated for any reasons.

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Post-Operative Recovery Profile				
	Walk (min, mean±sem)	Oral Intake (min, mean±sem)	NSAID (times, median, range)	Shoulder pain (yes/no)
Intercostal Block (n=16)	1735±155	2452±371	3 (0-10)	1/15
Epidural anesthesia (n=47)	1736±125	2961±382	3 (0-8)	20/27
P value	0.99	0.46	0.81	0.01

S-37.

ACUTE AORTIC DISSECTION STANFORD TYPE-A SECONDARY TO PULMONARY EMBOLISM DIAGNOSED BY INTRAOPERATIVE TRANSESOPHAGEAL ECHOCARDIOGRAPHY(TEE)

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[INTRODUCTION] Both of acute aortic dissection Stanford type-A and pulmonary embolism are well known as their property of high mortality rate. They are hardly supposed to occur at same time. If it happens, early correct diagnosis is sometimes difficult for similar symptoms. (1) We present a unique case that thrombus in the right pulmonary artery was found unexpectedly with Transesophageal echocardiography(TEE) during ascending aorta replacement surgery for acute aortic dissection Stanford type-A.

[CASE REPORT] A 77-year-old man suddenly complained anterior chest pain and shortness of breath, was transferred to our emergency room. Expiratory wheezing was heard. Transthoracic echocardiography(TTE) showed pericardial effusion, floating flap in ascending aortic, moderate aortic valve regurgitation. He was diagnosed acute aortic dissection by computed tomography(CT), which required surgical repair. The first arterial blood gas after intubation showed impairment of oxygenation ($\text{PaO}_2/\text{FI}\text{O}_2=97\text{torr}/1.0$), V/Q mismatch ($\text{Petco}_2/\text{Paco}_2=22/66$). TEE revealed severe Tricuspid valve regurgitation(TR) with peak pressure gradient calculated 56torr. Systolic pulmonary artery pressure(sPAP) was estimated 70-80 torr when systemic systolic blood pressure was 80-90 torr. The pulmonary hypertension was considered caused by acute congestive heart failure due to cardiac tamponade. But pulmonary hypertension still exist even after drainage of pericardial effusion. Therefore the cause of pulmonary hypertension was thought to be compression of pulmonary artery by dilated ascending aorta. Aorta was replaced by artificial graft. After aorta was declumped, the heart contractility was poor and required epinephrine and several times of defibrillation in weaning from cardiopulmonary bypass though the surgery went quite well. Bloody sputum suggested pulmonary hypertension still exist. We researched precisely and unexpectedly TEE revealed pulmonary artery occlusion by thrombus. Pulmonary artery thrombus was considered the main cause of pulmonary hypertension existing prior to the operation. A specialist of pulmonary thrombosis resection recommended not to remove the thrombus when the pulmonary embolism was thought to be chronic, because pulmonary vessel wall would be so fragile that the plasty would be almost impossible. Two days after, right pulmonary artery blood flow increased in TEE, he was extubated at post-op day 5. He finally went home 24 days later, and is doing well 7 months after the operation.

[DISCUSSION]

Acute aortic dissection and pulmonary embolism hardly occur at the same time. (1) Cardiac tamponade or pulmonary artery compression by dilated aorta was considered the main cause of pulmonary embolism in the first place, but this was wrong because bloody sputum is thought to be aspirated at advanced stage of pulmonary hypertension. We succeeded in maintaining pulmonary circulation, but correct diagnosis is still unknown. He may have died of aortic dissection or pulmonary embolism. TEE was useful to detect pulmonary embolism in this unique patient. We should research pulmonary artery precisely in those who present pulmonary hypertension and aortic dissection.

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S-38.

WITHDRAWN

S-39.

LOW ANAEROBIC THRESHOLD AND VENTILATORY INEFFICIENCY PREDICT ALL-CAUSE MORTALITY AFTER MAJOR PLANNED ABDOMINAL CANCER OR AORTIC SURGERY

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INTRODUCTION: Postoperative mortality in surgical patients who have undergone cardiopulmonary exercise testing (CPET) has been shown to be associated with an oxygen uptake at anaerobic threshold (AT) of 11 ml.kg⁻¹.min⁻¹ or less¹. Thus there appears to be a population of patients with occult heart failure who are at higher risk after major surgery. This is supported by recent work confirming that heart failure is associated with a worse outcome after surgery compared to coronary artery disease². In medical heart failure patients, a low AT (<11 ml.kg⁻¹.min⁻¹), combined with ventilatory inefficiency (VI) as evidenced by a VE/VCO₂ slope greater than 34, is associated with a worse prognosis³.

Since June 2004, in our institution all patients over 55 years presenting for potential surgical treatment for cancer of the gastrointestinal tract, kidney or bladder, and patients with aortic aneurysm, are routinely evaluated with CPET at pre-surgical clinic. AT is used to aid decision making for appropriateness of surgery, pre-operative treatments and peri-operative care.

This study evaluates the usefulness of Low AT, VI and a combination of the two, in predicting outcome after major surgery.

METHODS: Institutional ethical approval was given for analysis of data on patients attending pre-surgical clinic, being considered for the surgeries detailed above, between June 2004 and June 2008.

During the assessment all patients underwent a submaximal CPET, to obtain a value of AT using the V-slope method. Also measured were 12-lead electrocardiogram and blood pressure response. The results of the test were passed to the surgical and anaesthetic teams responsible; patients with AT less than 11 ml.kg⁻¹.min⁻¹ considered as indicating higher risk, in accordance with previous series¹. In this cohort VI was not routinely used to aid decision-making.

Data from CPET, relevant co-morbidities, and surgical or non-surgical outcomes were gathered prospectively and stored in a secure database. The ability of Low AT risk (AT<11 ml.kg⁻¹.min⁻¹), VI risk (VE/VCO₂ > 34 at AT), and a combination (Low AT risk and VI risk) to predict all-cause non-survival after major surgery was examined. Analyses were performed with SPSS version 13.0.

RESULTS: 870 completed surgical patient episodes were analysed. Outcomes are presented in the table below:

	Postoperative mortality		Odds ratio (95% CI)
	At risk	Not at risk	
Low AT risk (AT < 11 ml.kg ⁻¹ .min ⁻¹)	21/449 (4.7%)	7/421 (1.7%)	2.90(1.22-6.90)
VI risk (VE/VCO ₂ at AT > 34)	21/455 (4.6%)	7/403 (1.7%)	2.74(1.15-6.51)
Combined Low AT risk and VI risk	19/285 (6.7%)	9/585 (1.5%)	4.57(2.04-10.24)

DISCUSSION: The 2007 AHA/ACC guidelines for evaluation of cardiac risk in non-cardiac surgical patients acknowledge the importance of assessing functional capacity to evaluate risk⁴. By combining the Low AT and VI we have demonstrated the ability of functional capacity assessment through CPET to predict all-cause mortality after major surgery. In our institution this high-risk group comprises about one-third of the elderly surgical population. Resource-intensive therapeutic strategies that optimise outcome may have an increased beneficial effect when applied to this high-risk group.

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S-40.

HYPERGLYCEMIA: A COMMON PROBLEM DURING CARDIAC SURGERY IN DIABETIC AND NON-DIABETIC PATIENTS

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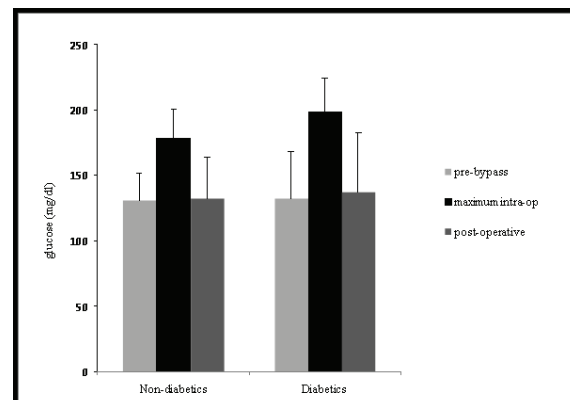
INTRODUCTION Intraoperative hyperglycemia is an independent risk factor for morbidity and mortality after cardiac surgery [1]. However, blood glucose is usually only measured intraoperatively in diabetic patients. Therefore, we wished to determine the incidence of hyperglycemia in non-diabetic patients undergoing cardiac surgery.

METHODS In this retrospective chart review we compared blood glucose levels of 82 adult patients undergoing coronary artery bypass graft (CABG) or valve replacement with bypass. Glucose levels were measured pre-bypass, every 30 minutes during and immediately after surgery. According to our departmental guidelines hyperglycemia above 175 mg/dl was suggested to be treated with insulin. Statistical analyses were performed using Student's *t*-test, Chi-square *-test* and Kruskal-Wallis One Way Analysis of Variance on Ranks. Data are presented as mean±SD or when appropriate as median [25-75 interquartile range].

RESULTS: There was no difference between the groups in age (non-diabetics [n=58] vs. diabetics [n=24] 65±12.7 vs. 63±12.7 years, *p*=0.456), and bypass time (104±37.7 vs. 104±34.1 minutes, *p*=0.979). PreOP glucose values were not significantly different (131[112-152] mg/dl in non-diabetics and 133[107-168] mg/dl in diabetics, *p*=0.819). In both groups glucose levels increased significantly [*p*<0.05] compared with the preOP values to a maximum level of 179[151-201] mg/dl (non-diabetics) and 199[166-225] mg/dl (diabetics). 17 non-diabetic and 36 diabetic patients received insulin intraoperatively [*p* = 0.616]. Glucose values returned to baseline levels in both groups after surgery (133[110-164] mg/dl in non-diabetic patients and 137[101-183] mg/dl in diabetic patients).

DISCUSSION: Hyperglycemia is commonly present in the perioperative period in patients undergoing cardiac surgery, even during administration of insulin. Data of this chart review indicate that the diabetic status of patients preoperatively is not a predictor of whether or not patients will become hyperglycemic perioperatively.

1. Mayo Clin Proc. 2005 Jul;80(7):862-6.



Glucose levels during cardiac surgery. Data are presented as median [75% interquartile range]. **p*<0.05 compared with pre bypass value, ***p*<0.05 compared with maximum value

S-41.**CAN PREOPERATIVE HEMOGLOBIN A1C DETERMINE THE AMOUNT OF TIME SPENT WITHIN THE TARGET BLOOD GLUCOSE RANGE IN THE INTENSIVE CARE UNIT FOLLOWING CARDIAC SURGERY? A UNIVARIATE ANALYSIS****AUTHORS:** D. Mahendran¹, D. Patel², B. Subramaniam³;**AFFILIATION:** ¹Anesthesia, Critical Care and Pain Medicine, Beth Israel Deaconess Medical Center, Boston, MA, ²Research assistant, Department of anesthesiology, Beth Israel Deaconess Medical Center, Boston, MA, ³Assistant Professor in Anesthesia, Beth Israel Deaconess Medical Center, Boston, MA.**BACKGROUND:** In our institution, a tight blood glucose control protocol has been in use for the past 8 years for cardiac surgical patients. Strict perioperative blood glucose control has been shown to decrease the incidence of mediastinitis in this patient population¹. The aim of this study was to assess whether there is a correlation between preoperative Hemoglobin A1C (HgbA1C) levels in patients undergoing cardiac surgery (coronary artery bypass, valve surgery and other procedures) and postoperative blood glucose control in the ICU.**METHODS:** Pre-operative HgbA1C levels were measured in 108 adult patients (75%) undergoing cardiac surgery during a four month period in a random fashion by the surgical team. Their preoperative HgbA1C level was correlated with the percentage of time that blood sugar was well controlled (target range 80-100mg/dL) during their ICU stay.In this exploratory, hypothesis finding study, subjects were divided in two groups, those with an HgbA1C ≤ 6.0 and ≥ 6.1 (n=73 and 35 respectively) in one analysis. In another analysis, subjects were divided into HgbA1C ranges of 4.3-5.8, 5.9-6.9, 7.9-9.0, and >9 (n= 57, 31, 15, and 5). The percentage of time in the ICU during which blood glucose levels were in the target range was used as the outcome during ICU stay.**RESULTS:** A 't' test was performed in the first analysis comparing HgbA1C ≤ 6 versus ≥ 6.1 . The second analysis for the group comparison was done using the one way ANOVA test.In patients with normal HgbA1C levels ≤ 6.0 , the percentage of ICU stay during which blood sugars were controlled was 62%, whereas it was 56.7% in subjects with HgbA1C levels ≥ 6.1 (p= 0.187).

HgbA1C	N	Mean of % of time in target blood sugar range	Std. Deviation	Std. Error
6.0 \leq	73	62.04	21.231	2.485
≥ 6.1	35	56.67	15.788	2.669

The group comparison with an ANOVA test was non-significant (p = 0.327).

DISCUSSION: Our hypothesis was to try and correlate pre-operative HgbA1C with post-operative blood glucose control. This has never been studied before.

- 1) There is insufficient evidence to reject the null hypothesis. Poorly controlled diabetics with an elevated pre-operative HgbA1C can be controlled tightly in the postoperative period.
- 2) It is possible that patients with a higher HgbA1C have higher variability in their blood sugar control and this was not tested in our study.
- 3) It is possible that this may be a false negative result due to lack of power in the study.
- 4) This is a univariate analysis. A negative result cannot become positive in a multivariate analysis unless it is negatively confounded which is rare in clinical studies.

CONCLUSION: These results indicate that elevated preoperative HgbA1C levels do not automatically result in poor blood glucose control postoperatively when patients are managed with an established tight glucose control regimen.**REFERENCES:** 1. Carr JM, et al. Implementing tight glucose control after coronary artery bypass surgery. Ann Thorac Surg. 2005 Sep; 80(3):902-9.**S-42.****EFFECTS OF ENDOSCOPIC VEIN HARVEST FOR THE SAPHENOUS VEIN WITH CO₂ INSUFFLATION IN THE OFF-PUMP CORONARY ARTERY BYPASS SURGERY****AUTHORS:** S. Kim¹, D. Kim², T. Yoon², T. Kim³, J. Lim², N. Woo²;**AFFILIATION:** ¹Department of Anesthesiology, Department of Anesthesiology, Konkuk University School of Medicine, Seoul, Republic of Korea, ²Department of Anesthesiology, Konkuk University School of Medicine, Seoul, Republic of Korea, ³Department of Anesthesiology and Pain Medicine, Department of Anesthesiology, Konkuk University School of Medicine, Seoul, Republic of Korea.**INTRODUCTION:** Endoscopic vein harvest (EVH) with CO₂ insufflation became a popular option for visualization and harvesting saphenous venous graft in coronary artery bypass graft surgery. However, possible systemic effect of insufflated and absorbed CO₂ has not been clearly defined.**METHODS:** The 100 patients underwent elective off-pump coronary artery bypass surgery (OPCAB) were enrolled into the present study. Anesthesia was maintained with high-dose remifentanyl with supplemental propofol. After fixing the position for harvesting of the left internal mammary artery, EVH for the saphenous vein was performed by using insufflation of 3 L/min of CO₂ through a 2-cm transverse linear skin incision above the knee. During the EVH, the maximal insufflation pressure was limited to 12 mmHg and ventilation of O₂/air mixture (FiO₂ 0.5) was adjusted to maintain end-tidal CO₂ at 35-40 mmHg. Parameters including mean arterial pressure (MAP), pulmonary arterial pressure (MPAP), central venous pressure, HR, P_{ET}CO₂, PaCO₂, cerebral oxymetry (rSO₂), peak inspiratory pressure (PIP), mixed O₂ saturation (SvO₂), cardiac index (CI) were measured before and at the end of EVH.**RESULTS:** The P_{ET}CO₂ (35.0 \pm 2.7 vs. 52.0 \pm 6.2 mmHg), PaCO₂ (35.1 \pm 3.1 vs. 52.5 \pm 4.3 mmHg), SvO₂ (75.6 \pm 4.1 vs. 82.0 \pm 1.6)%, CI (2.7 \pm 0.6 vs. 3.3 \pm 0.6 L/min/m²), and rSO₂ (Lt: 63.5 \pm 7.9 vs. 73.3 \pm 8.4 %, Rt: 62.2 \pm 8.0 vs. 72.3 \pm 6.3 %) showed significant difference before and after CO₂ insufflation (p < 0.05), whereas others did not.**DISCUSSION:** EVH for saphenous vein for OPCAB with the limited CO₂ insufflation pressure less than 12 mmHg was associated with hypercarbia and resultant cerebral vasodilation which were indicated by the increased CI, Sv O₂ and rSO₂ without any change in MAP and MPAP.**REFERENCES:**

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Unchanged parameters		
	After CO ₂ insufflation	After CO ₂ insufflation
MPAP (mmHg)	18.4 \pm 6.8	18.4 \pm 6.8
CVP (mmHg)	4.9 \pm 2.0	4.9 \pm 2.0
HR (beats/min)	63.4 \pm 7.9	63.4 \pm 7.9
PaO ₂ (mmHg)	219.3 \pm 32.8	219.3 \pm 32.8
PIP (cmH ₂ O)	16.2 \pm 3.5	16.2 \pm 3.5

S-43.

CORRELATION BETWEEN MIXED VENOUS OXYGEN SATURATION AND ANESTHETIC DEPTH DURING CARDIOPULMONARY BYPASS

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INTRODUCTION: During cardiopulmonary bypass, mixed venous oxygen saturations (SvO₂) often fluctuate in the absence of changes in temperature or cardiac output. One explanation for these changes has been changes in anesthetic depth and consequently brain metabolism. Existing evidence suggests that increased anesthetic depth decreases cerebral metabolic rate and brain oxygen consumption. Reductions in cerebral metabolic rate resulting from increased anesthetic depth would thus result in decreased whole body oxygen consumption and an increased SvO₂. Although a relationship has been suspected, no data currently exist examining the relationship between mixed venous oxygen saturation (SvO₂) and depth of anesthesia. We hypothesized that changes in anesthetic depth would correlate with changes in whole body oxygen consumption. To test this hypothesis, we correlated measurements of mixed venous oxygen saturation with anesthetic depth (as measured by the BIS monitor) in patients undergoing cardiopulmonary bypass.

METHODS: This study was performed as part of a larger study involving the BIS monitor (Aspect Medical Systems) and anesthetic depth. Patients having surgery involving cardiopulmonary bypass were consented, in accordance with IRB protocol. The BIS monitor was placed prior to the start of cardiopulmonary bypass and bispectral index values were measured continuously during the bypass period. Measured variables included the BIS value, SvO₂, patient body temperature, mean arterial pressure, blood inhaled anesthetic levels, cardiac output, hematocrit, and arterial PO₂. Along with the above variables, the SvO₂ was measured at five minute intervals during cardiopulmonary bypass using a real-time blood gas monitor (CDI monitor, Terumo Systems Cardiovascular, Corp.). The Pearson correlation (R²) coefficient was calculated to determine the relationship between the SvO₂ and bispectral index at intervals when stability among hematocrit ($\pm 2\%$), temperature ($\pm 1^\circ\text{C}$), constant blood inhaled anesthetic level, constant FiO₂, and constant cardiopulmonary bypass pump flow rates existed for each subject.

RESULTS: Twenty-three patients were studied; 6 underwent CABG, 9 underwent valve or aortic repair procedures, 5 underwent combined valve repair and CABG, 2 underwent left ventricular assist device placement, and 1 had an IVC thrombectomy. The average age was 65 years and average temperature during bypass was 34.6°C. Between 10 and 30 simultaneous measurements of SvO₂ and bispectral index were obtained per patient. The Pearson coefficient was calculated for each patient. The average Pearson coefficient was 0.002 \pm 0.320 (p>0.05).

DISCUSSION: In twenty-three patients undergoing cardiac surgery, we did not find a statistically significant relationship between bispectral index values and SvO₂. Our data were obtained while hematocrit, temperature, blood inhaled anesthetic level, FiO₂, and cardiopulmonary bypass pump flow rates were stable for each subject. These data suggest that during cardiopulmonary bypass, other factors besides depth of anesthesia may cause mixed venous oxygen levels to change.

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S-44.

CAN PREOPERATIVE PULSE PRESSURE BE EXPLAINED BY ADDITIONAL PREOPERATIVE COVARIATES SUCH AS HYPERTENSION, DIABETES AND RENAL FAILURE IN PATIENTS WITH PERIPHERAL VASCULAR DISEASE?

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INTRODUCTION: Preoperative pulse pressure (PP) has been shown to predict perioperative morbidity and mortality in patients undergoing cardiac surgery. This has not been tested in patients with peripheral vascular disease (PVD). In these patients pulse pressure may be determined by hypertension (HTN), diabetes mellitus (DM), chronic renal insufficiency or failure (CRI), influential risk factors for vascular surgical patients. However, whether PP is a surrogate for age, HTN, DM and CRI is unknown. As a first step, we sought to find the relationship between PP and DM, HTN, CRI, age in this unique cohort with PVD. If there is no relationship, PP could be an independent risk factor.

METHODS: A prospectively collected vascular quality assurance database over the last two years was queried. First 199 patients were tested in this hypothesis finding study. Preoperative variables age, gender, PP during their preoperative hospital visit, HTN, DM, CRI (serum creatinine > 2.0 mg/dl) were chosen. PP was the outcome and other factors were the covariates. All the factors were tested for individual relationships and also forced into a linear regression model. P<0.05 was considered significant.

RESULTS: The mean PP was 73mm of Hg (SD 20, range 22-110) (25% to 75% quartiles at 60 and 89). The PP data was normally distributed and the linear regression model was assumed to be appropriate.

Table 1. Individual factors (analyzed for univariate analysis):

	Yes	No	'p' value
Diabetes (61%)	72 [20]	75 [19]	0.34
Hypertension (80%)	74 [21]	69 [17]	0.18
Creatinine>2 (16%)	72 [21]	73 [20]	0.61
Males (57%)	72 [20]	75 [20]	0.34

Age correlated with PP by Pearson correlation test (p=0.005); r=0.20. By individual regression with age, $y = 50.2372 + 0.3273 (\text{Age})$ equation was obtained to calculate pulse pressure in patients with peripheral vascular disease. By univariate and multivariate analysis, a significant relationship between age and pulse pressure was seen. **Table 2. Linear regression model forcing all the related preoperative variables:**

Independent variables	Coefficient	Std.Error	t	P
(Constant)	44.0263			
Age	0.3256	0.1176	2.770	0.0062
HTN	3.7562	3.5759	1.050	0.2948
gender	1.2168	2.9195	0.417	0.6773
DM	5.0385	2.9563	1.704	0.0899
CR 2	-1.7638	3.9204	-0.450	0.6533

This model even though is significant had an adjusted R squared of 3%; HTN, DM, CRI, gender and age explained only 3% of variability in the PP.

DISCUSSION: The main finding of this study is HTN, DM, CRI, age and gender do not explain the variations in pulse pressure. It is possible that in patients with PVD, these factors are not that important to change the PP of a given individual. The second step in our study will be to study the relationship between PP and cardiovascular outcome in PVD patients. If there is a significant relationship, a logistic regression will be built to see the independent contribution of pulse pressure in predicting major cardiovascular outcomes.

PP may be an additional independent factor in a risk prediction model for vascular surgical patients as there is no relationship between PP and other important clinical factors such as DM, HTN and CRI.

S-45.**OUTCOMES IN ACYANOTIC PEDIATRIC PATIENTS ASSOCIATED WITH CONTINUOUS CENTRAL VENOUS OXYGEN SATURATION (ScvO₂)**

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INTRODUCTION: Central venous oxygen saturation (ScvO₂) is a useful marker of global tissue perfusion and recent investigations demonstrate that ScvO₂ desaturations are associated with increased risk of postoperative complications in adult cardiac surgery patients. While the accuracy and use of a new pediatric continuous ScvO₂ catheter has been previously described, similar associations have not been assessed in pediatric patients. The purpose of this study was to examine the association of intraoperative and postoperative ScvO₂ desaturations and patient outcomes in pediatric patients undergoing cardiac surgery.

METHODS: Following IRB approval and parental informed consent, forty three acyanotic pediatric patients undergoing cardiac surgery were enrolled. An appropriately sized central venous catheter (CVC) was placed in the SVC above the caval-atrial junction under transesophageal echocardiography guidance. Continuous ScvO₂, heart rate (HR), mean arterial pressure (MAP), central venous pressure (CVP), arterial pulse-ox (SpO₂), temperature (core and peripheral) were obtained perioperatively and every fifteen minutes in the ICU up to 24 hours post surgery. Venous blood gases (VBG) and lactate levels were measured. ScvO₂ area under the threshold (AUT) was computed, where the area is between a threshold and the minimum ScvO₂ values over time, to determine the influence of prolonged desaturations on postoperative outcomes. Spearman correlation methods were used to assess associations and potential influence of ScvO₂ desaturations on patient ICU outcomes.

RESULTS: Median age was 2 years (0.01-9 yrs) and weight 14 kg (3.1- 28 kg). Statistically significant correlations resulted between ScvO₂ AUT with an absolute threshold of 40% and length of intubation (LOI) (r= 0.41), length of ICU stay (LOS ICU) (r= 0.66), length of hospital stay (LOS hospital) (r= 0.51), and inotrope use (r= 0.50). ScvO₂ AUT with an absolute threshold of 50% significantly correlated with LOS ICU (r= 0.55), LOS hospital (r= 0.45), and inotrope use (r= 0.40). ScvO₂ AUT with an absolute threshold of 60% only correlated with LOS ICU (r= 0.40) and LOS hospital (r= 0.42).

DISCUSSION: Our results indicate that extended periods of ScvO₂ desaturation are associated with poor ICU outcomes in pediatric patients undergoing cardiac surgery. Our results support the use of ScvO₂ as a target parameter in high-risk acyanotic pediatric patients to improve outcome.

S-46.**DIFFERENCES IN PERIOPERATIVE CONDITIONS BETWEEN COMPLETE THORACOSCOPIC SURGERY AND CONVENTIONAL THORACOTOMY**

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INTRODUCTION: Video assisted thoracoscopic surgery (VATS) lobectomy has been developed for a couple of decades, especially advances in techniques and instruments allow complete endoscopic surgery for primary lung cancer. Although complete thoracoscopic surgery (CTS) is considered less invasive, few studies have been reported the invasiveness of CTS from the viewpoint of anesthesiologists. The aim of this study is to investigate differences in perioperative conditions following CTS vs. conventional thoracotomy (CT).

METHODS: Between January 2006 and September 2008, 162 patients underwent surgery for early stage primary lung cancer at Kanagawa Cardiology and Respiratory Center. Among them, 120 patients underwent lobectomy including conventional open thoracotomy (61) and complete thoracoscopic surgery (59). Of these 120 patients, perioperative conditions were investigated retrospectively. Two groups were compared using t-test and logistic regression analysis was used to test the correlation between operative procedures and perioperative conditions.

RESULTS: Table 1 showed perioperative conditions. There were significant differences in the following parameters; amount of blood loss, amount of drainage, amount of fluid requirement, duration of surgery, duration of chest drainage, length of hospitalization, max serum CRP, max serum CPK, and postoperative day of gait initiation (Table 1). Results of multivariate logistic regression analysis on perioperative conditions indicated that operative procedures were correlated to length of hospitalization after surgery (Table 2).

Table1: Perioperative conditions

	CTS	CT	p value
Length of hospitalization (days)	9.2±5.5	31.4±67.5	0.016
Duration of surgery (hh:mm)	5:22±0:51	4:15±0:46	<0.0001
Amount of blood loss (ml)	60.17±64	229.4±254	<0.0001
Fluid requirement (ml)	1574.6±532	2341±939	<0.0001
Amount of drainage (ml)	155.6±80	418.9±117	<0.0001
Duration of chest drainage (days)	3.85±4	6.56±4	<0.0001
Max serum CRP (mg/dl)	10.1±4.1	17.0±5.4	<0.0001
Max serum CK (IU/l)	1202±873	1748±689	0.0003
Gait initiation (POD)	1.89±1	3.87±2.3	<0.0001

Data were shown as mean±SD

Table 2: Multivariate logistic regression analysis for length of hospitalization

	Odds ratios	95%CI	p value
Duration of chest drainage (days)	4.95	1.26-19.38	0.02
Operative procedure	65.17	5.78-734	0.0007

DISCUSSION: In spite of longer operative time, complete thoracoscopic surgery might be less invasive in terms of perioperative management. However, further studies will be needed to evaluate intermediate to long term outcome for complete thoracoscopic surgery.

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S-47.

THE EFFECTS OF POSITIVE END-EXPIRATORY PRESSURE ON POSTOPERATIVE BLEEDING IN CORONARY ARTERY BYPASS SURGERY

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INTRODUCTION: Postoperative bleeding is still being one of the major complications for patients undergoing CABG surgery. Transfusion of whole blood and blood products has many adverse effects (1). Application of PEEP during postoperative mechanical ventilation period for decreasing postoperative bleeding is still controversial (2). We conducted this single-center, prospective randomized study to evaluate the effects of 5, 10 and 15cmH₂O PEEP, which is applied during postoperative mechanical ventilation period, on postoperative bleeding following CABG operations.

METHODS: Following Ethics Committee approval, informed consent obtained from three hundred ASA I-II patients who underwent elective, uneventful on-pump coronary artery bypass surgery with median sternotomy, between May 2006 and January 2008 were enrolled in this study. After the operation, in the ICU, patients were randomized into three groups; 5cmH₂O, 10cmH₂O and 15cmH₂O PEEP group, according to the PEEP value applied during the intubation period. Besides hemodynamic data, chest tube output, reoperation for bleeding and the amount of blood and blood products received were recorded until they discharge from ICU. The patients were excluded from the study if the MAP becomes < 70mmHg and not restored for more than half an hour during the selected PEEP application. Statistical analysis includes student's t, chi-square, Fischer exact test and one way analysis of variance. p < 0.05 was considered significant.

RESULTS Twenty-one patients were excluded from the study; twenty of them did not tolerate the selected PEEP values and the last patient was reoperated for intractable VF. The demographic and hemodynamic data were insignificant between the groups. The significant findings were summarized in table 1.

Table 1:

VARIABLE	5 cmH ₂ O PEEP GROUP (n=93)	10 cmH ₂ O PEEP GROUP (n=95)	15 cmH ₂ O PEEP GROUP (n=92)	p value
Reoperation for bleeding	3	3	1	p1=0.18 p2=0.24 p3=0.47
Postoperative drainage (6th hour, ml)	535±111	509±154	345±125	p1=0.17 p2=0.04 p3=0.03
Postoperative drainage (24th hour, ml)	794±201	758±177	485±105	p1=0.23 p2=0.02 p3=0.01
Packed Red Blood Cells (units)	2.1 ±1.3	1.9 ±1.1	1.1 ±0.7	p1=0.48 p2=0.03 p3=0.02
Fresh frozen plasma (units)	3.5 ±2.1	3.3 ±1.9	2.1 ±1.1	p1=0.56 p2=0.01 p3=0.02
Thrombocyte suspensions (units)	3.8 ±1.0	3.4 ±1.3	3.6 ±1.0	p1=0.38 p2=0.49 p3=0.66

p1, p2, p3: comparison between 1-2, 1-3, and 2-3 groups respectively.

DISCUSSION: Application of PEEP during positive ventilation probably causes an increase in mediastinal and thoracic cavity pressure which results in obliteration of minor bleeding areas in both cavities. If hemodynamically applicable 10 and 15cmH₂O PEEP seems to reduce postoperative bleeding and transfusion requirements following CABG operations.

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S-48.

EFFECTS OF PEEP ON HEPATIC VENOUS OUTFLOW: CONVENTIONAL VERSUS PROTECTIVE VENTILATION STRATEGY

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INTRODUCTION: Applying positive end-expiratory pressure (PEEP) during mechanical ventilation has been regarded to compromise hepatic venous (HV) flow and is not recommended for the patients with predisposing hepatic risk. Protective ventilation strategy using the relatively less tidal volume (TV), compared with that in conventional ventilation, may be beneficial in reducing the intrathoracic pressure and the impact of PEEP on HV flow. Authors determined and compared the change of HV outflow at applying 3-7 cmH₂O PEEP during conventional and protective ventilation.

METHODS: After anesthesia induction and before taking sternotomy in coronary artery bypass surgery (n = 8), O₂/air mixture (inspired fraction 0.5) of TV 12 ml/kg with 3 cmH₂O PEEP was ventilated to achieve normocarbica (C3). At every 5 min, the ventilation mode was sequentially changed to get 5 and 7 cmH₂O PEEP with the same TV 12 ml/kg (C5 and C7), and 3, 5 and 7 cmH₂O PEEP with TV 8 ml/kg (P3, P5, and P7). The HV flow velocity of systolic in diastolic and atrial contraction phases (HV_s, HV_d and HV_a) was determined by pulsed wave Doppler of transesophageal echocardiography at the end of each ventilation mode and then compared by one way repeated measures analysis of variance and Bonferroni t-test.

RESULTS: HV_s at each ventilation mode showed significant difference (p < 0.001). In all pairwise multiple comparison, HV_s-P7 and HV_s-C7 were significantly less than HV_s-P3 and HV_s-C3, respectively (p < 0.05), but HV_s-P7, HV_s-P5 and HV_s-P3 were not significantly different from HV_s-C7, and HV_s-C5 and HV_s-C3, respectively. HV_d and HV_a at each ventilation mode did not show significant difference.

DISCUSSION: In applying 3-7 cmH₂O PEEP, the protective ventilation strategy did not show superiority in reducing the impact of PEEP compromising HV outflow compared with the conventional ventilation strategy with the same PEEP level. While degree of PEEP is the major determinant for reducing HV outflow, further investigation determining the impact of protective ventilation with PEEP greater than 7 cmH₂O may be required.

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Hepatic venous flow (cm/sec)

	Conventional ventilation (C)	Protective ventilation (P)
HV _s	3 cmH ₂ O PEEP 23.7 ± 12.0	27.5 ± 12.8
	5 cmH ₂ O PEEP 22.2 ± 12.0	23.8 ± 9.8
	7 cmH ₂ O PEEP 19.3 ± 11.0	22.2 ± 9.5
HV _d	3 cmH ₂ O PEEP 22.6 ± 10.4	20.2 ± 6.2
	5 cmH ₂ O PEEP 21.2 ± 29.1	20.7 ± 7.8
	7 cmH ₂ O PEEP 20.7 ± 19.0	18.4 ± 6.6
HV _a	3 cmH ₂ O PEEP -11.9 ± 4.0	-12.2 ± 5.2
	5 cmH ₂ O PEEP -11.9 ± 4.9	-11.4 ± 3.6
	7 cmH ₂ O PEEP -13.5 ± 3.3	-11.1 ± 3.1

S-49.**IS THERE CONTINUITY OF STROKE VOLUME VARIATION BETWEEN MECHANICALLY VENTILATED AND SPONTANEOUSLY BREATHING PATIENTS?**

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INTRODUCTION: Surgical patients are often presented with intravascular volume concerns. Stroke volume variation (SVV) using the FloTrac/Vigileo™ system (Edwards Lifesciences, Irvine, CA, USA) is useful for the prediction of volume responsiveness in these patients. In reviewing previous research, many authors have found that the use of arterial pressure waveform analysis to determine SVV and pulse pressure variation must be performed using a control mode of mechanical ventilation with tidal volumes of at least 8 - 10mL/kg, else ventilation irregularities would lessen sensitivity and specificity found in their data results (1). Grier (2) recently proposed that the prediction of volume responsiveness can be correctly assessed in the non-intubated critically ill patient utilizing this technology. The hypothesis in this study was that there is a continuity of SVV between mechanical ventilation and spontaneous ventilation after surgery by general anesthesia.

METHODS: Approval for this study was obtained from the IRB, and subjects provided written informed consent. Fifteen patients (4 male, 11 female), aged 33-81 years (56 (12) years [mean (SD)]), scheduled to undergo elective surgery, were included in this study. Anesthesia was conducted by general anesthesia with endotracheal intubation. The SVV value was measured (under mechanical ventilation) just before spontaneous breathing appeared at the conclusion of surgery. The value was measured again (under spontaneous ventilation) at the point when the patient exhibited no major post-extubation problems. The two values were then compared.

RESULTS: Mean patients' body weight was 58 (14) kg, and mean height was 159 (9) cm. SVV just before the conclusion of surgery (under mechanical ventilation) was 7.5 (1.5) % and SVV after extubation (under spontaneous ventilation) was 7.8 (1.9) %. There was no significance difference between them.

DISCUSSION: Michard (1) commented as follows: Predicting fluid responsiveness may be very useful in obviating the need for unnecessary fluid loading, and in detecting patients who may benefit from a volume load. During the past few years, many clinical studies have emphasized the value of the systolic pressure variation, the pulse pressure variation, and the echo-Doppler or pulse contour SVV in predicting fluid responsiveness. These studies have also emphasized the lesser importance of static indicators of cardiac preload (*e.g.*, CVP, PAOP, left ventricular end-diastolic area) in identifying patients who may benefit from a volume load. The results of this study suggest that there is continuity of SVV between mechanical ventilation and spontaneous ventilation after surgery. SVV from the FloTrac/Vigileo™ system may therefore be used for fluid management during surgery (under mechanical ventilation) and post surgery (under spontaneous ventilation) at PACU or surgical ICU for fluid management.

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Critical Care Medicine & Trauma

S-50.**WHEN ARE SIRS CRITERIA AN APPROPRIATE SEPSIS SCREENING TOOL IN POSTOPERATIVE TELEMETRY PATIENTS?**

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INTRODUCTION: Sepsis represents a major factor in morbidity and mortality in postoperative patients and the critically ill.¹ The systemic inflammatory response syndrome (SIRS) criteria are recognized as a potential screening tool to identify patients with possible sepsis. Physicians are increasingly using SIRS criteria for guiding the care of their postoperative patients (i.e. ordering additional testing or admitting patients to a higher level of care). However, little is known about the natural history of SIRS criteria in the postoperative moderate care/telemetry patient. We sought to characterize the occurrence of SIRS criteria in patients admitted to telemetry following their post anesthesia care unit (PACU) course.

METHODS: We performed a retrospective analysis on all patients undergoing surgery and being admitted postoperatively to a monitored, non critical care unit between 6/1/2007 and 10/27/2008. We used a perioperative electronic medical record (Centricity, General Electric Healthcare, Waukesha, WI) to identify patients that underwent surgery and were subsequently admitted to one of two telemetry units at a large, tertiary, academic medical center. The system was then queried for any event on each postoperative day 0 to 10 for a heart rate ≥ 90 , respiratory rate ≥ 20 , PaCO₂ < 32 , WBC count $\geq 12,000$ or $\leq 4,000$ in accordance with the American College of Chest Physicians (ACCP) and the Society of Critical Care Medicine (SCCM) criteria for SIRS.¹

RESULTS: A summary of the data is shown in figure 1. Overall, 1675 patients were identified. The most common day for meeting two or more SIRS criteria was postoperative day 1 with 36 percent (594/1664) of patients meeting at least 2 SIRS criteria. By day 6, less than 10 percent (19/201) met 2 SIRS criteria.

DISCUSSION: Postoperative patients represent a distinct group that may become critically ill with sepsis. New initiatives such as Keystone aim to guide patient management based on the presence or absence of clinical predictors. Furthermore, the Surviving Sepsis Campaign advocates the aggressive, early, goal-directed treatment of septic patients. We have found, however, that using the SIRS criteria in the initial postoperative period may be misleading and is not sustainable as a screening mechanism for sepsis and subsequent ICU admission up to five days after surgery. Further study is required to find highly sensitive and specific clinical markers of early sepsis in postoperative patients.

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S-51.**ECONOMIC IMPACT OF DEXMEDETOMIDINE VS. MIDAZOLAM IN ADULT ICU PATIENTS WITH PROLONGED MECHANICAL VENTILATION: AN ECONOMIC MODEL**

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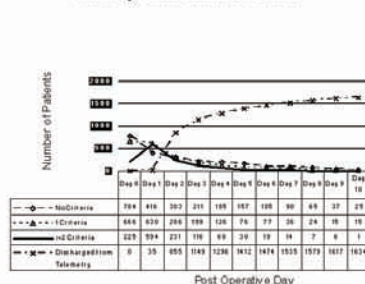
INTRODUCTION: The objective of this study was to determine the cost-effectiveness of IV dexmedetomidine (DEX) compared to IV midazolam (MID) in patients requiring greater than 24 hours of continuous sedation in the intensive care unit (ICU).

METHODS: Within the double-blind, multicenter SEDCOM study, 366 ventilated adult ICU patients were randomized to receive DEX or MID. This pharmacoeconomic analysis (blinded to treatment assignment) compared actual resource use by patients multiplied by US representative costs using Medicare schedules, IMS drug prices, and peer-reviewed literature. Additional analyses characterized costs associated with ICU and mechanical ventilation duration and treatment of study-related adverse events. Censored lengths of ICU stay and mechanical ventilation were imputed using a non-parametric adjustment algorithm. Crude and multivariate median regressions were performed to relate total cost of treatment with adjustment for patient (age, gender, race, Apache II score) and hospital characteristics (location, affiliation, size, type).

RESULTS: DEX was shown to be cost-effective compared to MID, with median cost savings of \$9679 (95% CI \$2314 to \$17045). Unadjusted total costs from time of randomization to ICU discharge were reduced (\$30,232 DEX vs. \$37,931 MID, p=0.031). The primary drivers of cost savings included reduced ICU length of stay (median savings \$6584, 95% CI \$727 to \$12440) and reduced length of mechanical ventilation (median savings \$2958, 95% CI \$698 to \$5219).

DISCUSSION: Despite a higher acquisition price, dexmedetomidine is cost-effective compared to IV midazolam for ICU patients requiring > 24 hours ICU sedation, mainly due to decreased lengths of mechanical ventilation and ICU stay.

Telemetry Patients With SIRS Criteria



S-52.

MORTALITY IN SEPSIS IS REDUCED AFTER PRE-EMPTIVE ADMINISTRATION OF EITHER CLONIDINE OR DEXMEDETOMIDINE

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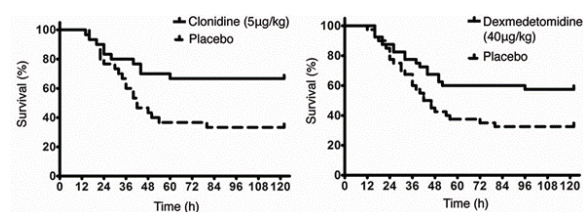
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INTRODUCTION: Despite early detection and widespread antibiotic use, sepsis still remains one of the main reasons for death on European and US American intensive care units. The pathophysiology of this generalized inflammation involves a network of pro-inflammatory cytokines such as tumor necrosis factor- α (TNF- α), interleukin-1 β (IL-1 β) and interleukin-6 (IL-6). Moreover there is an up-regulation of transcription factors such as nuclear-factor- κ B (NF- κ B). Suppressing this inflammatory response could potentially improve survival in septic patients. It has previously been shown that clonidine is able to significantly reduce pro-inflammatory cytokines in surgical patients. We therefore hypothesize that the clinically used central alpha-2 agonist clonidine has the ability to improve survival in experimental sepsis by inhibiting the sympathetic tone and consequently inhibiting the pro-inflammatory cytokine release.

METHODS: To investigate this therapeutic potential of clonidine and dexmedetomidine in a prospective, randomized laboratory investigation we used a well established murine model of CLP-induced sepsis (CLP: cecal ligation and puncture). Animals receiving pre-emptive injections were treated with either clonidine (5 μ g/kg) or dexmedetomidine (40 μ g/kg) 12 and 1 hours before the operation, as well as 1, 6 and 12 hours afterwards. Another group of animals only received clonidine (5 μ g/kg) 1h, 6h and 12h after the operation, while the pre-emptive injections were done with normal saline. The control groups received solvent injections at the respective time points. We measured survival after induction of sepsis over five days, the cytokine response after 24h (mIL-1 β , mIL-6, mTNF- α) and NF- κ B binding activity in the liver after 24h.

RESULTS: Pre-emptive administration of either clonidine or dexmedetomidine significantly reduced mortality in CLP induced sepsis (clonidine 66.7% vs 33% survivors: $p=0.015$; dexmedetomidine 57.5% vs. 32.5% survivors: $p=0.029$; see figure), while postoperative administration of clonidine failed to significantly prolong survival (43.3% vs. 31.0% survivors: $p=0.23$). Furthermore pre-emptive administration of clonidine significantly attenuated the cytokine response after CLP-induced sepsis (mIL-1 β pg/ml: 77.2 vs. 56.7; $p=0.017$; mIL-6 pg/ml: 679 vs. 213; $p<0.0001$; mTNF- α pg/ml: 251 vs. 78.2; $p<0.0001$) and inhibited an increase in NF- κ B, normally seen in sepsis.

DISCUSSION: Our results demonstrate that the pre-emptive administration of the central acting alpha-2 agonists clonidine or dexmedetomidine have the ability to successfully improve survival in experimental sepsis. This is most probably due to their sympatholytic effects that lead to down-regulation of pro-inflammatory mediators and consequently inhibiting an overwhelming inflammation response. In the light of more frequent use of central alpha-2 agonists in the peri-operative setting, our findings provide a rationale for further exploration and encourage the use of clonidine or dexmedetomidine as adjunct sedatives in an ICU setting in order to reduce the occurrence of sepsis. Furthermore, administration of a central acting alpha-2 agonist might even be considered as a pre-emptive therapeutic option in high-risk patients undergoing major surgery.



S-53.

EFFECT OF HYPERVENTILATION ON CENTRAL VENOUS SATURATION

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INTRODUCTION: Measuring mixed venous oxygen saturation has been established as a means of evaluating the supply and demand of oxygen in the body.¹ Many studies have examined the correlation between mixed venous saturation and central venous saturation with the later commonly replacing the former.²

One situation that has not been thoroughly evaluated that may have profound impact on central venous oxygen saturation monitoring is hyperventilation resulting in hypocapnia. Hypocapnia has a dramatic effect of reducing cerebral blood flow. As cerebral metabolic rate is unaffected within the range of normal hyperventilation, hypocapnia would result in increased oxygen extraction as a compensatory mechanism, thus leading to a lower central venous saturation. The purpose of this study was to quantify the effects of hypocapnia on central venous oxygen saturation during routine hyperventilation used in neurosurgical procedures.

METHODS: After IRB approval, we enrolled patients in a prospective observational study including patients scheduled for intracranial surgery where an arterial catheter, central venous catheter and retrograde jugular catheter were part of the anesthetic plan. During a normocapnic steady-state of general anesthesia, blood samples from the arterial, central and retrograde jugular catheters were taken for blood gas determination. Prior to opening the dura, after steady-state mild hyperventilation was established under similar anesthetic depth, a second set of blood gases was analyzed. Parametric variables were compared using a two-tailed paired t-test while nonparametric variables tested with the Mann-Whitney U test.

RESULTS: Nineteen subjects (6 men and 13 women) ages 43 ± 15 years were studied. Table 1 summarizes the effect that hypocapnia had on central venous oxygen saturation as well as physiologic parameters.

DISCUSSION: The substitution of central venous oxygen saturation for mixed venous oxygen saturation is certainly attractive when considering the added technical challenge and complications associated with placing a pulmonary artery catheter. However, there exist various situations that may confound this substitution and warrant caution during interpretation of measured central venous saturations. The cerebral vasoconstriction induced by hypocapnia leads to increased oxygen extraction secondary to decreased cerebral blood flow. As central saturation, measured in the operating room from a central venous catheter placed in the internal jugular vein, samples mainly upper extremity and cerebral venous effluent, it will be greatly influenced by the increased extraction secondary to hypocapnic cerebral vasoconstriction.

We found that hypocapnia significantly reduced both the jugular venous saturation as well as the central venous saturation. We conclude that monitoring of central venous oxygen saturation must take into account the confounding influence of hyperventilation.

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	Normocapnia	Hypocapnia
pCO ₂	41 \pm 4*	31 \pm 3*
SatCV (%)	79.5 \pm 6.3*	72.8 \pm 8.1*
SatJV (%)	66.8 \pm 9.9*	49.4 \pm 11.5*
HR	68 \pm 9*	65 \pm 8*
MAP	73 \pm 9	75 \pm 8
PiO ₂	0.53 \pm 0.06	0.53 \pm 0.06
Temperature (°C)	35.3 \pm 0.7*	35.1 \pm 0.6*

Table 1. Effect of hypocapnia on central and jugular venous oxygen saturation. Data are mean \pm SD. * $p<0.05$

S-54.**PREDICTION OF CARDIAC ARREST WITH HIGH-VALUE TISS-28 MEASURES**

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INTRODUCTION: The Therapeutic Intervention Scoring System (TISS-28) is a validated measure of severity of illness¹. TISS-28 captures the intensity of caregiver interventions (e.g., use of CPAP, presence of an arterial catheter, and frequency of dressing changes)². Our study seeks easily recognizable trends that predict cardiac arrest in hospital in-patients. In order to reflect only the most significant and obvious changes in nursing care, we evaluated the use of the TISS-28 interventions scored as 3 points or greater to predict cardiac arrest. These 17 interventions make up what we refer to here as TISS-17.

METHOD: In-patient hospital charts were obtained as part of a quality-improvement initiative. Charts were reviewed and data extracted to calculate TISS-17 scores for a baseline measurement (the calendar day before the event) and pre-event (the calendar day of the cardiac arrest). In addition, the absolute number of 3-plus point interventions was tallied. Each day's least favorable values were used.

RESULTS: Twenty charts of patients who experienced cardiac arrest were analyzed. TISS-17 scores increased from baseline to pre-event. The mean score increased from 3.3 to 9.25 ($p < 0.01$; see figure 1). Further, the number of 3-plus point interventions increased in this interval of time in 12 of the 20 patients included in this study and none decreased (see Figure 2).

DISCUSSION: Cardiac arrest carries a high morbidity and mortality and predicting its occurrence is clinically important. We evaluated the use of changes in the number of high point value interventions from TISS-28 (e.g. hourly vital signs, vasoactive medications, ventilatory support, dialysis and diagnostic or surgical procedures) to predict cardiac arrest. Both the total TISS-17 score and number of 3+ point interventions increased prior to decompensation or cardiac arrest suggesting that initiation of these interventions may serve as a warning sign for cardiac arrest. Future work will define a case-control sample to elaborate a predictive model.

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Figure 1: TISS-17 Items by Subject

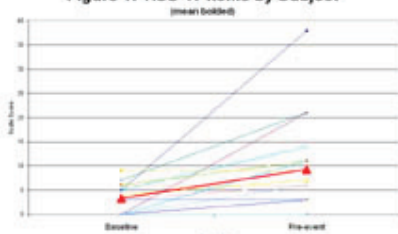
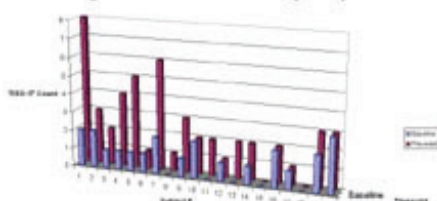


Figure 2: TISS-17 Count by Subject

**S-55.****EFFECTS OF GENERAL ANESTHESIA ON FLUID RETENTION AND REDISTRIBUTION IN HEMORRHAGED AWAKE- AND ISOFLURANE-ANESTHETIZED HUMAN VOLUNTEERS**

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INTRODUCTION AND BACKGROUND: Fluid administration during anesthesia and hemorrhage is a clinical issue for anesthesia practice. In a recently published work on humans by this group, isoflurane decreases fluid clearance which results in more fluid accumulation in the body fluid compartments compared to the awake state [1, 2]. The aim of the present study is to further elaborate these investigations to humans in the awake and anesthetized states during hemorrhage and to explore the effects of fluid on hemodynamics.

METHODS: Twelve healthy volunteers were randomly assigned to four different experiment groups: awake with blood withdrawal, no IV fluids given (CBN); awake with blood withdrawal, IV fluids given (CBF); anesthetized with blood withdrawal, no IV fluids given (ABN); and finally anesthetized with blood withdrawal and IV fluids given (ABF). Approximately 7 mL/kg of blood was withdrawn through an arterial cannula and then given back after each experiment. The isoflurane anesthetized subjects got a laryngeal mask airway (LMA) inserted and were breathing spontaneously. An infusion of 25 mL/kg of 0.9% saline was administered during 20 Min period. Blood pressure was measured noninvasively by an automated cuff.

RESULTS: Mean arterial pressure (MAP) decreased during induction of anesthesia in combination with hemorrhage. Fluid resuscitation did not raise MAP during combined bleeding and isoflurane anesthesia. Furthermore, fluid could not increase MAP in the awake state. Shock index (heart rate divided by systolic arterial pressure) increased by approximately 50% in the anesthetized experiments and was not restored by the fluid load.

Conclusion: Normal saline bolus does not increase MAP during hemorrhage with or without isoflurane anesthesia.

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S-56.

SACRAL TUMOR RESECTION: THE EFFECT OF SURGICAL STAGING ON PATIENT OUTCOMES AND RESOURCE MANAGEMENT

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INTRODUCTION: Curative treatment of most sacral malignancies requires radical sacrectomy. Sacral resection is similarly required to palliate symptoms in many patients with metastatic disease. Because of the nature of the procedure, a majority of sacrectomies may be amenable to surgical staging where components of the operation are performed on different days. "Staging" may offer advantages to the patient, procedural staff and health care system in terms of improved clinical outcomes and reduced hospital resource utilization. We investigated the impact of surgical staging on patient outcome and resource utilization in patients undergoing sacral tumor resection requiring lumbopelvic stabilization.

METHODS: After Institutional Review Board approval, the surgical database at a single academic institution was reviewed and all patients who underwent sacrectomy from January 1, 2000 to July 15, 2008 were identified. The resulting medical records were reviewed by two individual orthopedic spine surgeons to confirm that all of the identified procedures were amenable to surgical staging. The clinical records were then reviewed individually by the authors and de-identified data were abstracted. We determined whether or not the surgical procedure was staged and evaluated clinical outcomes and resource utilization endpoints.

RESULTS: From January 1, 2000 to July 15, 2008, 25 patients were identified. Eight patients had their procedure staged. Surgical staging was associated with a significant increase in ICU ($p = 0.03$) and ventilator free days ($p < 0.01$) at day 28, and reduced combined morbidity ($p < 0.01$). There was no difference in hospital mortality. Trends toward a greater number of hospital free days, and improved 6-month mortality were noted but did not meet statistical significance. Surgical staging significantly reduced postoperative red blood cell ($p=0.03$), and intraoperative after hours red blood cell ($p<0.01$) and non-red blood cell component requirements ($p=0.04$). By staging sacrectomy, the largest amounts of blood products were transfused during daytime hours when blood bank resources were maximal and additional anesthetic resources to assist with massive transfusion were available. Surgical staging did not affect total operating room time. Staging resulted in significantly fewer transfers of care between anesthesia care teams during the first operative encounter ($p<0.01$). Transfers of care did not differ during the second operative encounter.

DISCUSSION: Sacral corpectomy requiring lumbopelvic stabilization is a complex surgical procedure associated with major morbidity. The decision to perform only one phase of this lengthy procedure during the first operative encounter is associated with improved clinical outcomes and reduced hospital resource utilization. We believe this data can help guide the method by which this and potentially other procedures amenable to staging are performed. An open dialog between surgeons, anesthesiologists, intensivists, allied health staff, and transfusion medicine services is essential to the safe, successful care of these patients.

S-57.

HYDROGEN SULFIDE IMPROVES SURVIVAL AFTER CARDIAC ARREST AND CARDIOPULMONARY RESUSCITATION IN MICE

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INTRODUCTION: Sudden cardiac arrest (CA) is one of the leading causes of death worldwide. Hydrogen sulfide (H_2S), a colorless gas with a characteristic odor, is produced in mammalian tissues by enzymes including cystathionine γ -lyase (CGL) and exerts a host of biological effects.¹ The aim of this study was to evaluate the effect of an H_2S donor sodium sulfide (Na_2S) on the outcome after cardiac arrest and cardiopulmonary resuscitation (CPR) in mouse.

METHODS: Male mice were subjected to potassium-induced CA for 8 min with normothermia whereupon CPR was attempted with chest compression and mechanical ventilation.² After CA, mice received administration of Na_2S (0.55 mg/kg i.v.) 1 min before the start of CPR (Na_2S , $n=15$) or 10 min after CPR (post- Na_2S , $n=11$) or vehicle of Na_2S (vehicle, $n=21$). Survival rate and neurological and cardiac function were examined at 24h after CPR. Effects of Na_2S on pro-survival/pro-apoptotic signals were assessed by immunoblots in tissue extracts from brain cortex and left ventricle (LV) and by its effects on mitochondrial function. Potential role of nitric oxide (NO) on the protective effects of Na_2S was examined in nitric oxide synthase 3 (NOS3) deficient mice. Impact of endogenous H_2S on the outcome of CA/CPR was examined by studying mice with cardiomyocyte-specific overexpression of CGL (CS-CGLtg).

RESULTS: There was no difference in the rate of return of spontaneous circulation (ROSC), CPR time to ROSC, and hemodynamics at ROSC between groups. Survival rate at 24h after CPR was markedly higher in the Na_2S than in the post- Na_2S or vehicle group (Figure 1, $P<0.01$ for both vs Na_2S). Administration of Na_2S 1 min before CPR attenuated CA-induced cardiac and neurological dysfunction (Table 1). Administration of Na_2S increased phosphorylation of Akt, NOS3, and GSK-3 β in LV and brain cortex, increased serum nitrite+nitrate levels, and attenuated CA-induced caspase-3 activation in brain. Na_2S also increased Bcl-2 expression and prevented CA/CPR-induced mitochondrial permeability transition (MPT) in LV mitochondria. NOS3 deficiency abrogated the protective effects of Na_2S on the outcome of CA/CPR. In contrast, CS-CGLtg markedly shortened CPR time to ROSC and improved outcomes after CA/CPR.

DISCUSSION: These results suggest that administration of an H_2S donor at the time of CPR improves outcome after CA at least in part via activation of Akt/NOS3-dependent pro-survival signaling and prevention of MPT. These observations, if extrapolated to human, can be highly clinically relevant because they suggest that Na_2S may be administered to improve the outcome of CA at the time of CPR when IV access is obtained.

Figure 1. Animal survival after cardiac arrest and CPR

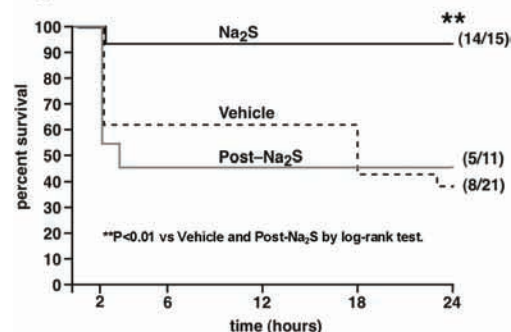


Table 1. Cardiac and neurological function 24h after CPR

	Sham	Vehicle	Na ₂ S	Post-Na ₂ S
HR, bpm	627±8	560±24*	574±19	551±13
LVESP, mmHg	118±8	78±11*#	105±6	87±6*
dP/dt _{max} , mmHg/s	17969±2290	10437±2275*	15328±1417	10958±850*#
Ees, mmHg/μl	7.6±1.1	3.9±0.3*#	10.9±2.4	3.9±0.4*#
PRSW, mmHg	122±15	41±8*#	118±13	73±15*#
Neurological score	10±0	2±1*#	6±1*	3±1*#
*P<0.05 vs sham. #P<0.05 vs Na ₂ S.				

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S-58.

ASSESSMENT OF VITAL SIGNS AND HEMODYNAMIC VARIABLES FOR EVALUATION OF BLOOD LOSS: SENSITIVITY AND SPECIFICITY

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INTRODUCTION: Traditional vital signs, such as heart rate (HR) and mean arterial pressure (MAP), are often used to assess blood loss in hemorrhagic injuries in the critical care environment. Our goal was to evaluate the sensitivity and the specificity of HR and MAP together with derived hemodynamic indices (stroke volume variation (SVV), pulse pressure variation (PPV), continuous cardiac output (CCO), and intrathoracic blood volume (ITBV) for early detection of hypovolemia after hemorrhage.

METHODS: Eight propofol-anesthetized swine were instrumented with arterial and venous catheters that were connected to PICCO® - Pulsion (PPV, SVV-P, ITBV, and CCO-P) and Vigileo® - Edwards (CCO-V, MAP, and SVV-V) monitors. After baseline period, each pig underwent four separate hemorrhages, 15ml/kg at T30, 5 ml/kg at T80 and T102, and 10ml/kg at T114. At the end of each hemorrhage, resuscitation with Hextend® or blood was infused to achieve MAP of 90 mmHg. We analyzed data from 5 ml/kg of hemorrhage was achieved, using univariate and multivariate logistic regression with using Receiver Operating Characteristic (ROC). Hosmer and Lemeshow tests were used to validate model fit for the multivariate analysis.

RESULTS: Table shows sensitivity and specificity of standard vital signs and calculated hemodynamic indices (univariate logistic regressions).

Variable	n = pigs/ bleeds	Sensitivity (%)	Specificity (%)	AUC	p
SVV (Vigileo®)	4/16	73	91	0.86	0.0001
MAP	8/28	65	96	0.82	0.0001
ITBV (PICCO®)	8/28	93	71	0.78	0.0014
CCO (Vigileo®)	4/16	82	82	0.77	0.007
PPV (PICCO®)	8/28	94	47	0.72	0.012
SVV (PICCO®)	8/28	88	35	0.60	0.28
HR	8/28	52	67	0.53	0.78
CCO (PICCO®)	8/28	27	87	0.50	0.97

MAP, CCO-V, and SVV-V from Vigileo® and PPV and ITBV from PICCO® showed significant change after 5 ml/kg hemorrhage, while all other variables were not able to significantly detect a change in blood volume after 5 ml/kg hemorrhage. Multivariate logistic regressions resulted in MAP and SVV-V having the most significant relationship and model fit to hemorrhage with a combined AUC of 0.983 (p<0.001).

DISCUSSION: In a propofol-anesthetized swine model, MAP, SVV (Vigileo®), CCO (Vigileo®), PPV (PICCO®), and ITBV (PICCO®) were all sensitive indicators of early hypovolemia (5ml/kg blood loss), while others vital signs, including some advanced hemodynamic variables, did not significantly detect this magnitude of decrease of blood volume. Our animal model differs from preoperative and operative trauma patients, since surgical stimulation and pain was blunted or absent. Choice of specific variables and related technology could provide earlier recognition of occult hemorrhage, allowing intervention before the onset of circulatory shock.

S-59.

THE ROLE OF THROMBIN RECEPTOR PAR-1 FOR INTERACTIONS OF DOTRECOGIN ALPHA (APC) AND RFVIIA IN ENDOTHELIAL CELL ACTIVATION

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INTRODUCTION: Dotrecogin alpha (APC) is a potent anti-inflammatory drug that is used in the therapy of severe sepsis or septic shock. If surgical treatment is needed APC therapy is contraindicated, because fibrinolytic and anticoagulatory effects of APC may cause intractable bleeding, which may constitute an indication for recombinant activated Factor VII (rFVIIa), another modulator of coagulation and inflammation. APC as well as Thrombin, generated by rFVIIa, bind to thrombin receptor F2r (PAR-1), but mediate different effects on intracellular trafficking of PAR-1. Use of FVIIa to treat bleeding induced by APC could or could not leave all or part of the beneficial effects of APC unaffected, which may affect outcome of sepsis. To examine APC/rFVIIa interactions at the level of leukocyte-endothelial interactions we examined adhesion molecule expression and leukocyte adhesion in static leukocyte adhesion assays in presence or absence of the PAR-1 in murine endothelial cells.

METHODS: After siRNA-knockdown of PAR-1 we incubated resting and TNF α -activated murine endothelioma cells (fend.5) +/- APC (10nM) and +/- APC and rFVIIa (10nM) in a buffer/media system. Effects on ICAM-1 expression were assessed using real time-RT-PCR and normalized to HPRT. To assess the effects of APC and FVIIa on neutrophil adhesion resting and confluent TNF α -activated endothelial cells were incubated in 6-well-plates under low shear on a rocking plate with 2x10⁶ CellTracker Green labeled bone marrow derived murine polymorphonuclear neutrophils (PMN) in 2 mL HBSS/Ca/Mg before washing three times. Adhering PMN were quantified by fluorescence microscopy and normalized to the control. Data are presented as mean \pm SEM. ANOVA followed by Student's t-test was used to identify significant effects (p<0.05).

RESULTS: Incubation with TNF α (10 U/ml) resulted in 11-fold increased expression of ICAM-1 (1.00 \pm 0.01 vs. 11.73 \pm 0.04; p<0.05) and 2-fold increased PMN adhesion (197.5 \pm 26.8 vs. 100 \pm 27.2%; p<0.05) compared to resting endothelial cells. ICAM-1 expression (11.7 \pm 0.04 vs. 9.86 \pm 2.23; p<0.05) and leukocyte adhesion (197.5 \pm 26.8 vs. 151.4 \pm 20.5%; p<0.05) to TNF α -stimulated endothelium was reduced by APC. rFVIIa incubation reversed the APC-afforded ICAM-1-reduction (9.9 \pm 2.2 vs. 13.5 \pm 9.9) and reduced leukocyte adhesion (151.4 \pm 20.5 vs. 225.7 \pm 28.6%; p<0.05) in TNF α stimulated cells. siRNA-knock down of PAR-1 significantly reduced ICAM-1 expression in all groups compared to controls but did not reduce leukocyte adhesion.

DISCUSSION: We confirm the anti-inflammatory effect of APC in our model. Knock down of PAR-1 results in a decreased expression of ICAM-1 and PMN-adhesion. FVIIa antagonizes the APC-induced reduction of ICAM-1 expression and leukocyte adhesion. We demonstrate that thrombin receptor PAR-1 plays a potential role for APC and rFVIIa effects and that rFVIIa may set off the beneficial effects of APC through another pathway than PAR-1. Further studies elucidating the interaction of APC and FVIIa to direct treatment of severe sepsis with APC are warranted.

S-60.

LARYNGEAL MASK AIRWAY IS ASSOCIATED WITH FEWER TRACHEAL INFLAMMATORY CELLS AND CYTOKINES THAN ENDOTRACHEAL TUBE IN SHORT-TERM ANESTHESIA IN SWINE

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INTRODUCTION: We have shown that intubation with an endotracheal tube (ETT) is associated with inflammatory cells and cytokines in the trachea during short-term anesthesia in swine¹. Introduction of bacteria into the airway, cell damage at intubation and continued presence of a foreign body may contribute to this process.

METHODS: With approval from the Animal Care Committee of Saint Louis University, the present study sought to determine whether anesthesia and ventilation with laryngeal mask airway (LMA) would produce less inflammation than that with ETT. To minimize the contribution of bacterial contamination of the airway to this process, we pretreated 14 swine with broad-spectrum antibiotics for 72 hours prior to anesthesia. Seven of these swine were anesthetized and ventilated with ETT for 6 hours, then lavaged once above the cuff with 5 ml of sterile saline. Another seven swine received anesthesia and ventilation with LMA for 6 hours, then were intubated and immediately lavaged above the cuff. Cell counts and differentials were performed on whole fluid, then fluids were centrifuged to remove cells. Supernatant cytokines were measured with enzyme-linked immunoassay.

RESULTS: LMA swine had significantly lower median polymorphonuclear cell (PMN) number, PMN percent, interleukin 6 (IL-6) and tumour necrosis factor α (TNF- α) than ETT swine by Mann-Whitney nonparametric t-test. Total protein, interleukin-1 β and interleukin-8 were not significantly different.

DISCUSSION: Inflammatory cells and cytokines are higher in the trachea of swine anesthetized and ventilated with ETT than with LMA.

	Group Median(range)	p value
PMN %	ETT 80 (18-96)	.007
	LMA 20 (0-37)	
PMN# (x10 ⁶)	ETT 3.64 (0.15-18.2)	.002
	LMA 0.02 (0-0.42)	
IL-6 Pg/ml	ETT 135 (0-604)	.017
	LMA 0 (0-44)	
TNF- α Pg/ml	ETT 331 (1-1631)	.026
	LMA 33 (0-126)	

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S-61.**HYPERGLYCEMIA AND 28-DAY MORTALITY IN SEVERE TRAUMATIC BRAIN INJURY**

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INTRODUCTION: Hyperglycemia is associated with poor outcomes in patients with traumatic brain injury (TBI)¹. Although intensive insulin therapy is widely used in the critically ill, its role in patients with severe TBI remains controversial. Of particular concern is the increased risk of hypoglycemia associated with intensive insulin therapy, which may exacerbate secondary brain injury. Thus, the optimal glucose range remains unclear. The goal of this study was to examine the association of serum glucose levels on 28-day mortality in patients admitted to the intensive care unit (ICU) following severe TBI.

METHODS: We conducted a retrospective cohort study of patients admitted to the ICU between May 2000 and March 2006 with severe TBI (Glasgow Coma Scale ≤ 8) who survived at least 12 hours. Daily 8am serum glucose values for the first 14 days were recorded. Demographic data, type and severity of injury, APACHE II score, baseline vital signs, ICU management and 28-day mortality were collected. TBI management was protocolized, which included infusion of insulin targeting serum glucose values between 7 and 10 mmol/L. For statistical analysis, daily 8am glucose values were divided into quintiles, with the second quintile used as the referent category. The association of glucose quintiles on 28-day mortality was evaluated using Cox proportional hazard regression. Covariates in the final model are listed in the table below.

RESULTS: 171 patients were included in the analysis. The majority were male (77.2%), with a mean APACHE II score of 23.4 \pm 4.7 and a median GCS of 6 \pm 1.96. Traumatic subarachnoid hemorrhage was present on the initial computerized tomography of the head in 91 (53.2%) patients. Thirty-one (18.1%) patients died within 28 days of admission. Daily 8am glucose quintile data and results are presented in the table below. Patients with glucose level in the highest quintile had a 3.7-fold increased rate of mortality ($p=0.05$) compared with those in the referent quintile.

Table: Rate of 28-day mortality by quintiles of daily 8am glucose

Quintile	Mean glucose \pm Standard Deviation (mmol/L)	Range (mmol/L)	Hazard ratio*	95% CI
1	5.0 \pm 0.6	1.8-5.7	1.3	0.28-6.0
2	6.1 \pm 0.3	5.8-6.5	1.0	-
3	7.0 \pm 0.3	6.6-7.4	1.2	0.25-5.3
4	8.0 \pm 0.3	7.5-8.5	0.68	0.11-4.2
5	10.2 \pm 1.8	8.6-20.9	3.7†	1.0-13.4

*Adjusted for: gender, age, APACHE, GCS, year of admission, craniotomy performed, mannitol administered, cooling < 38 degree Celsius, systolic blood pressure <90mmHg during the first 24 hours and traumatic subarachnoid hemorrhage on computerized tomography of the head.

† $P=0.05$

DISCUSSION: Glucose values greater than 8.5 mmol/L during the first 14 days after severe TBI were associated with a significantly increased rate of 28-day mortality. Although the optimal glucose range is unknown, maintaining serum glucose below 8.6 mmol/L may improve outcomes in these patients.

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S-62.**CYTOKINES AND CHEMOKINES IN THE EARLY PHASE OF VENTILATOR-INDUCED LUNG INJURY MODEL IN MICE**

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INTRODUCTION: Mechanical ventilation (MV) causes a type of acute lung damage termed ventilator-induced lung injury (VILI). The underlying molecular mechanisms have not been fully elucidated. The soluble mediators in inflammatory process seem to play an important role in biotrauma related to VILI (1). Thus, the mediators are useful to assess diagnosing biological markers. Here, we investigated levels of cytokines and chemokines as the mediators in early phase of mice VILI model.

METHODS: Anesthetized Balb/c mice (10 to 15 week-old female) were ventilated at high tidal (HT) or low tidal (LT) volume (Vt; 35 or 15 ml/kg, respectively) for 30, 60 and 120 min. After MV, 13 cytokine levels, interleukin (IL)-1 α , IL-1 β , IL-2, IL-6, IL-10, IL-12, granulocyte colony-stimulating factor (G-CSF), interferon (IFN)- γ , keratinocyte-derived chemokine (KC), monocyte chemoattract protein (MCP)-1, macrophage inflammatory protein (MIP)-1 β , regulated upon activation normal T-cell expressed secreted (RANTES), tumor necrosis factor (TNF)- α in both bronchoalveolar lavage fluid (BALF) and plasma were simultaneously measured by a Bio-Plex system.

RESULTS: In BALF of HT group, all cytokines except IL-12 and RANTES were significantly increased after MV compared with non-ventilated controls. Prior to elevation of most cytokines in BALF at 60 or 120 min, TNF- α significantly increased at 30 min after MV. IL-6 and G-CSF in BALF of LT group were also increased at 120 min. When we compare cytokines and chemokines between groups of LT and HT, IL-1 α , IL-1 β , IL-2, IL-10, IFN- γ and MIP-1 β were significantly higher in HT group than that in LT group. The other hand, in plasma, IL-6, G-CSF, KC, and MCP-1 were increased in both groups compared with non-ventilated controls.

DISCUSSION: MV at high tidal volume induced increase of many cytokines and chemokines in lung tissue and plasma, however, the kinds and levels of cytokines and chemokines were much higher in alveolar space than in plasma. Although many investigators have searched for biological markers of VILI, controversies still exist in several markers (1, 2, 3). Our results suggested that many kinds of proinflammatory, anti-inflammatory cytokines and chemokines increased simultaneously after increase of TNF- α in alveolar space in the early phase as reports (4, 5) as a significant role in VILI.

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S-63.

TISS-28 IS MORE SENSITIVE THAN SOFA TO PATIENT DECOMPENSATION

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INTRODUCTION: The Sequential Organ Failure Assessment (SOFA) and 28-item Therapeutic Intervention Scoring System (TISS-28) are validated measures of severity of illness^{1,2}. Whereas the SOFA is a measure of severity of illness based on laboratory data and vital signs (e.g., mean arterial pressure, arterial blood gas values, and doses of vasoactive medications), the TISS28 captures the intensity of caregiver interventions (e.g., use of CPAP, presence of an arterial catheter, and frequency of dressing changes). Our study evaluated changes in these measures prior to cardiac arrest to determine whether trends could be identified that might predict the subsequent event

METHOD: Subjects were part of a convenience sample of patients experiencing cardiac arrest during their hospitalization. Charts were obtained as part of a quality-improvement initiative and were not subject to IRB oversight. Charts were reviewed and data abstracted to calculate scores for SOFA and TISS-28 for a baseline measurement (the calendar day before the event) and pre-event (the calendar day of the event). Each day's least favorable values were used, in accordance with common practice when calculating these scales clinically.

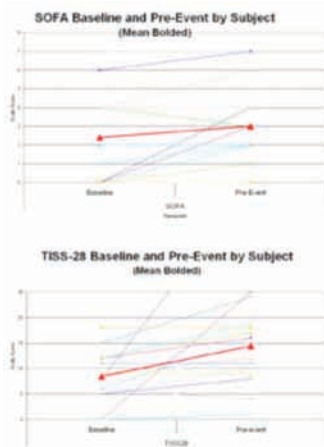
RESULTS: Twenty charts have been reviewed. The SOFA and TISS-28 scale scores both increased in 19 of the 20 patients. Paired samples t-tests revealed that both the mean SOFA and mean TISS-28 increased from baseline to pre-event ($p < 0.05$ for both). The mean SOFA increased 25% from 2.4 to 3.0 (0-24 scale; see figure 1), whereas the TISS-28 increased 70% from 8.5 to 14.4 (0-78 scale; see figure 2).

DISCUSSION: Predicting the occurrence of cardiac arrest has the potential to extend lives, and avoiding CPR has the potential to prevent hypoxic brain injury and its staggering cost among survivors. We evaluated two severity of illness scales to identify trends that might predict a subsequent cardiac arrest. Although statistically significant, the minimal increase in the mean SOFA suggest it may be less sensitive to deterioration in in-patients. This suggests that following changes in the TISS-28 in hospitalized patients might identify those patients at increased risk for cardiac arrest. Future work will increase the sample size and identify case-control subjects to refine a predictive model.

Figure 1. Figure 2.

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S-64.

THE VENULE, NOT CAPILLARY, MAY REPRESENT THE CRITICAL SITE FOR MICROCIRCULATORY DETERIORATION UPON PERIPHERAL NERVES AND THE PROTECTIVE EFFECTS OF DANAPALOID IN THE ACUTE SEPTIC RAT MODEL

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INTRODUCTION: Although peripheral nerve disorders linked with the critical illness polyneuropathy are associated with sepsis, the precise pathogenic mechanisms involved have yet to be clarified. Here, we speculate that a potential mechanism might include microcirculatory disorders, possibly involving the expression of E-selectin (leukocyte adhesion factor). In this study, we attempted to localize the critical sites of deterioration caused by lipopolysaccharide and also investigated the protective effect of danaparoid sodium (DS), an anticoagulant and anti-inflammatory agent, upon microcirculation in the acute septic rat model.

METHODS: Bronchotomy was performed, sciatic nerves exposed bilaterally, an indwelling catheter inserted into the left internal carotid artery for measurement of arterial mean arterial pressure (MAP), and finally, mechanical ventilators connected. Rats were divided randomly into 4 groups: a control group (C-group), a group administered with lipopolysaccharide (LPS:1mg/kg; L-group), a control group administered with 400 Units of DS (CD-group) and a group administered with both LPS and 400 units of DS (LD-group). LPS or normal saline was administered and the microcirculatory dynamics of venules and capillaries on the sciatic nerve recorded for four hours by microscopy and laser-Doppler flow meter. Nerve blood flow (NBF) was also measured. After the experiment, both sciatic nerves were removed and the expression of E-selectin was determined by immunostaining.

RESULTS: We observed severe reductions in NBF (C-group: 22.6 ± 3.7 ml/100g/min; L-group: 7.7 ± 2.1 ml/100g/min; $p < 0.001$) which were not in proportion to the observed reductions in MAP (C-group: 119 ± 17 mmHg; L-group: 115 ± 18 mmHg) and were more pronounced at 3 hours and 40 minutes in the L-group than in the C-group. In our analysis of microcirculatory dynamics, it was evident that leukocyte rolling and hemostagnation were significantly greater at both sites in the L-group (rolling phenomenon: $p < 0.01$; other: $p < 0.001$). However leukocyte adhesion was only seen in venules in the L-group. Immunostaining demonstrated that the expression of E-selectin was significantly greater in the L-group (C-group: 6/14 cases; L-group: 14/14 cases; $p < 0.01$). Administration of danaparoid improved not only the severe reductions in NBF induced by LPS (LD-group: 18.8 ± 5.5 ml/100g/min. $p < 0.05$, vs. L-group), but also the expression of E-selectin (LD-group: 3/16 cases; $p < 0.001$, vs. L-group).

DISCUSSION: Consequently, we postulate that the first stage of microcirculation collapse in sepsis, and the consequent reduction of blood velocity in the nerves, is characterized by the expression of E-selectin by the activation of vascular endothelial cells. It seems that deterioration in the venule is responsible for the microcirculatory collapse as a result of the lack of capillary adhesion. This suggests the possibility that these factors are likely to be associated with peripheral nerve disorders including the critical illness polyneuropathy. Furthermore, DS might reduce peripheral nerve damage by attenuating the expression of E-selectin.

S-65.

INTENSIVE INSULIN THERAPY(IIT) FOR TIGHT GLYCEMIC CONTROL: HOW TIGHT DOES IT NEED TO BE?

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Aim of This Review:

Safety and efficacy of tight glycemic control with intensive insulin therapy in cerebral ischemia

INTRODUCTION: Van Den Berghe in a landmark study showed that IIT reduces morbidity and mortality among critically ill patients.¹ This study led to many ICUs practicing tight glycemic control using IIT. But how safe is it? And what levels of blood glucose are safe?

Evidence: Relationship of Hyperglycemia and Worse Outcome

Studies: Hyperglycemia following traumatic brain injury (TBI) worsens outcome.² There is overwhelming evidence that supports the theory that acute hyperglycemia adversely affects stroke outcome. It can double the infarct size, reduce penumbral salvage and worsen functional outcome.³ In patients who have suffered from subarachnoid hemorrhage (SAH), hyperglycemia has been identified as an independent predictor of outcome (disability or death). Hyperglycemia is associated with the development of symptomatic vasospasm after SAH.

Evidence: Intensive Insulin Therapy. (IIT) What Level of Blood Glucose (BG) is Safe??

Author	Title	Trial	#of Patients	Measurement	Diagnosis	Conclusions
Bilotta et al (2008)	IIT after severe TBI	Prospective RCT	97	IIT range- 80-120 mg/dl Conventional Insulin therapy was started when BG>220 mg/dl	TBI	IIT significantly associated with risks of hypoglycemic episodes.
Schlenk et al (2008)	Hyperglycemia and cerebral glucose in aneurysmal SAH	Prospective RCT	28	Micro dialysis catheter	SAH	Low cerebral glucose was associated with severe metabolic distress (lactate/ pyruvate ratio, glutamate and glycerol)
Vespa et al (2006)	IIT reduces microdialysis glucose values	Prospective Monitoring followed by retrospective data analysis non RCT	47	IIT 14 pts had 70% ↓ in BG Conventional Group-15% ↓ in BG	TBI	IIT results in a net reduction in micro dialysis glucose and increase in microdialysis glutamate, lactate/pyruvate ratio

CONCLUSION: Hyperglycemia has been associated with poor outcome in critically ill patients. Hence tight glycemic control is practiced in many ICUs. However, an ischemic brain shows low cerebral glucose levels with evidence of cellular distress worse with hypoglycemia. Overzealous ↓ of BG may be self defeating. Patients on IIT need frequent monitoring of BG. If resources permit, monitoring of cerebral glucose by microdialysis catheter, which is more meaningful, may be considered.

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S-66.

THE EFFECTS OF VASOPRESSORS ON THE GUT MICROCIRCULATION OF ENDOTOXEMIC RATS

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INTRODUCTION: The use of catecholamines in patients with severe sepsis and septic shock remains a cornerstone of intensive care medicine. Vasopressors drugs can accentuate hypoperfusion of the gut mucosa, increasing the potential for bacterial translocation. The objective of presented study was to evaluate the effects of different vasopressors commonly used in sepsis on intestinal microcirculation in a rat model of endotoxemia.

METHODS: Seventy Wistar rats (250-350 g) were anesthetized and received 2 mg/Kg of lipopolysaccharide from Escherichia coli - LPS serotype 055:B5. After a 40% reduction in the mean arterial pressure (MAP) the animals were randomized to receive one of the following treatments: vehicle (saline 0.9% - control group); dopamine (10µg/kg/min - DOPA group), phenylephrine (10µg/kg/min - PHE group), epinephrine (5µg/kg/min - EPI group), norepinephrine (5µg/kg/min - NOR group), dobutamine (2µg/kg/min - DOBUTA group), or the association of norepinephrine with dobutamine (5 and 2 µg/kg/min, respectively - NOR + DOBUTA group). The functional capillary density (FCD) of the intestinal mucosa evaluated with fluorescent intravital video microscopy. The FCD was estimated during the shock and after the hemodynamic recovery with of one of the vasoactive drugs.

RESULTS: All tested drugs were equally efficient in restore MAP, however, in the DOPA, PHE, EPI, and NOR groups the FCD was significantly reduced. One the other hand, the FCD was preserved in the DOBUTA and NOR + DOBUTA groups.

CONCLUSIONS: The use of dobutamine and the association of norepinephrine and dobutamine present protective effects on mesenteric microcirculation in a rat model of endotoxemia.

S-67.

TRAUMATIC DISTRESS AND POSTTRAUMATIC STRESS DISORDER IN FAMILY MEMBERS OF SURVIVING INTENSIVE CARE UNIT PATIENTS

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INTRODUCTION: Family members of intensive care unit patients exhibit high levels of psychological distress and are a high risk sample for mental health morbidity ^{1,2,3}. We designed the first prospective long term study to evaluate acute and posttraumatic stress symptoms in family members of surviving intensive care unit (ICU) patients both during, and after ICU stay. This study aimed to meet the essential research needed to devise preventive strategies.

METHODS: For sixty-seven ICU patients the one closest family member was investigated, after admission, three, and six months later. Acute and long-term traumatic stress symptoms were assessed with the Acute Stress Disorder Scale (ASDS) to identify Acute Stress Disorder (ASD) according to the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) definition, the Impact of Event Scale-Revised (IES-R) and the Clinician-Administered PTSD Scale (CAPS).

RESULTS: Of 50 surviving ICU patients, data of their family members are presented. After admission a high rate (78 %) of acute traumatic distress was found in the sample. Every second family member (50 %) fulfilled the criteria for an Acute Stress Disorder (ASD). According to the IES-R results, symptoms of ASD remitted significantly, although posttraumatic stress symptoms exist continuously in 44 % at the second, and in 36 % at the third assessment. Posttraumatic Stress Disorder (PTSD) in family members was evaluated in 30 % after three months, and in 26 % after six months of admission, respectively. Both, female and male participants, exhibited a high level of ASD, traumatic stress symptoms, and PTSD over time regardless of ICU length of stay, and severity of the disease. A high rate of acute physical arousal or avoidance correlated significantly with posttraumatic stress symptoms and with PTSD at the second and third assessment.

DISCUSSION: Family members of ICU patients suffer from a high level of acute and long-term traumatic distress. Furthermore, they are at high risk to develop PTSD. Based on recent studies psychological care on the ICU becomes more significant. With reference to our results, a high rate of acute stress symptoms (primarily physical arousal or avoidance) is accompanied with PTSD. Early professional interventions may prevent mental health morbidity after experiencing the hospitalization of a beloved in the ICU.

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S-68.

ANESTHETIC MANAGEMENT OF URGENT AWAKE TRACHEOSTOMY: A RETROSPECTIVE REVIEW

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OBJECTIVE: To review the indications, anesthetic management, complications and outcomes of awake tracheostomy performed at Los Angeles County+USC Medical Center by otolaryngology service over a six year period between 2001-2007.

METHODS: Inpatient and outpatients charts were reviewed of patients who underwent awake tracheostomy at the LAC+USC medical center by otolaryngology service. The study was approved by the Institutional Review Board.

RESULTS: Urgent awake tracheostomy was performed in 49 patients by otolaryngology service. All patients received local anesthesia and were monitored by anesthesiologists. Indications for awake tracheostomy included impending airway obstruction due to head and neck malignancy 57.14%, infection 14.28%, head and neck trauma 6.12%, subglottic stenosis 10.20% and other causes accounted for 12.24%. We obtained data from male n=39, female n=10 with mean age of 49.6 years and average BMI of 25. One patient underwent cricothyrostomy followed by awake tracheostomy. There were four complications noted including pneumothorax, pneumonia, hemorrhage, and one case of profuse bleeding from malignant tracheal mass leading to airway obstruction, cardiac arrest and death.

CONCLUSION: Awake tracheostomy is a relatively safe way to secure an airway in patients with severe acute respiratory obstruction. It has low complication rate and low mortality. Our data suggests that awake tracheostomy should be considered in patients with impending airway obstruction in a timely manner because delaying the procedure may have devastating consequences.

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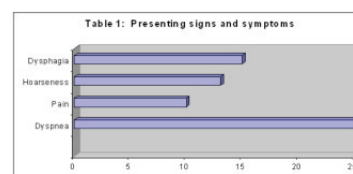
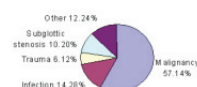


Table 2: Causes of Tracheal Stenosis



S-69.**ASSOCIATION OF ICU-ADMISSION HEMATOCRIT AND LONG-TERM MORTALITY IN ICU PATIENTS**

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INTRODUCTION: A recent NSQIP-based study of elderly patients showed that, for patients undergoing non- cardiac surgery, both anemia (Hematocrit (Hct)=27-38.9) and polycythemia (Hct>51) were associated with an increased risk of 30 day post-operative mortality and cardiac events(MI, cardiac arrest).¹ We hypothesized that this association may hold for the ICU and that the difference in mortality rates may extend to one year after discharge from the hospital.

METHODS: . After IRB approval, we extracted the data of 3387 consecutive patients (both medical and surgical) admitted between January 1, 2000 and August 5, 2003 to the intensive care unit at the Palo Alto Veterans Administration Medical Centers (PAVAMC) from the VISN 21 Analytics Healthcare Database a unique dataset that combines physiologic and administrative data of patients from five intensive care units . The PAVAMC dataset included patients from the lower acuity Intermediate ICU. Patients were grouped according to hematocrit level at admission to the ICU; (1) anemic (Hct 51; n = 40, 1.2%) and (2) normal (Hct = 39-51; n = 1342, 39.6%). The primary outcome was mortality within one year of discharge from the hospital. Kaplan-Meier survival analyses were conducted in order to determine whether the mortality rate for patients with either anemia or polycythemia was higher than the mortality rate for patients with normal Hct levels .

RESULTS: The mortality rate for patients with either anemia or polycythemia had a one year post-discharge mortality rate that was twice as high as the mortality rate for patients with hematocrit levels of 39-51 (0.216 vs 0.104 respectively, p < .0001).

DISCUSSION / CONCLUSION: Having an abnormal hematocrit level (anemia or polycythemia) was a highly significant predictor of one- year post- hospital discharge mortality from the ICU. A physiologic mechanism linking anemia to mortality may be the decreased oxygen delivery to tissues which, when combined with a compensatory increase in heart rate, may lead to higher cardiac morbidity and mortality. In future research, we plan to examine the interrelationships between tachycardia, anemia and poor outcome.

1.W C Wu et al, Preoperative Hematocrit Levels and Postoperative Outcomes in Older Patients Undergoing Noncardiac Surgery, JAMA, June 13, 2007_ Vol 297, No. 22

S-70.**IDENTIFYING DIFFERENCES IN PATIENT DATA UTILIZATION BETWEEN PHYSICIAN GRADES AT THE TIME OF ADMISSION TO THE ICU**

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INTRODUCTION Large quantities of patient data are available to the ICU physician and are the foundation of medical decision making. We have previously demonstrated that attendings grade some commonly-presented data points as infrequent contributors to ICU medical decision making [1] and demonstrated the existence of significant levels of information corruption associated with errors of medical judgment [2]. We sought to identify differences in data utilization between medical grades as an important first step in rationalizing data presentation and reducing information corruption in the ICU.

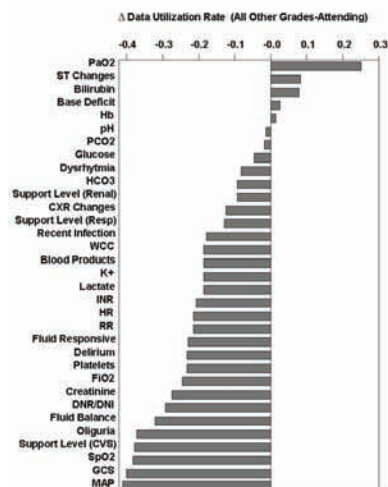
METHODS As part of a clinical study on information utilization at our tertiary referral centre, a 33 point data-set was presented to all physician members of the admitting ICU team within 2 hours of a new patient's arrival. Physicians were asked to identify data points they considered relevant for their initial diagnosis and management. Comparisons between attending and non-attending physician data utilization were made.

RESULTS Responses relating to 54 physician-patient interactions were collected. Of 33 data points, a median (IQR) of 13.5 (8-17) and 6 (3-9.75) were utilized by consultants (n=14) and all other grades (n=40), respectively (Chi Square 6.7, p< .001). The figure below demonstrates the difference in utilization, between attendings and all other grades of physician, for each data point. Matched pair analysis of individual data point utilization rates demonstrated a mean difference (95%CI) of -0.17 (-0.11 to -0.22), p<.0001.

DISCUSSION We have identified significant differences in data point frequency-of-utilization in admission decision making processes between physician grades in the ICU. Attendings utilize a greater number of data points and do not place the same value on some laboratory data compared to other grades of physician. These findings suggest that ICU experts and non-experts do not share a view on the decision making value of individual patient data points. Identification of these differences may contribute to the development of a rational patient-data presentation format for use in the ICU. In addition, by characterising expert defined high value data sets, physicians in training may gain insights into model decision making processes and contribute positively to their acquisition.

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- [2] Crit Care Med 2008;Dec. S336



S-71.

CARDIAC ARREST AND MEASURES OF SEVERITY OF ILLNESS

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INTRODUCTION: Cardiac arrest represents a severe physiologic derangement, frequently followed by clinical shock and critical illness. The Sequential Organ Failure Assessment (SOFA) and 28-item Therapeutic Intervention Scoring System (TISS-28) are validated measures of severity of illness^{1,2}. Our study evaluated changes in these measures before and after a cardiac arrest to begin to examine how well these measures capture the changes that occur in patients who experience cardiac arrest and cardiopulmonary resuscitation.

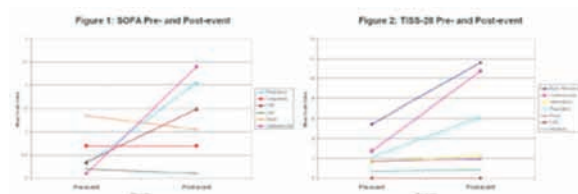
METHOD: Participants were part of a convenience sample of patients experiencing cardiac arrest and CPR during their hospitalization. Charts were obtained as part of a quality-improvement initiative and were not subject to IRB oversight. Charts were reviewed and data abstracted to calculate scores for SOFA and TISS-28 for a pre-event (the calendar day of the event) and post-event (the calendar day after the event) value. Each day's least favorable values were used, in accordance with common practice when calculating these scales clinically.

RESULTS: Twenty charts have been reviewed. Scores for both measures were significantly higher after the event compared with before as demonstrated by a paired-samples *t* test ($p < 0.01$ for both comparisons). For both scales, certain subscales made up the majority of the increase; some subscales remain the same or decline. For the SOFA, the Cardiovascular and Respiratory subscales increase substantially, while the remaining scales do not (see figure 1). For the TISS-28, the Basic Interventions (e.g., frequency of vital sign and laboratory monitoring), Cardiovascular (e.g., number of vasoactive medications), and Respiratory (e.g., use of CPAP) subscales of the TISS28 markedly increased (see figure 2).

DISCUSSION: The SOFA and the TISS-28 should capture the changes in severity of illness accompanied by a cardiac arrest event, and, in fact, the scale scores increase significantly. However, only some of the subscales increase, whereas others decline or remain stable. It is likely that these scales lack the ability to accurately assess changes in dynamic systems during periods of acute change. It may also be that a combination of items from both scales captures the clinical status of these patients better than either scale on its own.

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S-72.

EFFECTS OF DEXMEDETOMIDINE ON DIURNAL HORMONE SECRETION IN ARTIFICIALLY VENTILATED INTENSIVE CARE PATIENTS: A COMPARATIVE STUDY WITH PROPOFOL

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INTRODUCTION Dexmedetomidine is a selective alpha-2 agonist and reported to induce sedation similar to natural sleep. The purpose of this study is to compare the effects of two sedatives, dexmedetomidine and propofol, on diurnal secretions of various hormones including cortisol, aldosterone, arginine vasopressin, epinephrine, norepinephrine and plasma renin activity in artificially ventilated intensive care patients.

METHODS Sixteen patients ventilated artificially were included. No patients had cardiovascular instability requiring vasoactive drugs or fluid balance disturbances requiring diuretics or continuous renal replacement therapy. Sedation with propofol was started at 8:00 on the first day of the study. Blood samples were drawn for the measurement of plasma concentrations of various hormones mentioned above at 14:00, 22:00 on the second day and 7:00 on the third day of the study. Continuous infusion of propofol was stopped and sedation with dexmedetomidine was started at 8:00 on the third day. Blood sampling were carried out at 14:00 and 22:00 on the third day and 7:00 on the fourth day of the study. We aimed to achieve proper depth of sedation with the aid of Bispectral index and Ramsay Sedation Score. We made every effort to maintain natural lighting conditions and no interventional procedures were applied to the patients before the sampling times.

RESULTS Among plasma concentrations obtained, only cortisol at 7:00 during dexmedetomidine sedation had significant increase from other time points. Other hormones had even plasma concentrations throughout the study period.

Changes in plasma concentrations of various hormones under propofol (P) and dexmedetomidine (D)						
	P 14:00	P 22:00	P 07:00	D 14:00	D 22:00	D 07:00
Cortisol (microg/dl)	14.3 (5.3)	14.0 (6.8)	13.4 (6.4)	13.6 (5.9)	14.3 (6.7)	21.3* (7.7)
Aldosterone (pg/ml)	154.7 (105.8)	119.6 (72.4)	152.6 (74.4)	140.4 (92.0)	102.0 (67.9)	114.8 (101.6)
PRA (ng/ml/hr)	8.3 (7.0)	8.3 (8.1)	7.0 (7.3)	7.4 (8.7)	5.1 (5.5)	4.8 (5.0)
AVP (pg/ml)	1.4 (1.2)	1.2 (0.7)	1.1 (0.7)	1.3 (0.9)	1.2 (0.8)	1.5 (1.1)
NE (pg/ml)	883.9 (949.7)	861.2 (999.9)	885.5 (1053.9)	693.1 (797.8)	654.5 (806.5)	705.4 (1095.6)
E (pg/ml)	54.4 (32.4)	55.8 (40.1)	50.1 (30.4)	47.9 (37.1)	41.8 (23.3)	45.5 (30.7)

PRA; plasma renin activity, AVP; arginine vasopressin, NE; norepinephrine, E; epinephrine. Values are mean (SD), * $P < 0.05$ compared with other time points.

DISCUSSION Only cortisol had its peak plasma concentrations at 7:00 under sedation with dexmedetomidine, but not propofol. It was suggested that diurnal rhythm of cortisol secretion could be maintained during dexmedetomidine sedation. It also is possible that various stresses from ICU environment in the morning (e.g. sunlight or noises) were perceived by patients under dexmedetomidine sedation and stimulated secretions of cortisol. Unchanged plasma concentrations of epinephrine and norepinephrine, as stress hormones, might be considered a result of suppressed sympathetic system by dexmedetomidine *per se*.

In conclusion, this study demonstrated a diverse effect of dexmedetomidine and propofol on plasma cortisol secretions. Peak plasma concentrations of cortisol were observed in the morning when sedated with dexmedetomidine, but not propofol. Further studies are needed to examine the exact mechanisms and possible contribution to the improvement of prognosis and quality of care in patients treated in ICU.

S-73.

THE EFFECT OF ACLS REFERENCE CARDS ON IMPROPER ACTIONS DURING HIGH-FIDELITY SIMULATION OF ACLS MEGACODES

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INTRODUCTION: Errors in Advanced Cardiac Life Support (ACLS) performance can occur as wrong actions, which are associated with adverse outcomes.^{1,2} These occur due to lack of knowledge of the correct sequence and timing of actions. The best methodology to reduce wrong actions while treating cardiac arrest remains unknown. Accordingly, we performed a trial testing whether ACLS reference cards aid in retention of ACLS skills by reducing wrong actions during real-time simulations of American Heart Association (AHA) MegaCodes. In addition to published AHA/ACLS cards, we developed a card (MUSC card) that presents AHA/ACLS guidelines according to a 4-question algorithm: is the patient 1) pulseless? or 2) unstable? If neither, is the rhythm 3) narrow or wide and 4) regular or irregular? The answers to these questions guide the practitioner to the proper ACLS algorithm.

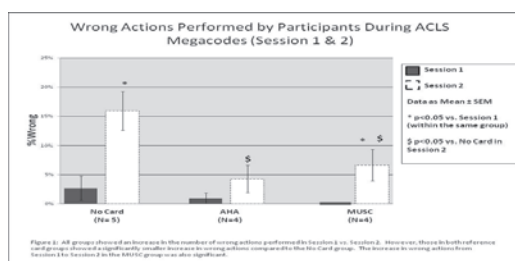
METHODS: Thirty medical students participated in a study investigating the impact of reference cards on ACLS performance. Thirteen were able to complete the entire study, including a session testing retention of skills 3 months after initial testing. The study consisted of 5 sessions. The first was didactic, covering ACLS protocols. The second was a high-fidelity simulation ACLS training session. Following the training session, students were randomized into three groups to test reference card impact (No Card, AHA Card, MUSC card). The third session and fourth session (Testing Session 1) presented students with a single MegaCode scenario per ACLS/AHA guidelines requiring them to treat various patient states. For the second phase of the study, these students were brought back after 3 months (Testing Session 2) and were given another MegaCode scenario to manage. All simulation sessions were video-taped and graded according to published checklists in ACLS/AHA training manuals. Data was analyzed by unpaired t-test and presented as Mean \pm SEM.

RESULTS: While all of the groups showed an increase in wrong actions, the No Card and MUSC Card groups were significantly increased (see Figure 1). However, after 3 months both the MUSC Card and AHA Card groups demonstrated a significantly lower degree of wrong actions compared to the No Card group.

DISCUSSION: As with prior studies, this study demonstrated a loss of ACLS skills after a 3-month interval from initial training. However, this is the first study to our knowledge to investigate the use of ACLS reference cards in retention of ACLS skills. These data suggest that the use of reference cards will decrease wrong actions by code team leaders and that their use improves ACLS performance months after the initial training. While promising, due to the small number of participants that completed the full protocol, further study is warranted to confirm or refute the data from this pilot study.

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S-74.

MAGNITUDE OF BICARBONATE DILUTION WITH INCREASING SALINE-BASED ADMINISTRATION BASED ON ADULT STUDIES

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INTRODUCTION: Saline and saline-based fluids are known to induce a metabolic acidosis when infused acutely and in large quantities. Two explanations as to the etiology include bicarbonate ion dilution and the more recent Stewart approach. Mechanisms based on the Stewart electrolyte variable (strong ion difference) are actually misconceptions (1). When SID is understood as solely an indirect measure of buffer base, dilution of bicarbonate is evident from this approach as well. This study sought to discover if there was a correlation between volume of saline administered and bicarbonate concentration based on published clinical data, and to determine the dose where an acidosis would likely start to develop.

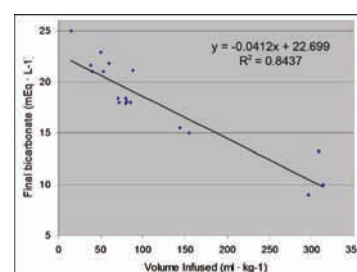
METHODS: Medline search from January 1980 to December 2007 was conducted for studies that incorporated saline or saline-based fluids with later analysis of acid-base results. Search criteria included the terms: hyperchloremic acidosis, dilutional acidosis, saline acidosis, strong ion acidosis, and bicarbonate dilution. Total volume of saline-based fluid administered was divided by the average weight (in kilograms) from reported biographical data.

RESULTS: The search revealed 11 prospective adult studies (9 perioperative and 2 volunteer) in addition to 6 case reports of massive saline infusions. Blood products were given in 5 studies and 3 case reports were longer than 8 hours (majority 2-6 hrs), which would minimize bicarbonate change. Regarding confounding causes, 7 of the 11 prospective studies had a balanced-fluid arm, which all demonstrated a lack of bicarbonate dilution. The remaining studies and case reports did not have an abnormal anion gap or lactate. A good correlation was found between volume per kilogram body weight and final bicarbonate concentration ($r^2=0.84$, total of 204 patients). In 13 studies that reported an initial bicarbonate, a similar correlation ($r^2=0.92$) and slope could be demonstrated using bicarbonate change as the dependent variable. Acute infusions over 45 milliliters per kilogram tend to decrease bicarbonate to less than 20.8 milliequivalents per liter and may lead to an acidosis ($pH \leq 7.34$ with a $PaCO_2$ of 40 mmHg). Although variable, the linear regression equations suggest at least a 0.4-0.5 mEq per liter drop for every 10 ml per kilogram of saline.

DISCUSSION: Acute (< 8-12 hrs) saline infusions in excess of 45 milliliters per kilogram may lead to clinically significant bicarbonate ion dilution. This information is valuable to the clinician when interpreting blood gas and chemistry results.

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S-75.

V₂-RECEPTOR ANTAGONISM PROLONGS SURVIVAL AS COMPARED WITH ARGININE VASOPRESSIN IN SEPTIC SHOCK

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INTRODUCTION: The mixed V₁/V₂-receptor agonist arginine vasopressin (AVP) is increasingly used to stabilize hemodynamics in septic shock. Previous studies, however, have shown that only the V₁-receptor mediates vasoconstriction, while V₂-receptor agonism may increase vascular leakage.¹ The present study was designed as a prospective, randomized, laboratory experiment to compare the effects of a selective V₂ antagonist [(Propionyl¹-D-Tyr(Et)²-Val⁴-Abu⁶-Arg^{8,9})-Vasopressin (TVA-AVP)] with AVP, when given as first-line therapy, on hemodynamics, metabolic changes and mortality using an established model of ovine septic shock.

METHODS: Twenty-one adult ewes were anesthetized and instrumented for chronic hemodynamic monitoring using an established protocol. A median laparotomy was performed to take feces from the cecum under sterile conditions. After baseline (BL) measurements had been performed, the feces were injected into the peritoneal cavity. Following onset of septic shock (shock time (ST), defined as mean arterial pressure (MAP) < 60 mmHg), the animals were randomly assigned to receive either a continuous infusion of 1 µg·kg⁻¹·h⁻¹ TVA-AVP or 0.5 mU·kg⁻¹·min⁻¹ AVP (n = 7 each). The control group (n = 7) received only the vehicle (normal saline). Norepinephrine (NE) was titrated up to a maximum of 1 µg·kg⁻¹·min⁻¹ to maintain MAP at 70 ± 5 mmHg in all groups, if needed. Data are expressed as mean ± SEM.

RESULTS: There were no differences at BL and ST between groups. The selective V₂-antagonist led to higher central venous and pulmonary artery occlusion pressures as compared to both other groups (p = 0.002 each). Neither MAP, cardiac index nor NE and fluid requirements differed between treatment groups. Selective V₂-antagonism reduced negative base excess from 2 h to 10 h after ST and attenuated the decrease in pH-values from 2 h to 5 h after ST as compared to both other groups (p < 0.05 each). In addition, arterial lactate levels were lower in the TVA-AVP (4.0 ± 0.3 mmol/L) than in the AVP group after 10 h (5.3 ± 0.3 mmol/L; p = 0.019). Notably, selective V₂-antagonism prolonged survival time as compared to AVP (14 ± 1 h vs. 10 ± 1 h; p = 0.004) and control animals (10 ± 1 h; p = 0.004).

DISCUSSION: The selective V₂-antagonist TVA-AVP stabilized hemodynamics as effective as AVP without increasing NE or fluid requirements in ovine septic shock. Since V₂-antagonism does not cause vasoconstriction, an increased intravascular volume due to less capillary leakage might be a possible explanation. In addition, metabolic acidosis was reduced by the selective V₂-antagonist. Future studies are warranted to investigate this potential beneficial therapeutic approach in the setting of septic shock.

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Economics

S-76.

A COST EFFECTIVE SCREENING METHOD FOR PREOPERATIVE HYPERGLYCEMIA AT A TERTIARY CARE HOSPITAL

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INTRODUCTION: In the United States, approximately 23.6 million people (7.8%) meet the clinical criteria for diabetes (fasting blood glucose >125 mg/dl), while 57 million people have impaired glucose fasting or pre-diabetes (fasting blood glucose 100 to 125 mg/dl).¹ In the perioperative setting, suboptimal glucose control has been shown to be a strong risk factor for increased postoperative morbidity and mortality.²⁻⁴ Many patients without a preexisting diagnosis of diabetes do not routinely have a preoperative glucose measurement. The purpose of this study was to assess the incidence of unsuspected preoperative hyperglycemia.

METHODS: After Institutional Review Board approval and informed consent, 347 adult, non-pregnant fasting patients had a preoperative glucose measurement determined. A drop of blood residue remaining on the intravenous needle after routine IV catheter placement was used to measure the blood glucose with a glucometer (Accu-Chek Inform, Indianapolis, IN). This blood glucose value, along with the patient's age and any past history of diabetes, was recorded. In the event of an elevated blood glucose level (≥ 100 mg/dl), the patient was informed and the appropriate clinical team notified.

RESULTS: A total of 347 patients (age range 19-76 years; 174 males and 155 females) were tested from June 2007 to May 2008, with 18 (5.1% of the subjects) excluded for a documented prior history of diabetes or pre-diabetes. Of the remaining 329 subjects, 7 (2.1%) patients (4 male, 3 female) had a glucose measurement between 100-119 mg/dl. More importantly, 6 (1.8%) patients (4 male, 2 female) had a glucose measurement greater than 120 mg/dl.

DISCUSSION: Any easy, inexpensive and readily implemented screen for undiagnosed diabetes and pre-diabetes is described in the preoperative setting. The cost per newly diagnosed pre-diabetic and diabetic patient in our series was \$24 and \$28, respectively. This compares to an estimate of the cost of screening for pre-diabetes ranging from \$176-\$236 per identified and previously unsuspected pre-diabetic or diabetic patient.⁵ The identification of previously undiagnosed preoperative patients with hyperglycemia can improve their immediate and long term care.

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S-77.

THE USE OF THE JOINT COMMISSION (TJC) LEVEL OF ACCREDITATION AS A GAUGE OF HOSPITAL QUALITY

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INTRODUCTION: In recent years there has been an accelerating drive to demonstrate and document healthcare "quality". The challenge has been to provide meaningful differentiation of care from the level of the hospitals all the way down to the individual practitioner. An entire industry has developed solely for the purpose of evaluating quality in healthcare. One early player in this game was The Joint Commission (TJC). TJC assigns levels of accreditation to its member hospitals that include full accreditation, provisional accreditation, preliminary approval of accreditation, conditional accreditation, preliminary denial of accreditation, and denial of accreditation. Tremendous amounts of hospital resources (financial and administrative) are devoted to the preparation for TJC reviews. This study was undertaken to evaluate how useful the level of TJC accreditation is for gauging hospital quality.

METHODS: The level of accreditation of all TJC hospitals as of July 2008 was gathered from the TJC website (<http://www.jointcommission.org>) as were all special certifications or awards of excellence from the TJC. Member hospitals were grouped by state and the overall rate of accreditation at each level and the rates by state were calculated.

RESULTS: There were 4,365 member hospitals of TJC. Overall, 97.3% of them achieved full accreditation. The rate of full accreditation varied by state/territory from the 14 states/territories having 100% full accreditation to the 89.47% full accreditation rate in Alaska. Only 8 states/territories (Alaska, the District of Columbia, Iowa, Nebraska, North Dakota, Puerto Rico, Rhode Island, and South Dakota) had accreditation rates lower than 94% and these tended to be states/territories with relatively few hospitals. Of the 4365 hospitals, 118 were not fully accredited: 31 had provisional accreditation, 70 had conditional accreditation, 2 had preliminary accreditation, 9 had preliminary denial of accreditation, and 6 were denied accreditation.

DISCUSSION: The fact that almost all (97.3%) of the member hospitals of TJC had a rating of full accreditation makes it hard to use this accreditation as a meaningful measure of the quality of healthcare systems. The exception to this might be in the states with a larger number of not "fully" accredited hospitals where consumers might choose to avoid the lower rated facilities. Unfortunately, even in these states it would be hard to use TJC data to guide hospital choices because the small number of hospitals and their distribution over these large sparsely populated states make effective consumer choice extremely difficult. The inconvenience of consumer choice in this setting may be the reason that there are more hospitals in these states that are not "fully" accredited--that is, there are no competitors to "punish" lower rated hospitals for their shortcomings. Thus, evaluative tools that more effectively differentiate facility quality are necessary to distinguish the relative standing of American medical centers.

S-78.**UTILIZATION OF AN ANESTHESIA INFORMATION MANAGEMENT SYSTEM FOR PHYSICIAN CREDENTIALING**

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INTRODUCTION: The Joint Commission (formerly JCAHO) recently mandated an enhancement of the metrics used for credentialing physicians in order to satisfy increasing public demand for accountability and scrutiny of clinicians.^{1,2} These standards, effective January 1st, 2008, require a competency based evaluation that is both an evidence-based and continuous evaluation of clinical performance.³

Different methods of evaluation have been used by other specialties including simulated patients, video or direct observation, peer assessment, medical record audits, and portfolio appraisals.⁴ In order to comply with this new mandate, our departmental credentialing committee set out to develop a set of objective metrics, grounded in the ASA standards for monitoring, that could be easily obtained from our automated anesthesia information managements system (AIMS).

METHODS: We sought data that was objective and automatically recorded in order to minimize any administrative burden. We solicited input from our department, other hospitals, and performed a literature search to determine what metrics had already implemented. Our process led to the development of three novel metrics:

(1) End-Tidal CO₂ monitored at least once during general anesthesia cases. (2) Blood pressure measured prior to induction of general anesthesia. (3) Compliance statements completed within 120 minutes of case conclusion.

We then extracted individual provider performance for each of the three metrics over a nine month period utilizing our existing AIMS database in order to (1) determine baseline provider performance and (2) set thresholds for review during our credentialing process. We now plan to report individual provider performance at six month intervals.

RESULTS:

Baseline Performance Data - 1/1/08-8/31/08		
Credentialing Metric	No. Physicians Evaluated	Group Mean Baseline Performance
End-Tidal CO ₂ Monitoring	90	98.8%
BP Prior to Induction	82	92.0%
Compliance Statements within 120 min.	103	97.9%

DISCUSSION: We have developed a robust set of physician credentialing metrics utilizing AIMS data. As we developed our metrics, we eschewed measures that might penalize practitioners in high risk specialties (e.g. reintubation rates) or would require risk adjustment for case-mix (e.g. frequency of post-operative nausea & vomiting). For our baseline assessment, we excluded providers who performed a limited number of cases (e.g. part-time/new faculty) which led to differences in the number of providers assessed within each metric. Of note, we did not exclude pediatric inhalational inductions in our BP metric, which likely explains the lower baseline performance. We plan to use these metrics going forward for our physician credentialing processes.

REFERENCES:

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4. Donnelly L., Strife J. "Performance-based assessment of radiology faculty: a practical plan to promote improvement and meet JCAHO standards." American Journal of Roentgenology. 184(5):1398-401, May 2005.

S-79.**WHATCHA GONNA DO WITH A BROKEN HEART?**

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INTRODUCTION: A plethora of metrics for assessing the relative quality of healthcare providers (from the medical center level to the level of the individual practitioner) has emerged in recent years. Two organizations that have a long history of providing insight into the relative quality of America's hospitals are The Joint Commission (TJC) which provides accreditation and recognizes excellence among its member hospitals with awards and special certifications and the annual issue of US News and World Report (USNWR) which provides a listing of the top hospitals in a wide range of specialties based on a national survey of practicing physicians (<http://www.usnews.com/directories/hospitals/index.html?specialty+ihqcard>). Since there is no "gold standard" of hospital excellence by which various metrics can be judged we endeavored to determine if these two metrics were at least consistent with each other as determinants of hospital excellence in the specific case of heart valve surgery.

METHODS: The top 100 hospitals by case volume for valve operations were identified using the Medicare Hospital Compare database. For hospitals that were members of TJC the number of awards for excellence they received from TJC were determined using the TJC website (<http://www.jointcommission.org/>). Then the members of the USNWR top 50 hospitals for cardiac care that were on the top 100 Hospital Compare list were identified and the number of awards for excellence received by each member of this group was identified. The number of awards in these groups was then compared to the national average for award recognition among member hospitals of TJC.

RESULTS: Among the 4365 members of TJC, 25.8% had no awards, 48.1% had one award, 16.8% had two awards, and 9.3% had three or more awards. Of the 100 hospitals that did the most valve operations, 97 were members of TJC. All 97 had at least one award, 20.6% had two awards, and 62.9% had three or more awards. Eighteen of these hospitals were also on the USNWR list of the top 50 heart hospitals. All eighteen of these hospitals had at least two awards and 88.9% of them had three or more awards.

DISCUSSION: Among the hospitals doing the highest volume of heart valve operations, there are a disproportionate number of facilities that have received awards for excellence from TJC. Additionally, among these high volume hospitals, the ones that have also been recognized as top cardiac care facilities by USNWR show an even more markedly skewed distribution towards higher numbers of awards from TJC. These data suggest that there is significant concordance of quality recognized by TJC's award recognition system and the survey-style results of USNWR as regards the quality of facilities doing cardiac valve operations.

S-80.

CAUSAL FACTORS THAT PROMOTE AND SUPPORT THE CAREERS OF WOMEN IN ANESTHESIOLOGY

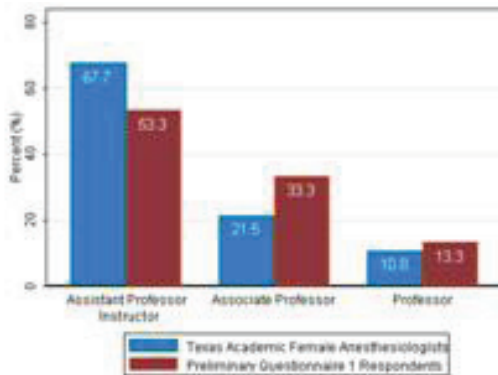
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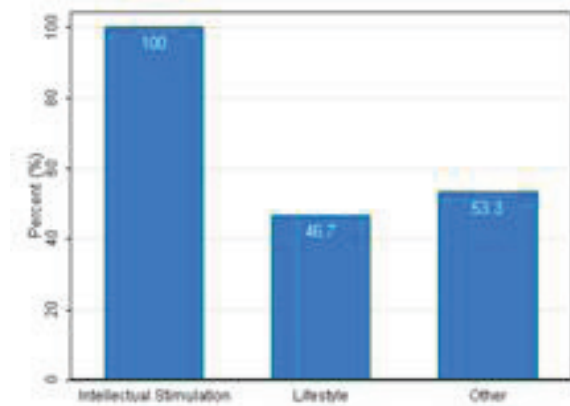
INTRODUCTION: For female anesthesiologists, personal and professional factors play an important role in achieving career success and maintaining a work-life balance. We hypothesize that specific individual and organizational factors are associated with the recruitment, retention, and advancement of women in the specialty of anesthesiology. However, to date no published studies have identified such influencing factors in this specialty. To identify these factors, we developed and administered a questionnaire to female anesthesiologists at different academic ranks from multiple institutions.

METHODS: The questionnaire (PQ1) was developed by assessing pertinent questions from a National Institute of Health Request for Application (GM 09-012). A multiple choice question was given for academic rank followed by 11 open-ended free text questions covering education, family, personal, financial, institutional, and career issues. Demographic information was also obtained from these institutions. The 12 -item PQ1 was sent to the department chairs or senior female anesthesiologists at five of the University of Texas institutions and Baylor College of Medicine. The senior faculty were asked to complete the PQ1 if they were female and also to distribute the PQ1 to three female faculty members in their department at each of the following academic ranks: instructor/assistant professor, associate professor, and full professor.

RESULTS: The response rate to the PQ1 was 30% (15/50). Two (33%) of the six institutions had two or fewer female anesthesiologists at the professor rank which demonstrated the general lack of female anesthesiologists achieving higher academic rank.



Distribution of academic rank in PQ1 respondents was similar to that of female anesthesiologists at these institutions in Texas (Figure 2).



Factors that promoted the decision to pursue a career in anesthesiology (Figure 3).

Three factors that influenced the choice of a career in anesthesiology were:

- 1) Intellectual stimulation
- 2) Lifestyle factors
- 3) Other factors. Other factors included performing procedures, switching into anesthesia from another specialty, and having variety and options available in the specialty.

Factors that supported female anesthesiologists' desire and ability to maintain their career included job satisfaction, intellectual stimulation, mentorship, good work environment, lifestyle, promotion, and other.

DISCUSSION: Our research has identified specific factors that promote and support female anesthesiologists in academic practice. Our future research will target a larger population and will include female anesthesiologists in private practice. We believe a more detailed questionnaire will elucidate additional factors that have led or could lead to promotion and career advancement for women in anesthesiology. Moreover, we believe that this knowledge will allow measures to be implemented that will improve the work environment for women anesthesiologists in the future. We anticipate that all anesthesiologists will benefit from this effort.

Education & Patient Safety

S-81.

THE FREQUENCY OF MEDICATION ERROR INCREASES BASED ON SURGICAL CASE TYPE

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Intro: Medication errors are a common occurrence in anesthesia (proposed frequency of 1 out of every 130-200 anesthetics). Several factors may contribute to medication errors in anesthesia, including experience of the anesthesia provider and the complexity of the case (ASA classification). But can the type of surgical case contribute to medication errors? Certain surgical procedures often require infrequently used medications, multiple infusions, and can have marked hemodynamic instability. The aim of this study was to assess if certain types of surgical cases at a tertiary training hospital have higher frequency of medication errors than others.

METHODS: Medication error reporting forms were designed and attached to every anesthetic record during a six month period (08/20/07-02/20/08). Anesthesia providers received training on what are considered medication errors before the start of the study. Providers were asked to voluntarily and anonymously return the reporting form for every anesthetic case whether or not a medication error occurred. If providers indicated positively (medication error occurred), further details of the medication error was requested, including type of surgical case. Type of surgical case for the negative response cases was obtained from the surgical informational system.

RESULTS: Total 52 forms out of 10574 anesthetics were returned with a positive response, indicating a medication error/pre-error occurred. The incidence of medication error for each type of case was recorded and is shown in Table 1. As no errors were reported in Ophthalmology cases, all other case types were compared to this standard. Neurosurgery cases showed no significant increase from Ophthalmology, with an equal incidence of 0.00%. There were 5 errors reported in OB/GYN, resulting in an incidence of 0.31%. Although this may be clinically significant, there was no statistical significance. All other case types, including General, Orthopedic, ENT, CVT, Colorectal, Transplant (heart, liver, kidney, kidney/pancreas), and Peripheral Vascular, showed a statistically significant increase in error rate over the standard.

DISCUSSION: CVT, colorectal, vascular, and transplant cases all were found to have an incidence of > 1.0%, resulting in a frequency of 1 in 66-100 anesthetics. These types of cases tended to include ASA III or higher, require multiple infusions, and typically required medications not frequently used in anesthesia. ENT cases were frequently pediatric cases, short in duration with fast turnaround, while most orthopedic cases were done with a regional technique, with or without a general, in older patients (hip replacements). Our findings show that a specific type of case has a higher incidence of medication error than previously reported. Previously reported error rates underestimate the true risk of medication errors in anesthesia due to statistical dilution from case types that rarely have errors. More complex cases on more complex patients lend themselves to increased rate of medication error.

Medication Error by Surgical Case Type			
Case Type	Errors Reported	Incidence	p value relative to Ophthalmology Cases
Ophthalmology/Neurology	0/1023 0/372	0.00% 0.00%	p=1.0 p=1.0
OB/GYN	5/1589	0.31%	p=0.068
General	7/1499	0.47%	p=0.0286*
Ortho	9/1593	0.56%	p=0.0163*
ENT	6/976	0.61%	p=0.0120*
CVT	3/299	1.00%	p=0.0013*
Colorectal	4/376	1.06%	p=0.0010*
Transplant	2/179	1.12%	p=0.0007*
Vascular	5/380	1.32%	p=0.0002*

S-82.

REPORTING OF MEDICATION ERRORS IMPROVES IN ANESTHESIA PRACTICE WHEN REPORTING IS FACILITATED

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Intro: Medical errors (largely due to medication errors) are now the seventh leading cause of death in the United States (1). Moreover, upwards of 20% of administered medications in hospitals are by anesthesia providers; however, current reporting systems may underreport these medication errors due to a number of factors. The aim of this study was to attempt to improve medication error reporting rates, through use of a facilitated reporting tool, over historical experience at a large, tertiary care, academic hospital.

METHODS: A new paper-based medication error reporting form was designed and attached to every anesthetic record during a six-month period (08/20/07-02/20/08) (Ref.). Anesthesia providers received training on what are considered medication errors and pre-errors before the start of the study. Providers were asked to voluntarily and anonymously return the reporting form for every anesthetic case whether or not a medication error or pre-error occurred. If a medication error was reported, then further details of the medication error, along with contributing factors, were elicited. Collected data were compared to medication errors reported in S.T.O.R.M (Standardized Tracking & Occurrence Report Management), a computerized risk management software program, for a similar time period (08/20/06-02/20/07).

RESULTS: A total of 8777 forms out of a possible 10574 anesthetics were returned which corresponds to an 83% reporting rate. 52 of the forms were positive for a medication error or pre-error. The frequency of both medication errors and pre-errors occurrence was 0.0049 (0.0037 - 0.0064; 95% confidence level) or an estimated occurrence rate of 1 out of every 203 anesthetics. This finding was compared to data from the previous medication error reporting system (S.T.O.R.M.), in which only 1 medication error was reported out of 10145 anesthetics corresponding to a frequency of 0.0001 (0.000017 - 0.00056; 95% confidence level). This difference in reported error rates was highly statistically significant (p<0.0001).

DISCUSSION: We achieved similar reporting (83% vs. 80%) and error rates (0.49% vs. 0.75%) compared to previously reported rates (ref Webster), thus validating our data. However, this report is the first study assessing how to improve medication error reporting among anesthesia providers using historical controls. We have demonstrated that providing in-service training on medication errors along with a facilitated reporting system can improve compliance in reporting among anesthesia providers.

(1)Webster CS, Merry AF, Larsson L, McGrath KA, Weller J. The frequency and nature of drug administration error during anaesthesia. *Anaesth Intensive Care*. 2001 Oct;29(5):494-500.

S-83.**MODERNISING MEDICAL CAREERS (MMC): IMPACT ON ANESTHESIA TRAINING IN THE UNITED KINGDOM****AUTHORS:** V. Sharma¹, A. Swinson²;**AFFILIATION:** ¹Nuffield Dept of Anaesthesia, John Radcliffe Hospital, Oxford, United Kingdom, ²John Radcliffe Hospital, Oxford, United Kingdom.

INTRODUCTION: Modernising medical careers (MMC) was implemented in August 2007 to provide a transparent, effective career path for doctors in the United Kingdom. Junior resident anesthesiologist / Senior House Officer (SHO) posts were replaced by run-through Specialty Training (ST) posts with hospitals losing autonomy of candidate selection in favour of a central recruitment process. Acute Core Common Stem (ACCS) was created as introductory training for emergency medicine, anesthesia and medical trainees. At Milton Keynes general hospital, a cohort of four medical ACCS and three anesthesia trainees replaced seven anesthesia SHOs. Five of the new trainees were novices. Rota restructuring to suit training and service demands meant that non-trainee staff grade anesthetists replaced the former SHOs on the general and obstetrics rota.

METHODS: Anesthesia administered for emergency surgical, obstetric and orthopedic procedures over an eighteen month period, nine months before and after the introduction of MMC in August 2007 was retrospectively analysed from the anesthesia database. Anesthesiologists were graded according to their designation. The number of anesthetics administered by each group was ascertained. Statistical analysis used the chi square test and resulting p values were calculated.

RESULTS: The total number and case mix of emergency cases was similar before and after implementation of MMC. However, there is a significant change in emergency workload distribution in our cohort of anesthesiologists. Junior anesthesiologists (ST) gain less experience in emergency as compared to the previous trainee anesthesiologists.

Anaesthesia workload trend before and after implementation of MMC			
	Before MMC Nov06-Jul07	After MMC Aug07-Apr08	p value
Number of cases	2125	2210	
Case mix			
-Orthopaedics	398	377	0.25
-Obstetrics	875	976	0.21
-Surgery	852	857	0.6
Consultant	180	296	< 0.001
Registrar	160	294	< 0.001
SHO / ST 1-2	1516	568	< 0.001
Non-training gr	242	1007	< 0.001

DISCUSSION: Our results show a sharp decline in the number of anesthetics administered by trainees post implementation of MMC. We were unable to allocate inexperienced anesthesia and medical trainees appropriate positions on the theatre and on-call rota. Ongoing service commitments resulted in non-training staff grade anesthetists replacing SHOs on the rota. Rota restructuring to meet training needs of junior physicians meant that anesthesia training opportunities formerly utilised by SHOs were lost to non trainee staff grade anesthetists. This explains the decline in the number of anesthetics administered by STs as compared to their colleagues. Implementation of the European Working Time Directive in August 2009 which limits the maximum number of hours worked by trainees may further diminish experience [1]. Whilst high quality patient care is paramount, we also have a duty to train our junior colleagues. With the current experience our trainees may be ill prepared to face demands of senior position in their subsequent placements. We recommend the introduction of dedicated obstetric, airway and trauma training modules for junior anesthesiologists during routine hours to compensate for missed opportunities in emergency situations.

REFERENCES: 1. Anaesthesia. 2004; 59:781-4.**S-84.****GUM ELASTIC BOUGIE GUIDED I-GEL™ AIRWAY INSERTION COMPARED WITH STANDARD TECHNIQUE****AUTHORS:** R. M. Khan¹, M. W. Brandon², G. Nikhil¹, B. M. Maroof³, N. Kaul¹, A. Sumant¹;**AFFILIATION:** ¹National Trauma Centre, Muscat, Oman, ²Anesthesiology, University of North Carolina, Chapel Hill, NC, ³University of North Carolina, Chapel Hill, NC.

I-gel™ airway (IGA) is a cuffless supraglottic device introduced by Intersurgical Ltd, Wokingham, Berkshire, UK. When correctly placed, the distal end of the gastric channel should be located in the upper oesophageal opening and the cuffless bowl should surround the perilaryngeal structure. However on occasions, the device fails to provide adequate ventilation or entry of the nasogastric tube into the oesophagus via its gastric channel. We hypothesize that placing the IGA over a preplaced gum elastic bougie should not only aid its insertion but also assure best approximation of the distal end of the gastric channel.

METHODS: After approval by the IRB and informed consent, 50 adult patients of ASA grade I and II scheduled for elective surgical procedures were selected for this prospective, randomized, double blind study. Anesthesia was induced with propofol 2-3 mg/kg. Patients were randomly assigned to one of the 2 groups. In Group I patients, IGA was placed unaided as per manufacturer's instructions [1]; while in Group II patients, IGA was railroaded over a preplaced gum elastic bougie using the gastric channel as the conduit.

Ease of IGA placement was judged by the time and attempts taken to place the device. Placement time was recorded in seconds from entry of the distal device tip between the incisors to the first recording of capnographic curve. Failure to insert the device correctly within 60 seconds was to be considered as an attempt. Maximum of three attempts were allowed.

Approximation of distal end of gastric channel of IGA to the upper end of the oesophagus was noted by the ease of nasogastric tube passage via the gastric channel [Grade 1= smooth passage in the first attempt, Grade 2= passed with some resistance, Grade 3= failed placement].

Percentage Of Glottic Opening [POGO] recorded as viewed by flexible fibroscope [Grade 1= POGO score 100%, Grade 2= POGO score >50%, Grade 3= POGO <50%, Grade 4= POGO score 0], the leak test as noted by movement of cotton wisp held near the proximal end of the drain channel [negative or positive].

Results:

In one of the Group I patients, POGO score of Grade 4 was noted versus none in Group II.

In all patients of Group II, Igel could be successfully placed in the first attempt. In contrast, one patient in Group I needed three attempts for its successful placement. Time needed to place the device successfully in both the groups was nearly identical and showed no significant difference [p>0.05], Leak was observed in 4 patients [16%] of Group 1. In three of these patients, Ryle's tube needed more than one attempt for successful placement [p<0.05].

REFERENCES: 1. I-gel User Guide. Intersurgical Ltd, Berkshire RG41 2RZ.

S-85.

DOES CASE COMPLEXITY AND ASA CLASSIFICATION RESULT IN A HIGHER FREQUENCY OF MEDICATION ERRORS?

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AFFILIATION: ¹Anesthesiology, University of Miami Miller School of Medicine, Miami, FL, ²Ochsner Health System, New Orleans, LA.

Intro: Medication administration errors are a common occurrence in anesthesia (proposed frequency of 1 out of every 130-200 anesthetics).¹ It has been suggested that higher complexity cases lead to more frequent medication errors. The objective of this study was to assess if complex anesthesia cases (stratified via ASA classification) lead to a greater frequency of medication errors.

METHODS: Medication error reporting forms were designed and attached to every anesthetic record during a six month period (08/20/07-02/20/08) at a large, tertiary care, academic hospital. Anesthesia providers received training on what are considered medication errors and pre-errors before the start of the study. Providers were asked to voluntarily and anonymously return the reporting form for every anesthetic case whether or not a medication error or pre-error occurred. If an error was reported, then further details of the medication error were requested. ASA classification data for negative responses (no error reported) was obtained from the surgical informational system. Cases were assigned to one of two groups: medication error or non-medication error, then comparisons were made between ASA classifications.

RESULTS: Total 52 forms out of a possible 10574 indicated either a medication error or pre-error had occurred. ASA classification distribution of cases where a medication error was reported versus cases where no medication error was reported is listed in Table 1. The relative risk of a medication error occurring in ASA III patients compared to ASA I or ASA II patients was 2.9:1 and 1.9:1 respectively. Using Chi-Square tests and Pearson's statistic, the difference was statistically significant (p=0.0231)

DISCUSSION: Higher complexity anesthetic cases routinely require frequent interventions for hemodynamic instability. Many medications are used infrequently, and providers may be unfamiliar with their use. These medications often require mixing/dilution, and many require programming of infusion pumps. With an increased number of steps in the medication administration process, where an error could possibly occur, one might infer that there would be a higher frequency of medication errors. We found that there was a trend to more frequent errors in ASA class III patients, although there were not similar findings in ASA IV or V patients. A likely reason for the lack of significant findings in these complex patients may be the small number of cases in these classes in the overall distribution. A larger study looking at these complex cases is warranted.

¹ Webster CS, Merry AF, Larsson L, McGrath KA, Weller J. The frequency and nature of drug administration error during anaesthesia. *Anaesth Intensive Care*. 2001 Oct;29(5):494-500.

Medication Error by ASA Classification			
ASA Class	Total Cases	Errors Reported	Incidence/Relative Risk Compared to ASA I/ASA II
I	1797	5	0.28%/ 1.0 / 0.86 (p=0.37)
II	5583	24	0.43%/ 1.1 / 1.0 (p=0.26)
III	2712	22	0.81%/ 2.9 / 1.9 (p=0.02)*
IV	461	1	0.22%/ 0.64 / 0.75 (p=0.81)
V	16	0	0.00%/ 1.0 / 1.0 (p=0.79)

S-86.

THYROPLASTY FOR GLOTTAL INCOMPETENCE UNDER LOCAL ANESTHESIA AND CONSCIOUS SEDATION

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INTRODUCTION: Thyroplasty is performed to augment vocal cord closure in patients with glottal incompetence that have significant speech and/or swallowing impairment. Thyroplasty involves placing a synthetic material into the larynx to allow the vocal cords to close. Previous thyroplasty articles describe general anesthetic techniques. We present our anesthetic experiences for 79 cases performed at our center.

METHODS: IRB approval was obtained, thyroplasty charts reviewed for last three years.

RESULTS: Glottal incompetence necessitating surgical thyroplasty was caused by previous surgeries, idiopathic, cancer, or intubation related. Two thirds of these previous surgeries were cardiothoracic and thyroid surgeries. All thyroplasty procedures were performed under MAC technique, mainly with midazolam for premedication (77% of patients, mean 2.3 mg) and intraoperative infusion of propofol (58%, mean 61 mcg/kg/min). The nasal airway was topicalized to allow passage of a fiberoptic scope. Cocaine was used for this in over 50% of cases with a mean dose of 89 mg soaked on cotton pledgets. Nine patients that received cocaine had a history of CAD, with four of these patients having coronary stents. Additionally, cocaine was used in two patients with atrial fibrillation, one with history of CVA, one after ablation for PSVT, and one had Bentall procedure. No complications were reported for any of the cases and no cases required conversion to general anesthesia.

Comorbidities	Etiology	Symptoms	
Hypertension	49%	Surgery	53%
CAD	20%	Idiopathic	16%
Coronary Stent	9%	Cancer	8%
GERD	38%	Intubation Related	5%
		Moderate Dysphonia	71%
		Severe Dysphonia	25%
		Moderate Dysphagia	10%
		Severe Dysphagia / Aspiration	25%

Table 1: Cormorbidities, etiology, and symptoms for study patients (n=79).

DISCUSSION: This is the first study describing the anesthetic management for thyroplasty under local anesthetic and conscious sedation. This approach is challenging for the anesthesiologist since it requires the patient to be awake enough to interact and provide feedback to optimize repair during surgery yet comfortable enough to allow surgery. Our surgical colleagues chose the local anesthetics for naso-pharyngeal topicalization with a predominance of cocaine usage due to the ideal surgical conditions created. No perioperative complications were reported even after administering cocaine to patients with cardiovascular disease in our series. This is likely due to the small doses used combined with incomplete absorption from the pledget [1]. However, the anesthesiologist needs to be aware of the complications of cocaine, such as ischemia and arrhythmia, as well as the treatment options. Cases of MI occurring in healthy young women after cocaine topicalization have been reported [2]. Recently, the American Heart Association published guidelines for management of cocaine-associated acute coronary syndrome, which can be used by anesthesiologists to guide management of cocaine associated intraoperative complications [3]. Beta blockers should be avoided and sodium bicarbonate should be considered for treatment of arrhythmias. Communication between surgeon and anesthesiologist is important during these cases.

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S-87.**EPIDURAL ANALGESIA AND DEEP VEIN THROMBOSIS PROPHYLAXIS IN SURGICAL PATIENTS WITH GYNECOLOGICAL MALIGNANCIES****AUTHORS:** R. Gordon;**AFFILIATION:** Anesthesiology, US Naval Medical Center, San Diego, CA.

INTRODUCTION: It has become increasingly evident in recent years that the “big four” surgical complications identified by the surgical care improvement project (SCIP), namely surgical site infections, deep vein thrombosis and pulmonary embolism, postoperative pneumonia and perioperative cardiac events are profoundly influenced by intraoperative and postoperative anesthetic management. In this study we focus on the patient with a gynecological malignancy undergoing major abdominal surgery, an extremely high risk group for thrombotic complications. ACOG has published practice guidelines for thrombosis prophylaxis for this patient group, suggesting in particular the importance of chemical prophylaxis with either fractionated or unfractionated heparin¹. But a recent survey suggests in approximately half of the surgical candidates chemical prophylaxis is not used, primarily because of the fear of bleeding. The role of epidural analgesia may play in such situations has not been clarified.

METHODS: Traditional medical teaching uses Virchow’s “triad” to elucidate the pathogenesis of deep vein thrombosis, namely reduced blood flow, increased coagulability, and vessel wall damage. To more accurately quantify the role of epidural analgesia, we use a simple chemical engineering model of a continuous stirred tank reactor to approximate the conditions wherein thrombi form behind the valve cusps in the deep leg veins and soleal sinuses. Such a model shows the key importance of the product rt in promoting thrombus creation, wherein r is the reaction rate for fibrin formation, and t is the residence time of blood behind valve cusps and in sinuses, inversely proportional to venous velocity.

RESULTS: Recent studies by Delis on the venous hemodynamics of the lower limb demonstrate marked increases in venous velocity with epidural analgesia², suggesting profound decreases in residence time t . Such increases in venous velocity are also known to affect blood rheology in a favorable fashion. These benefits offset to a significant effect the adverse effects of surgical stress (which increases blood rheology in an unfavorable fashion) and immobility, with its unfavorable influence on venous blood flow and t .

DISCUSSION: Our model demonstrates that epidural analgesia may play a significant role in impacting the frequency of one of the “big four” SCIP complications, namely deep vein thrombosis, in a patient subgroup at high risk for this complication. The model also offers clarity with respect to the relative roles of anticoagulation (through its effect on r) and early ambulation and epidural analgesia (through their effect on t). Thus for the surgeon who eschews chemical prophylaxis an alternative regimen to reduce thrombosis risk is available, an anesthetic management regimen.

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S-88.**DOES HIGH INTRAOPERATIVE INSPIRED OXYGEN REDUCE POSTOPERATIVE ARTERIAL OXYGEN SATURATION?****AUTHORS:** N. Mackintosh¹, H. W. Hopf², N. Pace², V. Wilding², J. White²;**AFFILIATION:** ¹Anesthesiology, University of Utah, Salt Lake City, UT, ²University of Utah, Salt Lake City, UT.

INTRODUCTION: Use of high inspired oxygen (FiO₂) intraoperatively has been shown to reduce surgical site infection (SSI) in colon surgery^(1,2). Controversy remains regarding the side effects of high FiO₂, particularly the degree of absorption atelectasis, which limits acceptance in lower risk patients⁽³⁾. PEEP may abrogate absorption atelectasis. We therefore studied the effect of FiO₂ 0.3 vs. >0.9 with and without PEEP on postoperative hypoxemia and need for supplemental oxygen in patients undergoing lower risk surgery.

METHODS: A double blind randomized 2x2 factorial design study was employed. After IRB approval and preoperative written informed consent, subjects were randomized into 4 treatment groups (FiO₂ 0.9 vs. 0.3, with and without PEEP). Except for FiO₂ and PEEP, induction and maintenance of anesthesia were at the discretion of the anesthesia team. After 30 minutes in the PACU, supplemental oxygen was discontinued. Arterial oxygen saturation by pulse oximetry (SpO₂) was recorded at 5, 10, and 15 min breathing room air. If at any time the subject’s SpO₂ decreased to <90% supplemental oxygen was added incrementally (starting with 0.5 Lpm) as needed to maintain SpO₂>90%. The same procedure was followed 22-26 hours later.

RESULTS: To date, 42 of 100 patients have been enrolled and data collection has been completed. Preliminary analysis using a non-parametric Wilcoxon-Mann-Whitney test demonstrated no statistically significant difference in postoperative supplemental oxygen use between groups ($p>0.5$).

FiO ₂	Median PACU O ₂ (liters)	Standard deviation
0.3 (n=19)	1	.92
.9 (n= 23)	1	1.5
FiO ₂	Median POD1 O ₂ (liters)	Standard deviation
.3 (n=19)	0	.77
.9 (n=23)	0	.56

PEEP	Median PACU O ₂ (liters)	Standard deviation
0 (n=18)	1	.92
3-5 (n= 24)	1	1.5
FiO ₂	Median POD1 O ₂ (liters)	Standard deviation
0 (n=19)	0	.5
3-5 (n=23)	0	.78

SpO ₂ FiO ₂ /PEEP	Preop SpO ₂	PACU SpO ₂	24 hours SpO ₂
0.9/0 (n=10)	93.8% ± 2.1	95.3% ± 3.3	92.8 ± 2.32
0.9/3-5 (n=13)	94.8 ± 1.4	94.9 ± 3.3	96.0 ± 1.7
0.3/0 (n=8)	97.4 ± 1.1	95.2 ± 3.9	95.0 ± 2.7
0.3/3-5 (n=11)	95.1 ± 1.1	93.3 ± 3.0	95.0 ± 2.0

DISCUSSION: The use of high inspired oxygen does not appear to lead to absorption atelectasis sufficient to increase postoperative hypoxemia and therefore it may be reasonable to employ high FiO₂ even in lower risk surgery to reduce the risk of SSI.

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S-89.

SURGICAL SITE INFECTIONS AND THE ANESTHESIOLOGIST: TOWARD MORE RAPID IMPLEMENTATION OF CURRENT STUDIES INTO PRACTICE

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INTRODUCTION: Annually, there are approximately 30 million surgeries in the United States, and recent studies suggest upwards of one quarter of a billion surgeries world wide¹. These enormous numbers imply that low cost interventions which decrease surgical complication rates may have profound global socioeconomic consequences. And the Surgical Care Improvement Project (SCIP) has identified surgical site infections as the most frequent of all surgical complications. Through the efforts of SCIP and the Institute for Healthcare Improvement (IHI) and other quality assurance groups, the timely administration of antibiotics has now become not only the single physician quality reporting initiative (PQRI) for anesthesia, but also a standard of care. Yet other aspects of the appropriate preoperative and intraoperative administration of antibiotics such as redosing for prolonged procedure time and/or significant blood loss are also within the purview of the anesthesiologist, but less widely known or practiced. And furthermore, recent and significant studies by Sessler² and Akca³ on the effects of intraoperative administration of high oxygen concentrations and permissive hypercapnia on infection risk have yet to make their way into routine clinical practice. The anesthesiologist's preoperative and intraoperative management represents the first and most important impediment to surgical site infection. This period coincides with most of what Sessler terms the "decisive period" for infection risk. Simple and useful tools for helping the anesthesiologist implement current thinking on perioperative infection reduction into their routine practice is important in reinforcing the role of the anesthesiologist as a perioperative physician, and represents a proactive practice for methods that may otherwise be mandated in the future.

METHODS: Current SCIP recommendations and anesthesia publications on surgical site infection reduction were analyzed and incorporated into a simple and readily utilized mnemonic, the **NO BUGS** mnemonic.

RESULTS: The NO BUGS mnemonic represents best available and generally accepted evidence on reducing surgical site infection, and corresponds to the following associations: N-normothermia, O-higher intraoperative inspired oxygen, B-best antibiotic with appropriate 1-2 antibiotic half life and (15 - 20%) of total blood volume blood loss redosing, U-underventilation or mild hypercarbia, G-glucose control and S-skin preparation for central lines and arterial lines with chlorhexidine.

DISCUSSION: Modern anesthesia literature suggests numerous perioperative interventions at the disposal of the anesthesiologist to reduce surgical site infection which all seem to offer significant potential benefit with little possibility of harm. As summarized into the NO BUGS mnemonic, these interventions may be readily taught and incorporated into clinical practice.

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S-90.

THE IMPACT OF ACETAMINOPHEN AND NEODOLPASSE ON BACTERIAL GROWTH

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INTRODUCTION: The effect of salicylates and other nonsteroidal antiinflammatory drugs on a few bacterial functions has already been investigated (1). Contaminated intravenous medications pose a serious infection risk if the drug supports bacterial growth (2). In this study we investigated bacterial growth in intravenous acetaminophen and in Neodolpasse (mixture of intravenous diclofenac and orphenadrine). Not only the common microorganisms encountered during infectious complications but the recently arising extended spectrum β -lactamase (ESBL) and metallo- β -lactamase producing strains were also included in the paper.

METHODS: The growth of *Staphylococcus aureus* (ATCC 25923), *S. aureus* (ATCC 29213), two MRSA (ATCC PTS 43300 and a clinical isolate), *Escherichia coli* (ATCC 25922), *Pseudomonas aeruginosa* (ATCC 27853), clinical isolates of *E. coli* ESBL, metallo- β -lactamase *Acinetobacter baumannii*, and *P. aeruginosa* in acetaminophen (paracetamol) (Perfalgan, 10 mg mL⁻¹, Bristol-Myers Squibb Pharmaceuticals Ltd, UK) and in Neodolpasse (diclofenac 0.3 mg mL⁻¹ and orphenadrine 0.12 mg mL⁻¹, Fresenius Kabi, Austria) were investigated. Ten μ L bacterial suspensions were inoculated into the above medications and kept at room temperature. The initial bacterial count was 5×10^3 colony forming units (cfu) mL⁻¹. At 0, 1, 2, 3, 6, 9, and 24 hours 10 μ L was plated on Mueller - Hinton (MH) agar. Having incubated for 24 hours at 37°C the cfu was counted. The method was described in details elsewhere (3). Saline 0.9% and MH broth controls were also applied. Two-way analysis of variance served as the statistical method.

RESULTS: Neodolpasse killed the *Pseudomonas* strains within 1 hour, *Acinetobacter* within 3 hours. The different *E. coli* strains lived up to 3 hours. *Staphylococcus* was killed after 9 hours while the cfu of MRSA only decreased throughout the experiment. Acetaminophen killed only *Acinetobacter baumannii* within 3 hours. One of the *Pseudomonas* strains was killed after 6 hours. The cfu of all other strains decreased throughout the 24 hours, but they all survived in small numbers.

DISCUSSION: All examined preparations are safe as far as infection control is concerned as none of them supported bacterial growth. Neodolpasse has good bactericidal properties, while most bacteria survived in acetaminophen at a reduced cfu.

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S-91.

STRESS AND ANXIETY REACTIONS DURING WORKSHOP & HIGH-STAKE EXAMS WITH SIMULATION FOR THE ANESTHESIOLOGY ISRAELI NATIONAL BOARD MEASURED BY SELF-ASSESSMENT, TEST PERFORMANCE AND CORTISOL LEVEL

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INTRODUCTION: The purpose of this study was to examine for the first time under simulation, how different levels of stress and state anxiety reactions are associated with psychological (burnout vs. enjoyment and vigor), physiological (cortisol secretion) and behavioral (test performance) reactions while functioning under acute stress (attending a demo-exam workshop and the board exam).

MATERIAL AND METHODS: The sample included 29 trainees in anesthesia who were attending their "practical-hands-on" specialization exam, which is taken under simulation conditions / environment¹⁻³. Data was collected before and after the exam-readiness workshop, and before and after the exam itself. Psychological reactions (feelings of stress, burnout, enjoyment and vigor) and personal characteristics (demographic data and trait anxiety) were measured by questionnaires, and cortisol levels were measured by saliva samples⁴. Performance was measured both subjectively (success perception) and objectively (actual success).

RESULTS: Cortisol level was significantly higher after the exam (2.3 ± 0.4 nmol/l) than after the workshop (0.4 ± 0.9 nmol/l; $p < 0.01$). Burnout, enjoyment and acute stress feeling were the psychological parameters found to be higher pre-exam (3.3 ± 0.8 , 4.3 ± 0.6 , 5.0 ± 2.9) when compared to pre-workshop (3.6 ± 0.7 , 4.5 ± 0.6 , 6.7 ± 1.6 respectively; $p < 0.05$ for all). Success rate was not significantly related to success perception or any other psychological parameter. The relationship of objective (behavioral and physiological) parameters with psychological parameters was significant only for cortisol level when related to trait anxiety during the workshop ($r = .56$; $p < 0.05$), but that relationship was not significant ($r = .11$) during the exam after the workshop. Cortisol log-transformation calculated values demonstrated the similar change, and also had significantly higher positive relationship with vigor, enjoyment and success perception feelings, and negative relationship with burnout feeling ($r = .62$, $.62$, $.78$; and $r = -.69$, respectively; $p < 0.05$ for all), during the exam but not during the workshop. Trait anxiety during the workshop was positively related to burnout ($r = .77$), and negatively related to enjoyment and vigor ($r = -.76$, $-.61$, respectively); while during the exam it was also positively related to acute stress ($r = .59$) and negatively related to success perception ($r = -.60$).

CONCLUSIONS: 1) The exam arouses more stress than the readiness workshop, demonstrated in both the psychological and the physiological reactions of the examinees. 2) Cortisol level significant relationship to trait anxiety disappeared during the exam after the workshop, demonstrating the advantage of readiness workshop in the physiological as well as the psychological level. 3) Subjective expression to stress (acute stress feeling) and the objective expression (cortisol level) are negatively related to success perception. 4) Objective criteria of success (actual success rate and the stress projected by the examinees) had no significant relationship to any subjective psychological feeling including success perception.

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S-92.

WHAT PATIENTS FEAR THE MOST AND KNOW ABOUT ANESTHESIC ISSUES? A SURVEY

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INTRODUCTION: Based on a survey done by Shevde in New York, (1) a study was conducted to assess what Ecuadorian patients know about anesthesiologists and feared the most about anesthesia.

METHODS: With IRB approval, 350 women scheduled to undergo either obstetric or gynecologic surgery at a county hospital, responded preoperatively a 47 item survey.

RESULTS: As in Shevde's study, patients' perceptions of the anesthesiologist's training and role were not accurate. 25.7% of patients thought doctors did not need a postgraduate training in Anesthesia and 8.57% thought anesthesiologists were "optional". Patient's main concerns were: becoming paralyzed (18.57%), death (18%), remain permanently unconscious postoperatively (11.71%) and fear of needles (11.71%). Surprisingly, patients were less concerned about postoperative pain (2%). None of the patients were evaluated preoperatively by an anesthesiologist.

DISCUSSION: During the preoperative visit, anesthesiologists not only assess the patient's readiness to anesthesia and surgery (2) but also choose an anesthetic and educate the patient regarding the planned anesthetic technique and discuss postoperative care plans and pain therapy options. Egbert et al. (3) reported its effectiveness in relieving patient anxiety. It is unacceptable that patients enrolled in this study were not evaluated preoperatively by an anesthesiologist. The fact that this study was conducted in an overcrowded county hospital is not an excuse for the lack of preoperative evaluation. Unfortunately, what was said about our specialty in the past (4) that "the fundamental threat to the discipline is the lack of awareness by health care administrators and other practitioners of the important role of the anesthesiologist in so many aspects of health care" is still applicable. We can only add that patients are also unaware about our role. Not only patients but also other physicians must be educated about it.

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S-93.

THE EFFECT OF ACLS REFERENCE CARDS ON THE MAINTENANCE OF REDUCED INACTION DURING HIGH-FIDELITY SIMULATION OF ACLS MEGACODES, A FOLLOW-UP STUDY

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INTRODUCTION: Errors in ACLS performance can occur as inaction due to lack of knowledge of correct sequence and timing of actions, which can lead to adverse consequences.^{1,2} The best methodology to reduce inaction while treating cardiac arrest when Advanced Cardiac Life Support (ACLS) guidelines would call for a definitive action remains unknown. Accordingly, we performed a trial to test whether ACLS reference cards aid in retention of ACLS skills and thus reduce inaction during real-time simulations of American Heart Association (AHA) MegaCodes. In addition to published AHA/ACLS cards, we developed a card (MUSC card) that presents the AHA/ACLS guidelines according to a 4-question algorithm: is the patient 1)pulseless? or 2) unstable? If neither, is the rhythm 3) narrow or wide and 4) regular or irregular? The answers to these questions guide the practitioner to the proper ACLS algorithm.

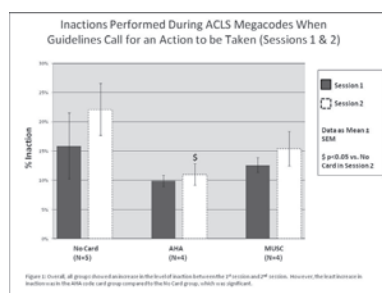
METHODS: Thirty medical students participated in a study investigating the impact of reference cards on ACLS performance. Thirteen were able to complete the entire study, including a session testing retention of skills 3 months after initial testing. The study consisted of 5 sessions. The first was didactic, covering ACLS protocols. The second was a high-fidelity simulation ACLS training session. Following the training session, students were randomized into three groups to test reference card impact (No Card, AHA Card, MUSC card). The third session and fourth session (Testing Session 1), presented students with a single MegaCode scenario per ACLS/AHA guidelines and required them to treat various patient states. For the second phase of the study, these students were brought back after 3 months (Testing Session 2) and were given another MegaCode scenario to manage. All simulation sessions were video-taped and graded according to checklists in the ACLS/AHA training manuals. Data was analyzed by unpaired t-test and presented as Mean \pm SEM.

RESULTS: All groups demonstrated increased inaction from Testing Session 1 to Testing Session 2, although not significantly. The AHA Card group showed a significant decrease in inaction compared to the No Card group (see Figure 1) in Testing Session 2.

DISCUSSION: As with prior studies, our study demonstrated a reduction in ACLS adherence after a 3-month interval from initial training. However, this is the first study to our knowledge to investigate the use of ACLS reference cards in retention of ACLS skills. The data suggests use of ACLS reference cards may have a positive impact on decreasing inaction in code leaders after initial training and in reducing inaction (such as delay to defibrillation) months after training. Further study is warranted to ascertain the benefits of reference card usage and to determine a difference between them in aiding adherence to ACLS guidelines.

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S-94.

USE OF RUSCH TRUVIEW EVO-2 LARYNGOSCOPY AND INTUBATION FOR FAILED INTUBATIONS WITH MACINTOSH LARYNGOSCOPE

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INTRODUCTION: The RuschTruview Evo-2 (Evo) is a recently introduced modified optic laryngoscope which incorporates an unmagnified optic side with prism to its special blade. This configuration provides a 42° additional anterior view. Unanticipated difficult intubation can be demanding and acutely challenging to anesthesiologists. Inability to Intubate by standard laryngoscopy have grave safety concerns, and it is desirable to have the means available to achieve speedy intubation. It was hypothesized that the Evo would enhance glottis visualization where the conventional Macintosh laryngoscopy (ML) provided minimal viewing capabilities resulting in two failed intubation attempts.

METHODS: This is two part cross over study. In part one patients with difficult airway predictors presenting for GA were selected for the study..

Following a uniform premedication and induction with either inhalation or slow propofol injection, mask ventilation was established. After relaxation with succinylcholine 0.75-1mg/kg, ML was attempted and percentage of glottic opening (POGO) scoring system utilized to subjectively estimate the POGO score (8 \pm 9). Thereafter, laryngoscopy was performed with Evo and these patients were intubated after recording their POGO scores under view by Evo 75 \pm 16.

Second part of study consisted of patients with normal airway assessment who failed to be intubated with macintosh blades after two attempts were included in the study. Third attempt to intubate these patients was made with Evo laryngoscope either with help of a bougie or ett with introducer with ahocky stick curve. We had 17 failed intubations with conventional laryngoscopy with a POGO of 0. There were 10 female and 7 male, the ages varied from 24 to 86 years.

all of these patients were intubated with Evo with a POGO of 89 \pm 11.7

CONCLUSIONS: Evo may be a usefull optical laryngoscope to give clear view of glottis in difficult intubation situations.



S-95.

MEDICATION ERRORS ARE COMMITTED MORE FREQUENTLY BY TRAINEES IN ANESTHESIA THAN BY EXPERIENCED PRACTITIONERS

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Intro: Medication errors are a common occurrence in anesthesia (proposed frequency of 1 out of every 130-203 anesthetics). It has been suggested that the inexperience of anesthesia providers-in-training may lead to a higher frequency of medication errors in teaching programs. The aim of this study was to assess if medication errors occur at a higher frequency in trainees versus those who have completed their training in a tertiary care, academic hospital.

METHODS: Medication error reporting forms were designed and attached to every anesthetic record during a six-month period (08/20/07-02/20/08). Trainees in anesthesia included anesthesiology residents (CA1-CA3) and Student Nurse Anesthetists. Experienced providers who have completed training included Anesthesiologist Attending physicians and Certified Registered Nurse Anesthetists. All anesthesia providers received training on what are considered medication errors and pre-errors before the start of the study. Providers were asked to voluntarily and anonymously return the reporting form for every anesthetic case whether or not a medication error or pre-error occurred. If providers indicated positively (that an error or pre-error had occurred), then further details of the medication error, along with level of training, was requested. The type of provider and the level of training (if applicable) data for the negative response cases was obtained from the surgical informational system.

RESULTS: Total 52 forms out of a possible 10574 anesthetics were returned with a positive response, indicating either a medication error/pre-error occurred. The distribution of cases included 7049 by those who completed their training as compared to 3473 who were still in training, 62.1% (61.1% - 63.1%) to 37.9% (36.9% - 38.9%) respectively (95% confidence level). The distribution for type of provider who committed the error/pre-error was: trainee 24/7049 and non-trainee 23/3473. Additionally there were 5 errors/pre-errors committed by pharmacy (2) and ancillary personnel (3) that were not included in this analysis. Comparison of the two groups, using Chi-Square tests and Pearson's statistic, resulted in a statistically significant difference ($p=0.0087$) with a relative risk ratio of 2.11.

DISCUSSION: Although it is intuitive that any type of trainee in a medical specialty might be responsible for a higher medication error rate than those who have completed their training and have had more practice experience, this has not been shown before. Anesthesiologists are unique among physicians in that they order, dispense, compound, and administer medications, yet as physicians, they are not trained in traditional medical school programs on how to perform many of these tasks. Nurses are trained in administration of medications, but not in ordering, dispensing, or compounding them.

This study is the first of its kind to demonstrate a two-fold increase in medication error rate among trainees versus non-trainees.

S-96.

A RETROSPECTIVE REVIEW OF CASES OF EMERGENCE DELIRIUM

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INTRODUCTION: Although emergence delirium (ED) has been recognized as a post-operative phenomenon for decades, it has been poorly investigated.¹ ED can be a cause of post-op morbidity and mortality and can have consequences for the patient such as increased pain, removal of catheters, and self-extubation. The aims of this study are; determine the incidence of emergence delirium at our institution, identify the factors that contribute to ED and identify the patients who are at increased risk for ED. By identifying these patients, we may be able to decrease incidence of ED and its related complications.

METHODS: After the approval of the Patient Safety Committee at our institution, the Anesthesiology Department Quality Improvement (QI) database and Risk Management database was queried for cases of emergence delirium from January 1, 2005 to July 1, 2008. These cases were entered either by the OR anesthesia provider, PACU nurse, or post-op nurse. The electronic medical records were then used to collect the following data: patient demographics, type of anesthesia, ASA-PSA, medical co-morbidities, type of surgery, and postoperative course and outcome.

RESULTS: 49 cases of emergence delirium were identified in the database over the included time period (total cases over the time period = 82,000). 1 case was excluded because delirium in this patient was felt to be directly due to an accidental administration of a high dose of Ketamine. Of the 49 cases, 13 occurred in the OR, 16 in the PACU, and 20 in the post-op period when patients were admitted to the surgical ward or ICU. The mean age was 55.6 (± 18.6) years, with a predominance of males (79%). Average surgical time was 2.87 (± 2.14) hours and 59% of cases were ASA 3. In three cases, there was morbidity documented including one case of fall from stretcher, one removal of surgical drain and one case of self-extubation. Treatment in most cases involved patient reassurance, however in six cases, haloperidol with or without midazolam were given.

DISCUSSION: We suspect that our QI database overall underestimates the true incidence of emergence delirium at our institution given that often it is short-lived and self-resolves without the use of any pharmacologic interventions. We hope by increasing awareness of emergence delirium among providers, we can prevent potential consequences.

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S-97.

ANESTHESIA MACHINE PIPELINE CROSSOVER: A SIMULATION TO PROBE HUMAN-MACHINE INTERACTION IN CRISIS SITUATIONS

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INTRODUCTION An equipment malfunction simulation scenario - oxygen/nitrous oxide pipeline crossover - can probe residents' knowledge and the use of anesthetic equipment in a rapidly escalating crisis.

METHODS Third year anesthesia residents took part in 10 scenarios in teams of 2 ("hot seat") and "first responder" (n=20).

Scenario: An Ohmeda Modulus SE 7500 anesthetic machine with a Datex AS/3 monitor provided vital signs and gas monitoring. Pipeline oxygen (O₂) and (N₂O) were supplied from hose drops. An auxiliary oxygen flowmeter, located on the side of the machine, received O₂ from the same central source - a standard arrangement. Before the start, we switched pipeline connections "behind the wall" so that N₂O entered through the O₂ pipeline and vice versa.

The simulated patient was a healthy 43-year-old male, undergoing herniorrhaphy under general endotracheal anesthesia. Anesthesia was maintained with 50% O₂, 50% N₂O and 1% isoflurane. The participants took over from a confederate at the end of surgery. During emergence, when the patient was placed on what was thought to be 100% O₂, they were *actually* receiving 100% N₂O. Low O₂ and high N₂O alerts appeared; the low O₂ alarm sounded and the patient became markedly hypoxemic. For teaching purposes, we froze the nadir of hypoxemia to 60-70% SaO₂ for up to 30 minutes, and did not allow a cardiac arrest.

Videotaped scenarios were reviewed by two expert independent raters. Alarms or alerts explicitly noted by subject, primary method of ventilation and use of the auxiliary O₂ flowmeter at any point in management were recorded.

RESULTS : see Table 1

DISCUSSION: Many participants failed to notice the presence of high N₂O alarm/alert. This may be, in part, due to its transitory nature or perhaps to the dominance of the O₂ alarm. Use of the auxiliary O₂ flowmeter as a presumed external source of oxygen revealed a lack of understanding of the anesthetic machine's gas supply, and contributed to delays in definitive treatment (80 %) or failure to successfully treat the hypoxia (20%). In real life, use of the auxiliary flowmeter (with 100% N₂O) would be quickly lethal. The machine design does not monitor O₂ concentration at the auxiliary flowmeter, nor is there any reminder that this flowmeter has the same O₂ concentration or source as the rest of the machine. The combination of design elements and inadequate deployable knowledge led to markedly suboptimal management techniques that would potentially lead to a catastrophic patient outcome.

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- J. Weller, A. Merry, G. Warman and B. Robinson: Anaesthetists' management of oxygen pipeline failure: room for improvement. *Anaesthesia*;2007, 62, pages 122-126

Table 1: Alarms/Alerts Noted, Mode of Ventilation, and Use of Auxiliary Nozzle	
Alarms/ Alerts noted	Low O ₂ alarm/alert: n= 18(90%); High N ₂ O alert: n= 6(30%) Both low O ₂ and high N ₂ O alert: n= 6(30%) Neither low O ₂ or high N ₂ O alarm: 10% (n=2) (alerted to crisis by low SAO ₂ alarm).
Definitive method of ventilation used during scenario	Mouth to tube: n=0(0%) Ambu and room air: n=4(20%) Ambu with external cylinder O ₂ source: n=12 (60%) Ambu with auxiliary oxygen flowmeter: n=4 (20%)
Use of auxiliary O ₂ flowmeter	n=18 (90%)

S-98.

DEVELOPMENT OF A SHORT MESSAGE SERVICE COMMUNICATION SYSTEM BASED ON AN ANESTHESIA INFORMATION MANAGEMENT SYSTEM

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INTRODUCTION: Reliable, efficient communications are vital for daily management of anesthesia personnel and to coordinate disaster recalls. Since cell phones are ubiquitous and hospital restrictions have been eliminated by most thoughtful organizations, they are ideal for such use. Email text messages can be sent through most vendors' Short Message Service Gateways to subscriber cell phones. Return messages can be directed back to an email address or cell phone number. We evaluated the feasibility of using our anesthesia information management system (AIMS) as the data source for a cell-phone based communication system.

METHODS: A software application was written in VB.Net (Microsoft) to manage the communication system user interface (Fig 1). Messages can be sent to a cell phone or to the AIMS workstation, where they appear as popups. Cell phone numbers and carriers were requested from department members and stored in the Staff table of our AIMS database. We added the first initial of the carrier followed by an * to indicate confirmed numbers. Test messages simulating a disaster recall was sent from the AIMS server using the MS SQL Server xp_smtp_sendmail procedure to cell phones with return receipt requested to confirm delivery. Latencies from clicking the send message button until the message alert sounded on the phones were determined in replicates of 5.

RESULTS: Cell phone numbers were obtained for 129/147 (88%) of department members during a 2-week configuration period. Of those, 100 (78%) responded to a test message sent during regular weekday hours. Latencies were similar for Verizon, Cingular, Sprint, and AT&A (Table 1) with an overall mean of 22.8 sec (95% CI 19.5 - 26.1, range 11.4 - 30.5). Some carriers truncated messages at 160 characters, while others delivered the full message in segments.

DISCUSSION: The AIMS database is an ideal place to store staff cell phone numbers, as it is easy to maintain. Use of the Short Message Service (SMS) for cell phone communication was fast and reliable. Confirmation of cell phone numbers was incomplete, as a few department members had blocked text messaging or did not own a cell phone. Concern was raised by some staff over the cost of the messages, although typical monthly plans in our area are around \$5/250 messages. Most staff carry their phones in the OR, but those who do not will need to be encouraged to provide a consistent method of communication. The messaging system is currently being used to send automatic notices to participating attendings when their patients arrive in the Holding Area, when the Surgery End event is entered in the AIMS, and for ad hoc communications with the anesthesia OR directors.

Table 1. Latencies (sec) and Carrier SMS Gateway Addresses

Carrier	Mean	95% CI	SMS Gateway
AT&T	19.6	17.0 - 22.2	<phone #>@txt.att.net
Cingular	23.3	16.8 - 29.8	<phone #>@cingularme.com
Sprint	30.1	27.0 - 33.2	<phone #>@messaging.sprintpcs.com
TMobile	ND	ND	<phone #>@tmomail.net
Verizon	27.9	22.1 - 33.7	<phone #>@vtext.com

Figure 1. Messaging System User Interface



S-99.**FREQUENCY OF PROLONGED GAPS IN BLOOD PRESSURE DOCUMENTATION IN ANESTHESIA INFORMATION MANAGEMENT SYSTEMS**

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INTRODUCTION: Anesthesia information management systems (AIMS) have been touted as providing more accurate intraoperative physiologic data than manual records.¹ However, prolonged lapses in the record have been reported,² and gaps in recording blood pressures have been noted at the authors' institutions. This study was designed to determine the frequency of cases with at least one gap ≥ 10 min between BP measurements and if a real-time alert system would lead to improvement.

METHODS: The AIMS databases at three large academic hospitals using three different systems were queried to determine intervals between successive BP values from either invasive or non-invasive sources. Each case was characterized by the duration of its longest BP interval. At two hospitals, a real-time system was developed that queried the AIMS database every 5 min and sent an alert to providers if the presence of a gap > 10 min was detected. At Hospital A, the alert appeared as a popup on the AIMS workstation. At Hospital B, the alert was generated from the decision-support tool included in the AIMS and also through a text message sent to the anesthesia provider's pager. The statistical significance of changes in the number of BP gaps following alert system implementation was determined using the chi-square test.

RESULTS: The incidence of BP gaps of 10 min or greater during the baseline period at the three hospitals was 10%, 8.5%, and 38.7%. The incidence of BP gaps was reduced significantly ($P < 10^{-6}$) at Hospital A (Table 1) after institution of the alert system. Insufficient time has elapsed at Hospital B to determine if there has been an effect. Hospital C does not have an alert system in place.

DISCUSSION: Almost all of the improvement following institution of the alert system at Hospital A resulted from a reduction in gaps in the 10 - 15 min range. Examination of individual records from the baseline period revealed that, in most cases, the provider had temporarily suspended automatically cycled BP measurements and forgotten to restart them. Thus, the alert appears to have changed behavior. However, the incidence of very long gaps was not materially affected by the alert system. Examination of such records revealed that most were due to malfunctions of the AIMS computers (e.g., communications was lost with the patient monitor, the computer crashed or froze). The high incidence of gaps at one of the hospitals is likely related to the common practice there of cycling the BP cuff every 5 min, as opposed to every 2-3 minutes at the other hospitals.

Figure 1. Screen Shot of AIMS Alert Popup at Hospital B

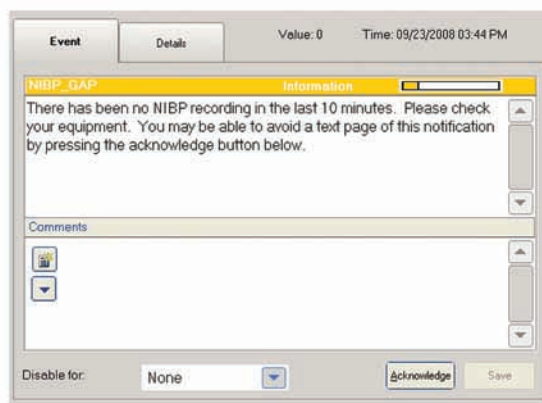


Table 1. BP Gap Frequency at Hospital A

BP Gap (min)	Baseline	Alert System
<10	90.1%	96.5%
10 - 14.9	8.7%	2.6%
15 - 19.9	0.7%	0.62%
20 - 24.9	0.3%	0.2%
25 - 29.9	0.1%	<0.1%
30+	0.1%	0.1%
Total Cases	12391	8281
Date Range	1/1 - 5/30/08	7/1 - 10/31/08

1. Anesth Analg 2008; 107:1598-1608

2. Anesth Analg 2006; 102:1798-1802

S-100.

BEST PRACTICE: A SYSTEMS-BASED APPROACH TO ANESTHESIA MEDICATION SAFETY

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INTRODUCTION: Knowledge of the pharmacokinetics and pharmacodynamics of anesthetic medications is paramount in the training of an anesthesiology resident physician. Anesthesiologists prepare and administer intravenous (IV) medications on a daily basis. Yet, proper handling, labeling, administration, and storage of the medication is not taught in medical school. Furthermore, many of the IV medications administered by anesthesiologists are high-alert medications. It has been estimated that one drug administration error occurs for every 133 anesthetics.¹ Recently, we experienced our first intraoperative heparin medication error. In the root cause analysis, an anesthesiology resident identified a lack of training in IV medication preparation and administration as a causal factor for the error.

EDUCATIONAL MODULE: An educational module has been developed. Components of the module include:

- Medication errors with IV medications
- High-alert medications
- Anesthesia medication errors
- Look-alike, sound-alike medications
- Types of pharmaceutical packaging for IV medications (single dose vial, multiple dose vial, ampule, carpuject, pharmacy prepared pre-drawn syringe)
- Drawing up medication
 - o Proper aseptic technique
 - o How to avoid coring
 - o Proper use of filter needles
 - o Special precautions for propofol
 - o Labeling requirements
 - o Double-check yourself. Read the label on the vial before drawing it up to make sure it's what you want. As you place the label on the syringe, confirm that it accurately reflects the drug and concentration drawn up.
- Recommendations for organizing syringes on the top of the anesthesia cart
- Reusing syringes - why this should never occur
- Drugs that must be administered slowly and/or diluted (e.g. potassium, vancomycin, phenylephrine)
- Additional tips to minimize risk of infection and medication error (e.g. saving original containers until the end of the case, communication between caregivers, double-check of dilutions/complex IV preparations)
- Proper storage of medications

DISCUSSION: This educational module was developed by anesthesiology residents, a clinical pharmacist, and a pharmacy practice resident. Because of this collaboration, we believe that our module represents best practice. Examples provided in the module are practical and relevant to an anesthesiology resident in training. Completion of the module during the orientation period of an intern and/or anesthesiology resident is now a requirement of our training program. Formalized education on IV medication preparation and administration early in the training of anesthesiology residents should raise awareness of the potential for medication errors, as well as the transmission of infections as a result of breaches in aseptic technique when preparing and administering IV medications.

REFERENCE: Can J Anaesth 2000;47:1060-1067

S-101.

AN ASSOCIATION OF PROLONGED POSTOPERATIVE HYPERCHLOREMIA AND PATIENT OUTCOME AFTER MAJOR NON-CARDIAC SURGERY: A RETROSPECTIVE PROPENSITY MATCHED COHORT STUDY

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INTRODUCTION: The perioperative use of normal saline in major surgery may lead to hyperchloremic metabolic acidosis. However, this electrolyte disturbance has not previously been associated with poor postoperative outcome. The objective of this study was to determine the incidence of prolonged hyperchloremia (chloride > 110 mEq/L on post operative days 1, 2 and 3) and whether this hyperchloremia is associated with an increase in length of hospital stay or 30-day postoperative mortality following major non-cardiac surgery.

METHODS: Following institutional approval, a retrospective chart review was conducted on all non-cardiac surgical patients from July 2004 to June 2006 at a single tertiary care institution. Only those patients undergoing major surgery were considered i.e. patients requiring admission to hospital and followed-up by the acute pain service. Perioperative variables extracted from the patient's chart included: patient demographics, co-morbidities identified from ICD10 coding, perioperative laboratory parameters (hemoglobin, chloride, glucose and creatinine), medications, and surgical variables (type of surgery and duration of the surgery). The outcome variables were length of hospital stay and in-hospital 30-day mortality. Statistical analyses were performed using SAS version 9.1 (SAS institute, Cary, NC). A propensity-matched cohort of patients was identified using logistic regression analysis of perioperative variables for those patients with hyperchloremia for the first 3 days after surgery. Balancing of the pairs was measured using standardized differences (*d*), where absolute values smaller than 10 indicate good balancing. Proper paired statistical tests were used to compare the incidence of 30- day mortality (McNemar) and the length of hospital stay (Wilcoxon) in the 2 groups.

RESULTS: The entire population consisted on 4,739 patients, and of these, 266 patients had prolonged postoperative hyperchloremia. The 266 propensity-matched pairs were balanced well for age, sex, serum creatinine, anemia (Hb < 130 gm/L) and use of any NSAID perioperative (*d* = 5.5, 6.1, 3, -3.9 and 0.9 respectively). Propensity matched pairs were generated via a greedy matching algorithm is SAS, producing 2 cohorts that were balanced for all variables. The length of hospital stay was greater in the prolonged hyperchloremia group (16.2 ± 17.3 vs. 11.9 ± 18.1 days; *p* < 0.001). There were 15 deaths in the prolonged hyperchloremic group and 6 deaths in the matched pairs (*p* = 0.04). If this is a cause and effect association, then avoiding hyperchloremia in 30 patients would avoid 1 in-hospital death in the first 30 days after surgery.

CONCLUSIONS: Prolonged hyperchloremia is associated with an increased length of hospital stay and mortality after surgery. The nature of this association will required further and more detailed investigation.

S-102.**ROBOTIC ASSISTED LAPAROSCOPIC RADICAL PROSTATECTOMY (RALP)-THE CITY OF HOPE EXPERIENCE****AUTHORS:** A. Falabella¹, M. W. Lew², W. Chang², E. Bak²;**AFFILIATION:** ¹Anesthesia, City of Hope, Los Angeles, CA, ²City of Hope, Los Angeles, CA.

INTRODUCTION: Early studies have demonstrated mixed surgical outcomes with RALP. Despite this, RALP has become the surgical treatment of choice in many centers. Anesthetic-related considerations for this procedure include: the patients age, co-morbidity, and the sustained steep trendelenburg position with pneumoperitoneum.

METHODS: Consent was given by 1931 of 3012 patients to have their data entered into our data base. Data was collected as the patient transitioned through the perioperative period. Descriptive statistics including frequencies, means and medians were used to summarize outcomes.

RESULTS: 1931 cases were included. Mean operative time was 2.9 hours, median 2.8 hours and Std Dev 0.8. The mean estimated blood loss was 264ml median 200ml and a Std Dev 191.2.

Complication	Number	Incidence
Postoperative Ileus	31	1.6%
Intraoperative mortality	0	0%
Postoperative mortality	1	0.1%
Intraoperative transfusion	7	0.4%
Postoperative transfusion	33	1.7%
Intraoperative arrhythmia	2	0.1%
Intraoperative MI	1	0.1%
Peripheral neuropathy-upper	7	0.4%
Peripheral neuropathy-lower	1	0.1%
CNS deficit / Ischemic optic neuropathy	0	0%
Postoperative pneumonia	1	0.1%
Corneal abrasion	14	0.7%
DVT	12	0.6%
Postoperative renal insufficiency	1	0.1%
Sepsis	2	0.1%
Conversion to open	2	0.1%

DISCUSSION: Surgical advantages of RALP versus traditional radical prostatectomy are controversial (1). One case of postoperative mortality was recorded and likely due to a pulmonary embolism on discharge day. Pederson reported hospital mortality as high as 1.8% in a study that involved 2043 patients ages 50 to 90. We had two cases of supraventricular tachycardia (0.2%), and one intraoperative myocardial infarction (0.1%). The incidence of perioperative cardiac complications for healthy patients ages 50-90 has been reported as high as 8.2 % (2).

Peripheral neuropathy was surprisingly higher in the upper extremities considering that the procedure is done in the lithotomy position with the arms positioned and well padded on the patient's side. Warner previously reported the incidence of lower extremity neuropathy during lithotomy as 1.5 % (3). No cases of central nervous system deficit, or ischemic optic neuropathy were recorded in this series. A common complication was corneal abrasion (0.7%), which was attributed to direct trauma in the immediate postoperative period.

Robotic assisted laparoscopic radical prostatectomy is associated with perioperative complications that are comparable with other surgical techniques. The steep trendelenburg position and pneumoperitoneum did not increase the incidence of perioperative complications in our patients.

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S-103.**EVALUATING THE REQUIREMENTS OF ELECTROENCEPHALOGRAPH EXPOSURE FOR ANESTHESIOLOGY RESIDENTS****AUTHORS:** B. G. Fahy¹, D. F. Chau², M. B. Owen²;**AFFILIATION:** ¹Anesthesiology, University of Kentucky, Lexington, KY, ²University of Kentucky, Lexington, KY.

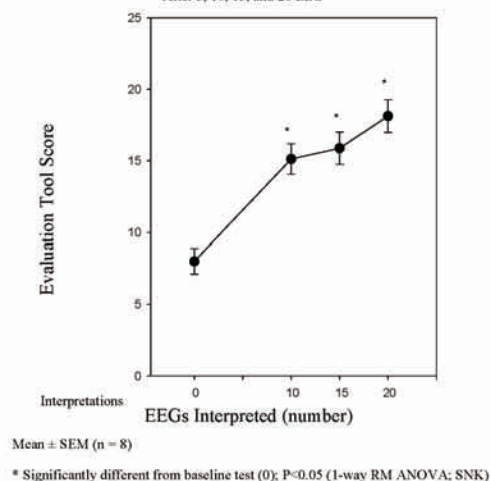
INTRODUCTION: During anesthesiology residency the Accreditation Council for Graduate Medical Education (ACGME) requires electroencephalogram (EEG) monitoring experience. Previously, an EEG learning module was created to improve the anesthesiology residents' education in collaboration with an EEG expert neurologist. (1) This experience included EEG tracings, clinical EEG interpretation and monitoring, and EEG anesthetic effects with the curriculum outlined in the previous study. The number of EEGs interpreted during this previous experience ranged from 14-48. This study assessed the minimum number of EEG interpretations required to meet curriculum goals.

METHODS: Following IRB approval, the residents were assessed prior to the EEG learning module and following interpretation of 10, 15, and 20 EEGs. Four evaluation tools, each uniquely consisting of 25 multiple choice items were developed for these assessments. Eight residents completed all the assessments.

RESULTS: Eight residents had evaluations before and again after in depth EEG interpretation of 10, 15, and 20 EEGs. The residents' evaluation scores were analyzed using one way analysis of variance. The mean scores significantly improved from 8.00 ± 2.51 at baseline to 15.12 ± 3.00 ($p < 0.001$) after 10 EEG readings, 15.88 ± 3.18 ($p < 0.001$) after 15 readings, and 18.12 ± 3.23 ($p < 0.001$) after 20 EEG readings. The data was then analyzed using a Student-Newman-Keuls method to compare scores after interpretation of 10, 15, and 20 EEGs. However, there was no significant difference between interpreting 10 compared to 15 or 20 EEG interpretations, although there was some small improvement in assessment scores.

CONCLUSIONS: This educational effort utilizing the department of neurology expertise provided a significant improvement in mean EEG assessment evaluation scores after 10 EEG readings.

Figure 1. Electroencephalogram (EEG) Evaluation Results Prior to EEG Reading (Baseline) and After 5, 10, 15, and 20 EEG



S-104.

TSE “MASK” REDUCES SEVERE O₂ DESATURATION IN HIGH-RISK PATIENTS BY CONVERTING A NASAL CANNULA TO A FACE TENT DURING CARDIOVERSION/AICD

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INTRODUCTION: Patients undergoing cardioversion or testing of automatic implantable cardioverter defibrillator (AICD) usually receive supplemental O₂ (Suppl O₂) via nasal cannula (NC) with intravenous (iv) sedation. However, over-sedation and/or airway obstruction may cause respiratory depression and severe O₂ desaturation in patients with advanced cardiomyopathy and/or dysrhythmia. A simple plastic sheet (TSE “Mask”) has been shown to convert an ineffective NC to an effective face tent that provides 40-60% FiO₂^{1,2}. It improves oxygenation, prevents severe O₂ desaturation and reduces the need for assisted ventilation in deeply sedated patients during upper GI endoscopy². This study would determine its effectiveness in improving oxygenation in high-risk patients during cardioversion/AICD.

METHODS: This is a retrospective review of Cath Lab procedures of 89 patients (ASAIII) undergoing cardioversion or testing of AICD (5/08-9/08). Standard monitors included ECG, BP cuff, pulse oximetry with or without arterial BP. Patients received NC O₂ (3-5 l/min or higher as needed). Group 1 (NC) patients received only NC O₂ throughout the procedure and Group 2 (TM) received routine NC O₂ and a TSE “Mask”. A TSE “Mask” was prepared using a clean clear plastic bag and used to cover patient’s nose and mouth as previously described^{1,2}. Patients received iv propofol that was titrated to achieve deep sedation prior to induction of ventricular tachycardia/fibrillation and/or cardioversion. Data collected for comparison included age, weight, height, the baseline room air (RA) O₂ saturation (O₂ Sat), O₂ Sat with Suppl O₂ at 5 min intervals, the lowest O₂ Sat, assisted ventilation with Ambu bag and the amount of propofol received. Paired and unpaired Student’s t-tests and Chi Square test were used for statistical analysis. A p value <0.05 is considered as significant. Data are presented as Mean±S.D.

RESULTS: There were no differences in age (NC: 70±13; TM: 67±12 yrs), BMI (NC: 29±7; TM: 30±8), the baseline RA O₂ Sat (99±1%), O₂ Sat after 5 min with Suppl O₂ (99±1%) and the dosages of propofol (NC: 1.2±1.8; TM: 0.9±0.3 mg/kg) between two groups. Propofol significantly reduced O₂ Sat in both groups (NC: 99±1% to 86±11%; TM: 99±1% to 94±7%). However, its effects were significantly greater on Group 1 than Group 2 patients. There were significant differences in the lowest O₂ Sat (NC: 86±11%; TM: 94±7%), severe O₂ desaturation (≤ 85%) (NC: 17/46; TM: 4/43) and the need for assisted ventilation with Ambu bag (NC: 16/46; TM: 2/43) between groups (Table 1).

DISCUSSION: These data show that TSE “Mask” reduces severe oxygen desaturation and the need for assisted ventilation in deeply sedated high risk cardiac patients. This technically simple and effective face tent may improve patient safety at no additional cost and should be routinely used during cardioversion/AICD.

REFERENCES: 1. *Anesth* 102:484, 2005. 2. *Anesth* 107:A922, 2007.

Table 1. Effects of TSE “Mask” on Oxygen Saturation in Sedated Patients during Cardioversion/AICD



S-105.

ANESTHESIOLOGY RESIDENTS' READINESS FOR SELF-DIRECTED LEARNING DOES NOT CORRELATE WITH PERFORMANCE ON STANDARDIZED EXAMINATIONS

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INTRODUCTION: Graduate Medical Education is frequently an apprenticeship model where the resident is a passive learner and success is determined by attainment of board certification. However, the Accreditation Council for Graduate Medical Education (ACGME) recommends that resident learners take the initiative in determining their learning needs, designing learning experiences, and evaluating their learning (1). This study assessed the degree of readiness for self-directed learning (SDL) in anesthesiology residents utilizing a validated questionnaire (2) and correlated this with resident performance on standardized examinations.

METHODS: Following IRB approval, anesthesiology residents in our department were requested to participate in the study. The Self-Directed Learning Readiness Scale (SDLRS-A) was administered and scored electronically (www.lpasdlrs.com). Utilizing normative data (mean = 214, S.D. 25.6), participants with scores of 58-201 were considered below average, 202-226 average, and 227-290 above average in terms of readiness for self-directed learning. Utilizing Statistical Analysis Software (SAS, Cary, NC), resident scores on the SDLRS-A were compared with 1) normative data for the adult population (MEANS Procedure) and 2) resident performance on the USMLE I and II and the ABA/ASA In-Training Examination (ITE) (CORR Procedure).

RESULTS: Of 46 residents, 36 (78%) chose to participate. The score on the SDLRS-A ranged from 167-265 with mean = 222 (S.D. 22.8). Seven residents scored below average, 14 average, and 15 above average. There was no statistical difference between the mean score of the residents and the mean of the adult normative population and no significant difference between SDLRS-A score and post-graduate year of training. Moreover, there was no statistically significant correlation between the individual SDLRS-A score and performance on either the USMLE I and II or ABA/ASA ITE.

DISCUSSION: The SDLRS-A is designed to measure the complex array of attitudes, abilities, and characteristics that comprise readiness to engage in SDL. Those who score high on the SDLRS-A tend to perform better in jobs requiring a high degree of problem solving ability, creativity, and willingness to change (3). Although anesthesiology residents' SDLRS-A mean scores were higher than the average adult, they did not reach statistical significance. SDL skills may not be as critical for knowledge assessment where the expected knowledge base is well defined (e.g. ABA content-outline). In future studies, scores on the SDLRS-A will be correlated with ability to develop individualized learning plans (ILP), global faculty performance evaluations, and scores on Life-Long learning questionnaires administered to residents in this study one-year following graduation from residency training.

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S-106.

PREVALENCE AND IMPACT OF VOCAL DYSFUNCTION FOLLOWING TRACHEAL INTUBATION

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BACKGROUND: Following general endotracheal anesthesia a large minority of patients experience postoperative throat pain, perhaps as high as 40-45%.^{1,2} Patients also complain of dysphonia. Data on the prevalence of post-intubation vocal dysfunction (VD) and more importantly, its impact on activities of daily living are limited.

METHODS: Institutional review and approval was obtained. ASA I, II and III patients, age 18-75, undergoing ambulatory surgery requiring endotracheal intubation via direct laryngoscopy were screened. Subjects were excluded if they had preexisting vocal dysfunction, were having airway surgery, or if a difficult airway was expected. Details of the intubation were recorded by a study observer. Prior to subject discharge, an investigator administered survey tool was used to assess throat discomfort (Visual Analog Scale rating of the pain) and speech, utilizing a previously validated Voice-Related Quality of Life survey (VRQL). Data were collected post-operatively at predefined time points. All subjects were surveyed on day of surgery (DOS) in the Phase II, Postanesthesia Care Unit (PACU) prior to discharge, and by telephone on post-operative day (POD) 1 and POD 2. If subjects experienced discomfort or VD on POD2, they were surveyed on POD 5 and then weekly until resolution of symptoms.

RESULTS: Seventy subjects were enrolled; data was complete for 44 subjects DOS, 30 subjects POD 1, and 28 subjects POD2, 5 subjects POD5 and 2 subjects POD10. Results from the VRQL revealed 41% of patients to have some degree of VD on DOS. This included trouble speaking, feelings of "running out of air," having to repeat phrases, not knowing what will come out and frustration related to voice changes. Difficulties were more frequently noted POD1 (55%) but lessened by POD 2 (28%) and were present in a minority by POD5 (17%). Overall, difficulty speaking out loud was the most commonly reported symptom of VD. Sore throat correlated with VD on both the DOS and POD1 (Spearman $r=0.4$, $p=0.007$ and $r=0.52$, $p=0.003$, respectively). When dysfunction persisted beyond POD2 it was not correlated with sore throat. Complaints of VD exceeded that of throat pain by POD5.

CONCLUSION: An element of VD occurred following endotracheal intubation in a significant number of subjects. We believe this problem to be under recognized by most clinicians. We acknowledge a potentially significant attrition bias. However, recalculating the data assuming all subjects lost to follow up had no VD, we still would have a VD rate of 39% on POD1 and 18% on POD2. Ongoing data collection should further elucidate this issue, reduce survey attrition bias, and establish an accurate prevalence such that future interventions designed to minimize this morbidity can be appropriately assessed.

REFERENCES: 1) EJA 2005; 22: 307-311 2) BJA 2002; 88: 582-584

S-107.

ONE YEAR INCIDENCE OF POSTOPERATIVE MYOCARDIAL INFARCTION (PMI) IN PATIENTS UNDERGOING MAJOR ORTHOPEDIC SURGERY

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INTRODUCTION: For the purposes of cardiac risk stratification, orthopedic surgery is considered intermediate risk (1-5% incidence of cardiac death or MI). We previously reported that the one year incidence of a postoperative myocardial infarction (PMI) was 0.6% for all patients and 6.5% for patients with cardiac risk factors undergoing non-ambulatory orthopedic surgery (1). Using two medical information retrieval systems we tracked the incidence of a PMI for major orthopedic procedures: hip (THA) and knee arthroplasty (TKA) and spinal fusion (SF) patients, their preoperative risks and complications over one year.

METHODS: With IRB approval from 7/01/07 to 6/30/08 we tracked the THA, TKA, and spinal fusion patients with cardiac risk factors who were assessed for a PMI using our electronic ordering system (SMM;Eclipsys). Preoperative risk factors and postoperative complications were tracked using a web-based medical information management system, My Medical Files (MMF). Preoperative risk factors which were tracked included previous MI, stress test positive for ischemia, coronary stents, diabetes, Cr \geq 2.0, congestive heart failure (CHF), and use of β -blockers and statins. A serum Troponin I (cTnI) > 0.02 ng/ml (the reference level) was considered a PMI (ischemia).

RESULTS: During the one year period 807 patients were assessed for a PMI; THA 212, TKA 231, SF 92, other 272. For THA, TKA and SF patients the overall incidence of a PMI was 0.9% (63/6948) and for those patients with cardiac risks, 11.8% (63/535). The incidence was highest in SF patients, 17% (16/92). Of the patients with elevated cTnI levels: 16% required transfer to a CCU, 17% were treated for CHF, and 56% were treated for dysrhythmias. Patients with higher cTnI releases had more complications.

CONCLUSIONS: Although the overall incidence of a PMI after major orthopedic surgery remains low, for those patient with cardiac risks a PMI represents a significant risk (12%). In addition postoperative elevated cTnI levels in this population are associated with cardiac complications.

REFERENCE:

1. HSS Journal (2008) 4: 76-80.

S-108.

EFFECTS OF SHORT INTERACTIVE ANIMATION VIDEO ON PREANESTHETIC ANXIETY, KNOWLEDGE AND INTERVIEW TIME

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INTRODUCTION: Although it is easy for patients to imagine their surgery such as tumor resection, it is difficult for them to understand anesthesia. This insufficient understanding of anesthesia makes patients feel anxious. Although it would be ideal to obtain patient's consent with full understanding of the risks and benefits of anesthesia, it is impractical because anesthesiologists do not have sufficient time to talk with their patients until they are satisfied with the explanation of anesthesia. In order to solve these problems, we designed an interactive animation video which explains basics of anesthesia for patients (Ref 1). We hypothesize that our video will reduce patients' anxiety, improve their anesthesia knowledge and shorten the interview time.

METHODS: *Animation Video(Ref 1):* Our animation video is intended to help patients understand anesthesia, to help anesthesiologists understand what their patients do not understand and to make anesthesiologists' pre-operative interview effective and efficient. The animation character which represents a female anesthesiologist explains anesthesia in the plain Japanese language in a female voice. This video is composed of several brief sections. Each section lasts from 1 to 2 minutes. There is questionnaire at every end of section.

Study Design: Approval of the institutional ethics committee and written informed consent were obtained. Sixty patients scheduled for cancer surgery (including diagnostic procedures) under general or general/ epidural anesthesia who had been admitted to our hospital at least overnight before surgery were randomly assigned to video group (n=30) or no-video group (n=30). Patients in the video group were asked to watch an interactive short animation video in the ward. After the video session, the patients were visited by an anesthesiologist who undertook routine preanesthetic assessment and risk explanation. Patients in no-video group were visited by an anesthesiologist, as usual, who undertook routine preanesthetic assessment and risk explanation.

In both groups, patients were asked to complete state-trait anxiety inventory (STAI form Y-1) and to take knowledge tests before interview and on the day of surgery. We also measured interview time by the anesthesiologist. Statistical analysis was done with t-tests.

RESULTS: There was no difference in the baseline anxiety and knowledge between the groups. Interview time was significantly shorter and knowledge of anesthesia was higher in the video group. However, there was no difference of preoperative anxiety between the two groups (Table 1).

DISCUSSION: Our short interactive animation video helps patients understand anesthesia while reducing anesthesiologists' interview time.

REFERENCE: 1. Development of short interactive animation video for patients undergoing anesthesia. *Proceedings of the 9th Annual International Meeting on Simulation in Healthcare 2009*;(in press)

CONFLICT OF INTEREST: This study was supported by Grant-in-Aid from the Japanese Government Ministry of Health, Welfare and Labor.

Table 1

		Video group	No-Video group	P-value
Knowledge(points)	Before	9.5 \pm 2.0	9.4 \pm 2.2	NS
	After	12.0 \pm 1.9	10.8 \pm 1.6	0.00399
Anxiety (points)	Before	46.0 \pm 8.6	44.1 \pm 10.0	NS
	After	42.3 \pm 8.7	43.3 \pm 9.9	NS
Time(min)		12.7 \pm 4.3	19.2 \pm 6.1	<0.001

P<0.05 was considered statistically significant. NS: not significant.

S-109.

CODE BLUE: WHO RESPONDS, AND WHICH DRUGS AND EQUIPMENT ARE USED, IN ACADEMIC ANESTHESIA PROGRAMS

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INTRODUCTION: The sudden, unpredictable, and often chaotic nature of code blue (cardiopulmonary resuscitation) requires anesthesia care team members responsible for airway management to bring the necessary drugs and equipment. Responders should have adequate training in securing and maintaining difficult airways. The purpose of this survey was to understand how academic anesthesiology programs prepare for the care of patients at code blue events.

METHODS: After approval from the IRB, a survey was sent to the chief residents at 131 anesthesiology training programs in the United States. Questions related to who responds (attendings, residents, nurse anesthetists, respiratory therapists) to code blue, as well as when (all day, everyday), and where (including emergency department, neonatal and pediatric intensive care units). We sought to know how many months of anesthesia training are required before a resident can respond to code blue, and specific drugs and airway equipment that are always brought to these emergencies.

RESULTS: The questionnaire was mailed twice with a total of 106 (80 %) responses received. Succinylcholine (97%), etomidate (92%), rocuronium (67%), and propofol (63%) were the drugs most commonly brought to codes. Ketamine (14%) and cisatracurim (14%) were least likely to be supplied in the code pack. Endotracheal tubes brought to code blue ranged from less than 3.0 to greater than 8.5, but the most common sizes were 7.0 (99%), 8.0 (96%), and 6.0 (93%). One hundred percent of the survey departments brought a laryngeal mask airway. Only 66% placed bougie in the code pack. Twenty seven percent of the programs require residents to have at least one year of training in anesthesiology prior to responding to code blue, while 33% require 3 months or less. All of the departments responding to the survey have residents assist with the code blue, but only 64% and 21% respectively send attendings and nurse anesthetists. Twenty-two percent of the departments do not care for code blue patients in the pediatric intensive care unit or emergency department. Two percent of the academic programs do not respond to code blue twenty-fours a day, seven days a week.

DISCUSSION: Many factors related to cardiopulmonary resuscitation (CPR) have been associated with outcome, including the interval between the onset of arrest and start of CPR, and quality of CPR. While the results of our survey has shown uniformity as related to drugs and equipment employed in CPR, it has also revealed considerable disparity in the training of residents who respond to code blue and whether they are accompanied by another anesthesia care team member. These issues may be important factors in how quickly CPR is instituted and how effectively it is performed.

S-110.

THE IMPACT OF AN EXAM ORIENTED DIDACTIC LECTURE SERIES DURING CA3 YEAR ON THE ABA WRITTEN EXAMINATION PERFORMANCE

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PURPOSE: We examined the impact of an educational intervention: an exam-oriented didactic lecture/question series board review program (BRP) on the American Board of Anesthesiology (ABA) written examination.

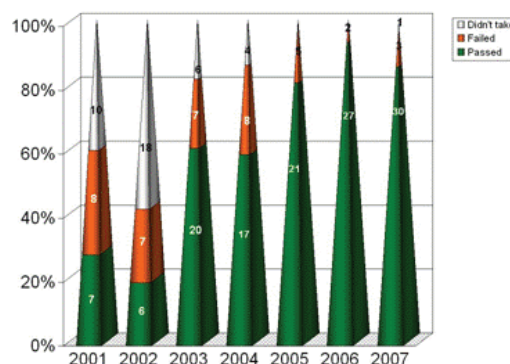
METHOD: The University of Miami/Jackson Memorial Hospital program is the largest Anesthesiology residency program in the United States. Since 2001, the CA3 class has consisted of 29 to 34 residents. The educational program for the CA3 year residents includes a series of didactic tutorials. These are conducted by a faculty member once a week. Before 2006, the tutorials for the CA3 class were case-based, oral-board format discussions. In 2006 this format was changed to include an exam-oriented didactic lecture/question series during the last 5 months of the CA3 year.

We retrospectively analyzed the impact of this educational intervention on ABA written examination scores. The ABA written examination results of our residents for the past 7 years were reviewed. The following parameters were analyzed: ABA exam pass rate, average scaled score compared to other programs, and the number of residents above the national mean before and after starting the BRP. Although we were not able to collect all the attendance sheets for the year 2006 (first year of the BRP), attendance to the BRP for the year 2007 was collected and compared with the passing rate of the residents.

RESULTS:

CA3 average scaled score:

Before 2005, our average scaled score was less than the average scaled score of other programs. In 2006, our scaled score exceeded the average and in 2007 it was equal to other programs.



CONCLUSION: Our study suggests that the BRP improves the passing rate on the ABA written examination. There was also a strong correlation between attendance to the sessions and the passing rate of the exam.

Previous studies have found a weak relationship between attendance at the didactic teaching conferences and their relation to medical certifying exams¹. However, teaching behavior as measured by student assessment has shown to affect student performance at the exams².

In recent years, anesthesiology has become increasingly popular among US medical school graduates attracting some of the best students. This may have had some impact on the improved performance at the ABA examination in our study. Better graduates add to the reputation of the program, while marginal graduates often require help to improve their performance. Therefore, ABA written

examination performance may reflect a composite measure of the anesthesiology program as well as its residents.

REFERENCES:

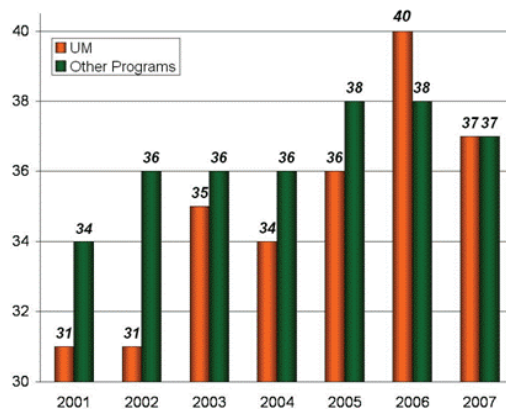
1. Didactic teaching conference for IM residents: who attends, and is attendance related to medical certifying examination scores? Acad Med. 2003;78:84-9.
2. Effect of clinical teaching on student performance during a medicine clerkship. Am J Med. 2001;110:205-9.

Number of residents above the national mean from 2001 to 2007						
2007	2006	2005	2004	2003	2002	2001
15	19	10	6	11	4	4

Passing rate of ABA exam		
before 2005	2006	2007
<76%	92%	87%

2007 total number of residents and Total number of BRP sessions	
Number of CA3 residents in 2007	Total Number of sessions in 2007
34	19

CA3 resident attendance and examination success rate:		
15 attended >70% of the sessions	8 attended 50%-70% of the sessions	4 attended <30% of the sessions
14 passed 1 failed with 1 mark less than the passing score	All passed	1 passed 3 failed

**S-111.****A DIFFICULT AIRWAY MADE EASY - SURVEY RESULTS FROM AN EDUCATIONAL EXHIBITION ON RIGID STYLET LARYNGOSCOPY THROUGH A SUPRALARYNGEAL AIRWAY**

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INTRODUCTION: The use of a supralaryngeal airway (LMA) has become part of the difficult airway algorithm [1]. Subsequent intubation through regular LMAs remains challenging. We present a simple and novel technique that allows easy intubation with an endotracheal tube (ETT) through an LMA.

METHODS: The newly developed Air-Vu Stylet®, a rigid anatomically shaped endoscope modified from the one by AH Shikani [2], facilitates visualized intubation with a regular ETT loaded over the stylet through the Air-Q Airway® LMA without the need for flexible fiberoptic intubation (FOI). This LMA has been specifically designed to ease intubation: its wider lumen and removable 15-mm adapter allow the insertion of an 8.5 (7.0) ETT through a 4.5 (3.5) LMA in men (women). 85 anesthesia providers visiting our hands-on educational exhibition at the 2007 ASA meeting practiced this technique on an airway mannequin and responded to an IRB-approved anonymous survey. Data are mean ± SEM; statistics: unpaired t-test and Pearson's correlation; *P<0.05 two-tailed.

RESULTS: Between 0 (not useful) and 10 (extremely useful) this technique was overall rated very useful (8.1±0.2). Anesthesia providers with previous airway difficulties in trauma (*9.2±0.3 vs 7.8±0.2) or ICU patients (*8.6±0.5 vs 8.0±0.2), and those not feeling sufficiently proficient with FOI (*8.7±0.3 vs 7.8±0.3) rated this technique slightly higher than their counterparts; gender, years of practice, private practice, board certification, proficiency with other intubating LMAs, previous difficult airways in elective or OB patients, and previous attendance of a difficult airway course did not correlate with a change in perceived usefulness. 86.6% successfully intubated at their first attempt in 34±3 seconds.

DISCUSSION: The combination of Air-Vu Stylet® and Air-Q Airway® is a valuable alternative to conventional FOI in both the anticipated and the unrecognized difficult airway. This technique is easy to learn and perceived very useful by anesthesia providers. It can be used in fully anesthetized as well as only moderately sedated spontaneously breathing patients. The equipment is inexpensive, easily portable and does not require external light sources. High quality stainless steel material ensures durability and reliability. Although not formally approved, we have also successfully used it for difficult airway management in the MRI environment.

REFERENCES: 1) Anesthesiology 2003;98(5):1269-77; 2) Otolaryngol Head Neck Surg 1999;120(1):113-6.

S-112.**INFLUENCE OF RAFFLE PRIZES ON RESPONSE RATES TO AN ONLINE SURVEY OF RESIDENCY APPLICANTS****AUTHORS:** L. Chu¹, D. Lowe², A. Macario¹;**AFFILIATION:** ¹Stanford University, Stanford, CA,²Anesthesiology, University of Southern California, Los Angeles, CA.

INTRODUCTION: Response rate is an important limitation to any survey study. The higher the response rate the less likely the respondents are not a representative sample. Longer surveys are less likely to be returned. Providing a financial incentive may be an effective strategy to increase response rate. The purpose of this study was to determine the impact of increasing financial incentives on response rates to a web-survey of applicants to anesthesia residency.

METHODS: We invited the 572 applicants to the Stanford Anesthesia Residency Program in 2007 to complete an anonymous online survey. An invitation to participate was sent June 1 that entered participants into a raffle for two \$50 Amazon.com gift certificates upon completion by June 30. Non-responders were sent a reminder on June 9, without any additional incentives. A second reminder was emailed to non-responders on June 20 that entered new participants into an additional raffle for two \$100 Amazon.com gift certificates. The survey opened to applicants from June 1 to June 30, 2008.

RESULTS: Of the 572 survey requests, 208 (36%) were received overall. After the initial invitation (raffle offer for two \$50 Amazon.com gift certificates) was sent out 6/1/08, 62 of 572 (10.8%) responded (approximately 5%/day) in the first 2 days and required an average of 15 minutes (SD 12.8) to complete the survey. In the following 5 days, only 17 of the remaining 510 eligible subjects responded (0.5%/day) and required on average 19 minutes (SD 19.9). After the first reminder was sent on 6/9/08, 48 of 493 (9.7%) responded (5%/day), needing an average 13 minutes (SD 9.1). In the subsequent 8 days, only 14 of 445 responded (0.4%/day) and required a mean 12 minutes (SD 7.5). When the incentive was increased to two \$100 Amazon.com gift on June 20, an additional 56 of 431 responded (7%/day) and used an average 12 minutes (SD 6.4) to complete the survey. In the subsequent week, 9 of 375 responded (0.3%/day) in an average of 11 minutes (SD 5.4).

DISCUSSION: Increasing the financial incentive increased response rates to a web-survey of applicants to anesthesia residency. The time taken to complete the survey by each cohort was similar, averaging 13 minutes overall, suggesting that subjects did not quickly answer items in survey without reading the survey in hopes of winning the prize. Nonetheless, in light of 3 invitations and monetary incentives to participate, over half (63%) of eligibles did not respond to the survey. More research is necessary to understand the optimal type and size of financial incentives to maximize response rates.

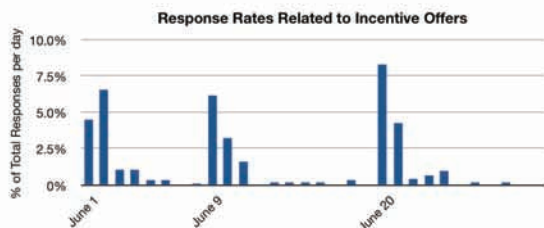


Figure 1. Daily response rates (% of total per day) of participants completing the Stanford Anesthesia Residency Program Website survey between June 1 and June 30, 2008. A financial incentive was offered on the June 1, June 9 and June 20.

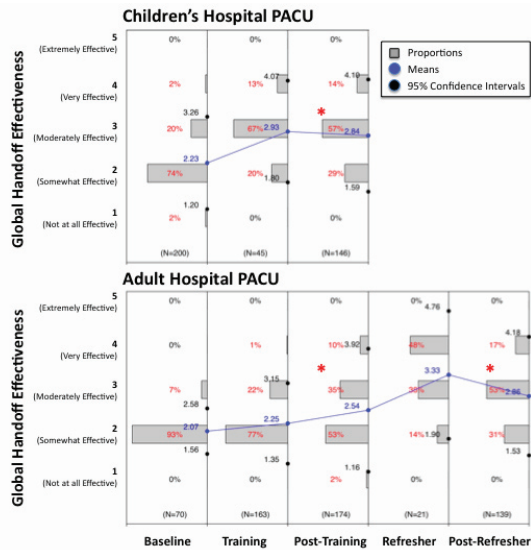
S-113.**A SIMULATION-BASED HANDOFF TRAINING INITIATIVE SIGNIFICANTLY IMPROVES THE QUALITY OF ACTUAL PACU HANDOFFS****AUTHORS:** M. B. Weinger¹, J. M. Slagle², A. Kuntz², N. Mercaldo², D. Peterman², T. Speroff²;**AFFILIATION:** ¹Anesthesiology, Vanderbilt University Medical Center, Nashville, TN, ²PACU Handoff Team, Vanderbilt University, Nashville, TN.

BACKGROUND. Failures of communication have been associated with poor quality care. We developed a simulation-based training intervention to improve patient care transitions, focusing on handoffs between anesthesia providers (AP) and Post-Anesthesia Care Unit (PACU) nurses (RN). We hypothesized that our performance improvement intervention would increase the quality of handoffs, enhance PACU culture of communication, and improve care quality. We report on the effects of the intervention on the quality of actual PACU handoffs.

METHODS. Using a multiple baseline staggered entry prospective cohort design with repeated measures, a training and process improvement intervention was introduced into adult (VUH) and pediatric (VCH) PACUs. The curriculum and assessment were designed from observations of PACU handoffs and targeted clinician interviews. The training focused on obstacles to effective handoffs that included: unclear roles & responsibilities, no standardization, and interruptions & distractions. Handoff competencies assessed included engagement, organization, completeness, coordination, situational awareness, confirming comprehension, interpersonal communication, and conflict management. The intervention included a didactic webinar, a new handoff report tool, and a 2-hour training session using standardized patients and clinicians, manikin simulators, and facilitated debriefing. The assessment tool was iteratively developed and validated to measure core competencies. Trained and certified RN observers scored 865 actual handoffs over a 12-month period with monthly feedback to PACUs on their overall handoff performance and opportunities for improvement. VUH PACU personnel were trained in Months 3-4 and then received a "refresher" (1-hr simulation course) in Month 9. VCH personnel were trained in Month 6. Aggregated handoff performance was scored pre- vs. post-training.

RESULTS. Baseline (pre-training) data were stable in both PACUs with the majority of actual handoffs being rated only "somewhat effective" (a global score of 2 out of 5 (extremely effective); VUH 2.07±0.51 (mean±SD) & VCH 2.23±1.03, see **Figure**). Post-training, handoff quality improved significantly with most handoffs observed being rated at least "moderately effective" (3 out of 5) in both PACUs (VUH 2.54±1.27 & VCH 2.84±1.27, both P<0.001 vs. pre-training by Kruskal-Wallis). After the "refresher course", the VUH global score increased further to 2.86±1.27. Overall, the simulation-based course received excellent trainee evaluations with overall trainee ratings of 8.1±0.8 VUH and 7.8±1.3 VCH, respectively, on a scale of 1 (worst) to 9 (best).

CONCLUSION. Creating and delivering comprehensive simulation-based clinical handoff training, with associated real-world assessment, is inherently complex and resource intensive. This study cannot assess the relative impact of the training component vs. the new handoff tool or the feedback of actual handoff effectiveness to PACU clinicians. Pre- vs. post-training data on simulated videotaped handoffs, communication culture, and actual patient outcomes remain to be analyzed. We demonstrated a significant improvement in actual PACU handoff effectiveness following a simulation-based training and performance improvement intervention. *Supported by AHRQ grant 1U18HS016651.*



S-114.

CRICOID PRESSURE DOES NOT AND CANNOT OCCLUDE THE ESOPHAGUS, BUT SELICK'S MANEUVER WORKS

AUTHORS: M. J. Rice¹, A. Mancuso², C. Gibbs², T. E. Morey², N. Gravenstein², L. A. Deitte²;

AFFILIATION: ¹Department of Anesthesiology, University of Florida College of Medicine, Gainesville, FL, ²University of Florida College of Medicine, Gainesville, FL.

INTRODUCTION: Sellick¹ described cricoid pressure (CP) as occluding the esophagus between the cricoid ring and the cervical spine. A recent report² noted that with the application of CP, the esophagus moved laterally more than 90% of the time, questioning the efficacy of this maneuver. Because of this report, we believed further investigation was warranted. This study was designed to accurately define the anatomy of the Sellick maneuver as well as investigate its efficacy.

METHODS: After IRB approval, twenty-four consenting adult volunteers underwent neck magnetic resonance imaging with and without CP in the sniffing, neutral, and extended neck positions. Measurements were made of the post cricoid hypopharynx as well as lateral displacement of the cricoid ring both prior to and during the application of CP. In addition, the relevant anatomy was reviewed.

RESULTS: The results are summarized in Table. The hypopharynx, the portion of the alimentary canal at the cricoid level, was fixed with respect to the cricoid ring and not mobile in any subject. The esophagus was not observed in any subject at the level of the cricoid ring. With cricoid pressure, the mean AP diameter of the hypopharynx tissue thickness was reduced by 35% and this degree of compression was similar even when the cricoid ring was displaced laterally by the application of CP.

DISCUSSION: Contrary to previous literature regarding the Sellick maneuver, the esophagus does not exist at the level of the cricoid ring. The hypopharynx, which is the alimentary tract at this level, and cricoid ring moved together as an anatomic unit, which we have named the "cricoid pressure unit". This relationship is essential to the efficacy and reliability of Sellick's maneuver, which works to obstruct the alimentary tract even if the cricoid ring is not midline in which case the deep cervical musculature provided a sufficient backstop to still achieve comparable alimentary tract compression.

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Hypopharynx,Diameter (AP) without and with Cricoid Pressure			
Measurement (mm)	Without CP	With CP	Difference (P value)
Postcricoid Hypopharynx (AP)			
Sniffing	7.3 +/- 1.6	4.7 +/- 1.3	2.6 +/- 1.1 (< 0.001)
Neutral	7.3 +/- 1/4	2.6 +/- 1.2	2.6 +/- 1.2 (< 0.001)
Extended	7.5 +/- 1.8	4.5 +/- 1.4	2.6 +/- 1.7 (< 0.001_

S-115.**IMPACT OF ACUPRESSURE (PRESSURE RIGHT) AS PART OF A MULTI-MODAL ANTIEMETIC STRATEGY ON RESUMPTION OF NORMAL ACTIVITIES AFTER MAJOR LAPAROSCOPIC SURGERY**

AUTHORS: M. Zhao¹, J. Tang², P. F. White³, R. Yumul², R. Naruse², R. H. Wender²;

AFFILIATION: ¹Department of Anesthesiology, Cedars-Sinai Medical Center, Los Angeles, CA, ²Cedars-Sinai Medical Center, Los Angeles, CA, ³UT Southwestern Medical Center at Dallas, Dallas, TX.

INTRODUCTION: Controversy exists regarding the optimal strategy for managing postoperative nausea and vomiting (PONV) in high-risk surgical populations. Although acupoint stimulation at the P6 acupoint has been demonstrated to be effective in preventing PONV (1), the effect of this non-pharmacologic therapy on the patient's recovery of quality of life and resumption of normal activities has not been previously assessed as part of a multi-modal antiemetic regimen after major laparoscopic surgery. Therefore, we designed this randomized, sham-controlled, and double-blinded study to assess the efficacy of Pressure Right, a simple disposable acupressure device, on the impact of recovery when administered for prophylaxis in combination with ondansetron and dexamethasone.

METHODS: Following IRB-approval, 100 consenting ASA I-III patients undergoing major laparoscopic procedures were randomly assigned to one of two treatment groups. A "sham" patch (Control) or Pressure Right (Acupressure) was placed on the P6 point bilaterally at least 30 min before induction of anesthesia. All patients received a standardized general anesthetic consisting of propofol and desflurane, and local anesthesia at the incision site to minimize postoperative pain. A combination of ondansetron, 4 mg IV, and dexamethasone, 4 mg IV, was administered during surgery for antiemetic prophylaxis in both study groups. The incidences of nausea and vomiting and the need for 'rescue' antiemetic therapy were assessed at specific time intervals for 72 h after surgery. The recovery profiles and quality of recovery questionnaires (2) were evaluated at 48 h, 72 h, and 30 d after surgery. Patient satisfaction with their PONV management was also assessed using a three-point verbal rating scale (0= dissatisfied, 1= satisfied and 3= highly satisfied). Data were analyzed using Student's *t*-test, Mann Whitney U test and Chi-square test or Fisher's exact test where appropriate. (**p*<0.05 vs. Control Group)

RESULTS: The two groups did not differ with respect to their demographic characteristics (Table 1). The incidence of vomiting (emesis) was significantly decreased in the Pressure Right group. Use of a Pressure Right device also significantly enhanced patient satisfaction with PONV management and their quality of recovery scores at 48 h after surgery. However, the recovery times with respect to hospital discharge, resumption of physical activities and returned to work did not differ significantly between the two treatment groups.

DISCUSSION: The Pressure Right acupoint stimulation device was effective in reducing emetic symptoms, as well as improving patient satisfaction with their PONV management and quality of recovery after major laparoscopic surgery procedures.

REFERENCE: (1) Anesthesiology 2002;97:1075-81; (2) Anesth Analg 1999;88:83-90

Table 1.

	Sham	Pressure Right
Age (yr)	43±11	46±14
Weight (kg)	97±31	90±26
Anesthesia time (min)	135±34	137±48
Propofol (mg)	220±68	228±93
Fentanyl (µg)	199±67	204±113
Nausea 0-72 h [n (%)]	25 (50)	20 (40)
Vomiting 0-72 h [n (%)]	13 (26)	5 (10)*
Rescue antiemetic 0-72 h [n (%)]	22 (44)	14 (28)
PACU stay (min)	126±62	136±53
Time to actual discharge (d)	2±1	2±1
Resumption of physical activities (d)	12±8	11±7
Returned to work (d)	15±12	15±13
48 h quality of recovery score [median (inter-quartile range)]	16 (15-18)	17 (16-18)*
72 h quality of recovery score [median (inter-quartile range)]	17 (16-18)	17 (16-18)
Highly satisfied with PONV management [n (%)]	33 (66)	42 (84)*

S-116.**HISTORY OF CARDIAC ARRHYTHMIA AND CAD PROLONG STAY IN HOSPITAL AFTER MAJOR ORTHOPEDIC SURGERY**

AUTHORS: B. Mraovic¹, B. Hipszer², J. Joseph², E. Pequignot², I. Chervoneva², Z. Grunwald²;

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INTRODUCTION: Hospital administrators and third party payers desire a short hospital postoperative length of stay (LOS). Risk factors that affect LOS after orthopedic surgery were reported but influence of patients comorbidities on hospital LOS after the surgery are less known.(1,2) We investigated which preoperative comorbidities are associated with increased LOS after total hip and knee arthroplasty.

METHODS: After obtaining IRB approval, we retrospectively reviewed the medical records of patients undergoing elective total hip or total knee replacement from January 2001 to April 2006. Detailed preoperative comorbidities were recorded. Data were analyzed using logistic regression and robust ANOVA. Data are reported as geometric mean and odds ratios with 95% confidence interval in parentheses.

RESULTS: Data from 7282 patients were included in the study. The median LOS was 3 days (mean 3.46 days, range 1-58). Multivariate analysis showed that odds ratios for prolonged LOS were significantly increased by sex, 1.04 (1.03,1.05; *p*<0.001) male versus female; age, 1.01 (1.01,1.01; *p*<0.001) per decade of life; ASA status, 1.01 (1.00, 1.02; *p*=0.003) ASA status 3+4 versus 1+2; duration of surgery, 1.14 (1.12, 1.15, *p*<0.001) if >137 min; bilateral surgery, 1.15 (1.14,1.17;*p*<0.001) versus unilateral; and revision surgery, 1.04 (1.03,1.06; *p*<0.001) versus primary. BMI did not affect LOS, 1.00 (1.00,1.00; *p*=0.311). History of (h/o) cardiac arrhythmia significantly increased odds ratios by 1.02 (1.00,1.04; *p*=0.024) and h/o coronary artery disease (CAD) by 1.01 (1.00,1.02;*p*=0.032). H/o cardiac valve disease, congestive heart failure, HTN, pulmonary disease, malignancy, diabetes, stroke, hematological disease, and dislipidemia did not significantly increased the odds ratios.

DISCUSSION: The influence of patient comorbidities on LOS after hip and knee surgery is sparse. Our data confirm recognized risk factors: age, length of surgery, ASA status, revision surgery and bilateral surgery; but of multiple comorbidities only h/o CAD and cardiac arrhythmias independently prolonged hospital LOS. Recognizing the preoperative risk factors that prolong LOS after joint arthroplasty can enable physicians and administrators to better anticipate hospital bed utilization.

REFERENCES: 1. *J Hospital Medicine*. 2008;3:218-227 2. *J Arthroplasty*. 1998;13:186-190.

S-117.

CAN ROLE-PLAYING SCENARIOS DEVELOP THE NECESSARY SKILLS AND HABITS FOR AN ANESTHESIA RESIDENT TO WORK EFFECTIVELY AS A MEMBER OR LEADER OF A HEALTH CARE TEAM?

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INTRODUCTION: The ACGME is requiring all residencies to be proficient in the six competencies. One of these competencies is interpersonal and communication skills. Role-playing is often used in industry to emphasize the importance of teamwork and communication in the work place. A workshop was developed which utilized role-playing scenarios with common anesthesia conflicts and complaints, suggested solutions to the conflicts, and a guided group discussion. All were designed to hone interpersonal and communication skills.

METHODS: Six weeks before a workshop presentation was to take place, a questionnaire, designed to evaluate communication skills and teamwork was distributed to the anesthesia residents. Ten out of thirteen residents completed the questionnaire. At the workshop, four complex conflict-ridden operating room and PACU scenarios were assigned to anesthesia attendings and residents, PACU nurses, circulating nurses, and scrub nurses. Some of the issues addressed included violating resident work hour regulations, PACU delays and miscommunications, conflicts over dinner breaks, a patient presenting to the operating room without the necessary labs, and management of a post operative patient with nausea. The scenarios all had role reversals; all the physicians played non-physician roles and all non-physicians played physicians roles. A moderator kept the role-playing focused and gave possible solutions to all of the issues brought up during the workshop. At the conclusion of the workshop, an article¹ and a handout on teamwork were distributed to the anesthesia residents. The original questionnaire was redistributed to the anesthesia residents six weeks post intervention. Ten out of thirteen residents completed the questionnaire.

RESULTS:

Pre-intervention and post-intervention results		
	Pre-intervention	Post-intervention
Number of surveys	10	10
Average total score out of 50	38.5	40.8
Standard deviation	± 3.3	± 1.8
P-value for the study	0.04	
Confidence interval for the study	0.0076	

DISCUSSION: Our intervention has made a positive impact on the level of teamwork and communication between anesthesia residents and between residents and other care providers. This was demonstrated by the above results and an informal discussion with participants. We believe that if the intervention were to be given more than once a year, and to a greater number of people, the level of teamwork and communication among anesthesia residents would be further enhanced and demonstrate greater significance.

REFERENCES: "So, you're going to be a member of a team." Phillips, Patricia L., *Chemical Engineering Progress*. January 1997.

S-118.

PERIOPERATIVE REMOVAL OF JEWELRY AND BODY ART; JACHO YES-ANESTHESIOLOGISTS, WELL MAYBE NOT

AUTHORS: A. Kuppusamy, D. Hall;

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INTRODUCTION: The Joint Commission on the Accreditation of Healthcare Organizations (JCAHO) states in its guidelines that "all body jewelry worn by the surgical patients shall be removed before they are brought to the operating room" (1). Body jewelry worn during the perioperative period could result in pressure necrosis of tissue, nerve injury, lacerations, abrasions, strangulation of body parts or electrocautery related burns. Despite the above, perioperative removal of body jewelry is not consistently performed in our institution. Therefore we wished to determine to what extent other anesthesia residency training programs tolerate the presence of body jewelry in the perioperative period.

METHODS: After receiving IRB approval, we surveyed the 128 ACGME-accredited anesthesia residency training programs regarding the perioperative management of body jewelry, specifically body piercings and rings. Surveys were mailed out once, and a follow-up email was sent. Survey questions included whether the institution inquired about body jewelry (including location), if present was it removed, and whether cases were allowed to proceed if a patient was wearing body jewelry.

RESULTS: We mailed 128 surveys, and received 39 responses (approximately 31%), which is typical for physician surveys (2). We found significant variation in practice patterns regarding removal of body piercings and rings in the perioperative period. The data revealed that approximately 14% of the institutions surveyed did not always ask patients if they had any body piercings or rings. Moreover, when body piercings and/or rings were present, 39% of the institutions reported that they were not always removed. The most striking finding was that among our survey respondents was that operative cases were allowed to proceed in the presence of body piercings and rings in 77% of the institutions.

DISCUSSION: This project was conceived after our observation that this JCAHO standard was not routinely followed in our institution and after we previously reported widespread disregard of another perioperative JCAHO standard (3). All responding institutions are JCAHO participating facilities. Since these hospitals are training future anesthesiologists, consideration should be given to either modifying practice patterns or modifying JCAHO standards with regard to body piercings and rings in the perioperative period.

REFERENCES:

1. Joint Commission on Accreditation of Health care Organization. Hospital Licensing Standards: Provision of Care, Treatment and Services 4.10
2. Health Serv Res 2001; 35: 1347-1355
3. Anesthesia Analgesia 2008; 106: S-87.

Do Anesthesia Training Programs:		
	Always	Not Always
Remove a finger ring	36%	64%
Remove an ear ring	61%	39%
Remove a tongue ring	78%	22%
Case does not proceed if jewelry present	23%	77%
Jewelry removed	61%	39%
Patients asked if jewelry was being worn	86%	14%

S-119.**PUBLICATIONS ON OBSTETRIC ANESTHESIA. ARE WE DOING ENOUGH? A QUANTITATIVE ANALYSIS****AUTHORS:** S. Sathish Kumar¹, B. Netke², A. Velayudhan³;**AFFILIATION:** ¹Department of Anaesthesia & Intensive care Medicine, Stafford Hospital, Stoke School of Anaesthesia, Stafford, United Kingdom, ²Stafford Hospital, Stoke School of Anaesthesia, Stafford, United Kingdom, ³Hillingdon Hospital, Uxbridge, London, United Kingdom.**INTRODUCTION:** A detailed layout of publications related to obstetric anesthesia is lacking. We therefore decided to undertake a quantitative study on the distribution of obstetric anesthesia related literature in major anesthesia journals.**METHODS:** A search was made using PubMed database for English language articles containing "obstetric anesthesia" as a keyword published in leading anesthesia journals over the last 10 years (1998-2008). The journals analysed were British Journal of Anaesthesia-BJA, Anaesthesia, Anaesthesiology, Anesthesia & Analgesia, European Journal of Anaesthesia-EJA, Acta Anaesthesiologica Scandinavica-AAS, and Anaesthesia & Intensive care. The same journals were searched to find the total number of all articles that were published during that period.

Types of obstetric anesthesia related articles published in major journals							
	BJA	Anaesthesia	Anesthesiology	Anesthesia & Analgesia	EJA	AAS	Anaesthesia & Intensivecare
Journal Origin	UK	UK	USA	USA	UK/Belgium	Scandinavia	Australia
Clinical Trial	36	38	40	74	15	19	7
Editorial	6	7	9	9	0	0	0
Letter & Comments	47	117	31	33	10	9	8
Meta-Analysis	1	1	1	2	0	0	1
Practice Guideline	0	1	2	0	0	0	0
Randomised Controlled Trial	35	28	32	67	14	15	5
Review	7	12	9	6	1	2	4
Case reports	47	57	21	47	9	18	25
Total	179	261	145	238	49	63	50
All articles in 10 years	3818	4758	5125	7844	1881	2497	1644

RESULTS: A total of 27567 articles were published in all the seven journals combined. Only 985 articles were related to "obstetric anesthesia". About 50% of these were case reports and letters. Clinical related articles and randomised controlled trials are the next major publication type contributing 229 and 196 respectively.**DISCUSSION:** Our study shows obstetric anesthesia related articles represent only 3.2% of all articles published in the seven major journals. Journals published in USA contribute to more clinical related articles. In terms of randomised controlled trials Anesthesia & Analgesia alone published 67 articles (34%). Though our study is only a quantitative study, it clearly shows that obstetric anesthesia is under represented as a specialty in terms of number of publications. A detailed qualitative study is needed to examine the areas being researched in the field of obstetric anesthesia.**S-120.****RISK FACTOR FOR CORNEAL ABRASIONS IN ADULTS DURING GENERAL ANESTHESIA****AUTHORS:** P. W. Gunn¹, K. Lee², D. P. Martin², J. Sprung², T. N. Weingarten²;**AFFILIATION:** ¹Department of Anesthesiology, Mayo Clinic College of Medicine, Rochester, MN, ²Mayo Clinic College of Medicine, Rochester, MN.**INTRODUCTION:** Postoperative corneal injuries due to exposure keratitis or corneal abrasion are known perioperative complications. The purpose of this study was to analyze the association between patient and procedure-related factors among adults who experienced perioperative corneal injury.**METHODS:** Our institution has previously implemented a system that allowed immediate identification of postoperative corneal injuries with confirmation by an ophthalmologist. All cases of corneal injury identified from January 1st, 2006 through July 31st, 2008 were identified. We studied the risk factors for corneal injury by using a 1:2 matched case-control study design with regard to year and month of anesthetic. A retrospective electronic medical record review was performed for all cases and controls with attention to demographic, comorbid, procedure-related, and anesthetic-related variables. Univariate analysis was performed to assess the association between each individual risk factor and the occurrence of corneal injury.**RESULTS:** During the study period 171,850 non-ophthalmologic operations and procedures requiring anesthesia were performed, and 120 cases of corneal injuries were identified. The overall incidence of corneal injuries was 0.70 per 1000 anesthetics. These were matched with 240 control cases. We found that patients in whom corneal injuries occurred were more likely to have hyperthyroidism (6.7% vs. 2.5%, p=0.05), Grave's Disease (3.3% vs. 0.4%, p=0.03), had a lower median ASA status (2 vs. 3, p=0.02), and a longer duration of anesthetic (267±11 min vs. 202±8 min, p<0.001) than case controls. Patients in the corneal injury cohort were more likely to be undergoing head and neck procedures, but this did not reach significance (15.0% vs. 8.8%, p=0.07). We found no other associations for demographic differences, body habitus, other comorbid conditions, or surgical or anesthetic related factors.**DISCUSSION:** Consistent with previous studies¹, perioperative corneal injuries were associated with lengthier anesthetic time, hyperthyroidism and Grave's Disease. Contrary to previous studies, we found no association between corneal injury and patient positioning. Although the exact mechanism of injury is speculative and likely multifactorial, awareness of risk factors for perioperative corneal injuries allows anesthetic providers to use increased vigilance in preventing this complication.**REFERENCE:** Roth S, Thisted RA, Erickson JP et al. Eye injuries after nonocular surgery. A study of 60,965 anesthetics from 1988 to 1992. Anesthesiology 1996;85:1020-7.

S-121.

ALKALINIZATION OF INTRACUFF LIDOCAINE WITH GEL LUBRICATION TO MINIMIZE POSTOPERATIVE LARYNGOTRACHEAL MORBIDITY

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INTRODUCTION: Postoperative sore throat occurs in up to 90% of intubated patients and is the most common complaint after tracheal intubation¹. Unfortunately, cuffs can be easily over-inflated during nitrous oxide administration in air-filled cuffs creating excessive pressure even when the initial sealing pressure is satisfactory². Dollo and his colleagues³ have reported that addition of sodium bicarbonate (NaHCO₃; alkalization) increased diffusion of low dose of lidocaine hydrochloride (L-HCl) across an endotracheal tube (ETT) cuff. The aim of this study was to evaluate safety and efficacy of using alkalizing lidocaine with two different concentrations (1.68% and 0.84%) of NaHCO₃ in different volumes added to a fixed low dose of lidocaine (40 mg).

METHODS: Sixty patients were randomly assigned into three equal groups; ETT cuff filled with air (air control group) or with alkalized lidocaine using 1.68% (group I 1.68%) or 0.84% (group II 0.84%) concentrations of NaHCO₃. Cuff inflation initial volume and pressure, cuff end pressure and cuff deflation final volumes were recorded. Cough and restlessness before extubation; hoarseness, dysphonia and dysphagia after extubation were noted in PACU. Sore throat was evaluated as the main endpoint by visual analog scale (VAS) score at 30 minutes, 1, 2, 3, and 24 h after extubation. Spontaneous ventilation time (TSPO-EXT), extubation time (TEND-EXT) and hemodynamic variables were recorded.

RESULTS: The pH range (the preliminary in-vitro study) in group I 1.68% and group II 0.84% was (7.47-7.77) and (7.35-7.47) respectively. The VAS score of sore throat was reduced in each of the alkalized lidocaine groups when compared to the air control group all over the study period ($p < 0.05$). The cuff deflation final volumes (6.4 ± 0.9 and 6.3 ± 0.7 ml) and the cuff end pressure (10.9 ± 3.1 and 11.1 ± 3.4 cm H₂O) values in group I and II were significantly lower than corresponding values of volume (10.9 ± 1.8 ml) and pressure (41.8 ± 12.1 cm H₂O) in the control group ($p < 0.01$). The TSPO-EXT (15.4 ± 7.6 and 14.6 ± 6.8 min.) and the TEND-EXT (24.1 ± 9.1 and 22.5 ± 8.5) in group I and II were significantly longer than the control group (5.3 ± 2.1 min), (14.5 ± 5.6 min) ($P < 0.01$).

DISCUSSION: It is concluded that ETT cuff inflated with small dose of alkalized L-HCl (0.84% NaHCO₃) with safe physiological range of pH, was associated with decrease in sore throat during the postoperative period in comparison to air-filled cuffs. This method improves ETT tolerance, maintains hemodynamic stability at emergence from anesthesia, and also reduces hoarseness and cough due to tracheal irritation. This technique is recommended to be tried for intubated ICU cases and lengthy surgical procedures.

REFERENCES:

- 1) Lev R and Rosen P. *J Emerg Med* 1994; 4: 499-506
- 2) Raeder J.C. et al. *Anaesthesia* 1985; 40: 444 -7
- 3) Dollo G. et al. *Eur J Pharm Sci* 2001; 13: 319 -23

S-122.

SAFETY OF DRIVING IN PATIENTS AFTER MINOR SURGERY WITH MONITORED ANESTHESIA CARE: A PILOT STUDY

AUTHORS: A. Buvanendran¹, M. Moric², R. Ananda², P. Zavislak², J. S. Kroin², K. J. Tuman²;

AFFILIATION: ¹Anesthesiology, Rush Medical College, Chicago, IL, ²Rush Medical College, Chicago, IL.

INTRODUCTION: Patients are currently advised to refrain from driving for a 24-hour period after they undergo any minor ambulatory surgical procedure (Anaesthetist 1981;30:377-82). This advice is routinely given as a safety precaution to all patients undergoing monitored anesthetic care (MAC). The 24-hour driving restriction was introduced when pharmacological agents such as diazepam, methohexitone, and inhalational agents such as enflurane and halothane were utilized in the 1970's. However in the context of recently introduced short-acting sedative anesthetics that may facilitate rapid recovery and an early return to normal daily activities (Anaesthesia 1995;50:22-8), current driving restrictions beg re-examination. The study compared newer short-acting anesthetic agents (propofol, midazolam, sufentanil) utilized in MAC for healthy minor surgical procedure patients, to determine if these pharmacological agents have residual effects that impair driving ability after their short term effects have dissipated.

METHODS: Healthy patients scheduled for minor surgical procedure with MAC, drove for approximately 12 minutes in a validated driving simulator prior to the surgical procedure and again at discharge (Anesthesiology 2008;109:A1342). Analysis was based on a comparison of preoperative to discharge driving performance measures. MAC was initiated and maintained with midazolam 1-2mg IV in holding area, sufentanil 5µg and propofol 10-50mg IV in the operating room. The primary outcome measure is the ubiquitous, Standard Deviation of Lateral Position (SDLP), an "automatic behaviors" measure, also referred to as "weaving". "Control behavior" will be measured by reaction time (RT), a psychomotor component that is easily referenced and interpreted. The final criterion, "number of collisions", provides the most comprehensive integration of the many facets/abilities involved in driving as well as integrating higher level cognitive functioning. Within subject measures were compared with paired t-test for difference and the "Two-One Sided T-tests" (TOST) method for equivalence.

RESULTS: With IRB approval, twenty three subjects after minor ambulatory surgery with MAC were evaluated. No significant differences were found for any of the criterion outcome parameters, and non-inferiority was statistically determined for all of the parameters. The primary measure "weaving" was found not to be different with an between subject average SDLP of 1.63 ft preop and 1.53 ft at discharge (Equivalence $P=0.0142$). Weaving at discharge was significantly lower than the 1.85 ft measured in intoxicated subjects ($P=0.0005$). The number of vehicle accidents were similar with 3.8 accidents preop and 3.7 accidents at discharge (Equivalence $P=0.0394$), and was well below the intoxicated threshold of 4.8 ($P=0.0071$). Reaction time was actually better at discharge (0.76 sec preop and 0.71 sec at discharge).

DISCUSSION: The results clearly indicate recovery of driving proficiency by discharge time following MAC. Large randomized clinical trials need to be carried out before policy changes can be re-evaluated.

S-123.

IMPLEMENTATION OF A JOURNAL CLUB IN AN ANESTHESIA RESIDENCY PROGRAM - A SURVEY ON RESIDENTS' EXPECTATIONS

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BACKGROUND: Journal clubs (JC) are regarded an essential component of residency training in many disciplines [1-3].

METHODS: A voluntary IRB-approved survey was conducted during the first JC meeting for the 69 anesthesia residents at our institution. Data are mean \pm SEM or percentages. Statistics: Kruskal-Wallis, Chi square and Spearman's rank correlation; * $P < 0.05$; § no significant difference among classes.

RESULTS: 35 of 52 residents attended (67%; 17 were excused), 30 (86%) participated in the survey. Between 1 (not useful) and 5 (extremely useful) having a JC was rated very useful (3.5 ± 0.2 §). 70% suggested monthly (88%, *25%, 83% of the CA-1s, 2s, 3s), 13% weekly (§), 17% (0%, *50%, 17% of the CA-1s, 2s, 3s) quarterly meetings. 64% preferred voluntary, 36% mandatory attendance; level of training correlated positively with a shift to mandatory, perceived usefulness did not. 53% preferred to meet before, 40% after work (§); 57% preferred their workplace, 40% did not (§); time (before work) correlated significantly with location (workplace). 23% preferred primary studies, 30% reviews, 43% both; preference for primary studies correlated positively with training. 67% stated their expectations; among those, 85% (100%, *50%, 100% of the CA-1s, 2s, 3s) preferred articles that impact their clinical decisions, 50% (§) wanted to learn about critical literature appraisal, 20% (§) about literature search, 15% (§) how to present a manuscript and 15% (§) about statistical techniques. Between 1 (not comfortable) and 5 (extremely comfortable) residents judged their ability to search literature 2.8 ± 0.2 (§), to present a manuscript 2.6 ± 0.1 (§), to critically appraise literature 2.3 ± 0.2 (§), and their statistical knowledge 1.9 ± 0.2 (2.1 ± 0.2 , * 1.3 ± 0.3 , 2.1 ± 0.3 by CA-1s, 2s, 3s); perceived statistical knowledge correlated significantly with previous statistical training, in-training exam results in statistics did not.

DISCUSSION: Residents in our institution regard JCs as very useful. A majority supports meeting at the workplace monthly and before work, but - in contrast to recommended practice [3] - on a voluntary basis. Articles with high impact on clinical decisions and reviews are preferred, especially among beginners. Critical literature appraisal is rated second most important, while only a minority expects improving on literature search, presentation techniques or statistical knowledge despite clearly perceived deficits. Especially the perceived lack of statistical knowledge contrasts with the low importance given by residents. Additionally, the discrepancy between discussing preferably reviews with a high yield for clinical practice and improving on critical appraisal of primary literature constitutes a challenge for the selection of appropriate JC articles.

REFERENCES: 1) Aust Fam Physician 2008;37(1-2):54-6; 2) Ophthalmology 2006;113(3):497-500; 3) J Gen Intern Med. 1998;13(5):347-53.

S-124.

THE IMPACT OF ECG ELECTRODES ON HUMAN SKIN FLORA

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INTRODUCTION: There are reports that re-usable ECG electrodes may transfer bacteria from one patient to another (1). To apply ECG electrodes is mandatory in the operating theatres and in the ICU and they may be in use for 24 hours. In this study we investigated the changes of normal human skin flora under ECG electrodes in use for 24 hours.

METHODS: Fourteen healthy volunteers were involved in the study. First they had a shower with non-bacteriostatic soap and a bacterial sample was taken from the skin of the chest. Then 3 ECG electrodes (Kendall ARBO ECG electrodes H66LG REF31.1663.21 liquid gel Ag/AgCl sensor, press-stud, foam backing, diameter 55 mm) were put on to the chest. Twenty four hours later, when the electrodes came off samples were taken from where the electrodes had been and from the adjacent skin area. Bacterial samples were taken with Envirocheck® RODAK GKZ contact plates (Merck KGaA, Darmstadt, Germany). The surfaces of unused ECG electrodes were also cultured on blood agar plates. The number of colony forming units (cfu) was counted. Two-way analysis of variance served as the statistical method.

RESULTS: There was no bacterial growth from the unused electrodes. The cfu number did not change significantly during the study period on the unaffected skin. The cfu under the outer (sticky) part of the ECG electrode was 5.27 times higher than on the unaffected skin. The cfu number was less under the central part (gel) of the electrodes (58% of the outer part). Twelve volunteers out of 14 complained of itching around the electrodes. There was no sign of skin infection under or around the ECG electrodes at the end of the study.

DISCUSSION: The bacterial number increases significantly under ECG electrodes compared to free skin areas after 24 hours. Whether this poses any infection risk or not, needs further investigations.

REFERENCES: (1) J Hosp Infect 2005; 61: 264.

S-125.

THE EFFECT OF REFERENCE CARDS ON THE RETENTION OF ACLS SKILLS AS MEASURED BY CORRECT ACTIONS IN CODE SITUATIONS USING HIGH-FIDELITY SIMULATION

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AFFILIATION: ¹Anesthesia & Perioperative Medicine, Medical University of South Carolina, Charleston, SC, ²Medical University of South Carolina, Charleston, SC.

INTRODUCTION: Correct actions during treatment of a cardiac arrest are associated with improved outcomes.^{1,2} The best educational methodology to increase the percentage of correct actions while treating cardiac arrest remains unknown. Accordingly, we performed a trial to test whether ACLS reference cards can aid in the retention of ACLS skills and thus increase correct actions during real-time simulations of American Heart Association (AHA) MegaCodes. In addition to the published AHA/ACLS cards, we developed a reference card (MUSC card) that presents the complete AHA/ACLS guidelines according to an alternative 4-question algorithm: is the patient 1) pulseless? or 2) unstable? If neither, is the rhythm 3) narrow or wide and 4) regular or irregular? The answers to these questions guide the practitioner to the proper ACLS algorithm.

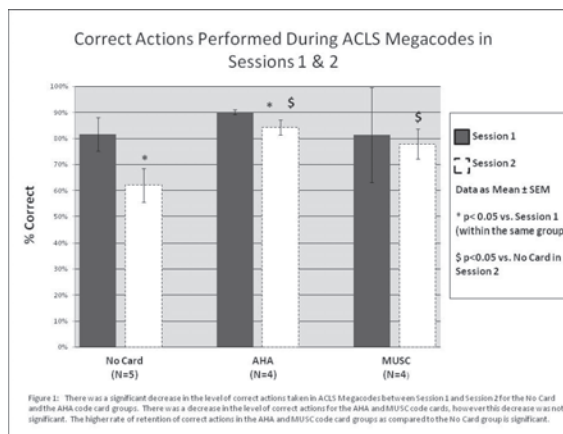
METHODS: Thirty medical students participated in a study investigating the impact of reference cards on ACLS performance. Thirteen medical students were able to complete the entire study protocol, including a session testing retention of skills 3 months after initial testing. The study consisted of 5 sessions. The first session was didactic, covering ACLS protocols. The second was a high-fidelity simulation ACLS training session. Following the training session, students were randomized into three groups to test reference card impact (No Card, AHA Card, MUSC card). In the third session and the fourth session (Testing Session 1), students were presented with a single MegaCode scenario per ACLS/AHA guidelines and required to treat various patient states. For the second phase of the study, these same students were brought back after 3 months for the fifth session (Testing Session 2) and were given another MegaCode scenario to manage. All simulation sessions were video-taped and graded according to published checklists in the ACLS/AHA training manuals. Data was analyzed by unpaired t-test and presented as Mean \pm SEM.

RESULTS: While all groups showed a decrease in correct actions performed, the No Card and AHA Card groups were significant in their decreases (see Figure 1). At the 3-month test of retention of ACLS skills, both the MUSC Card and the AHA Card groups demonstrated a significantly higher level of correct actions when compared with the No Card group.

DISCUSSION: As with prior studies, the present study demonstrated a loss of ACLS skills after a 3-month interval from initial training. However, this is the first study to our knowledge to investigate the effect of ACLS reference cards on retention of ACLS skills. The data show that use of reference cards significantly impacts retention of correct actions in ACLS performance months after training. This study, while promising, warrants further investigation due to the small number of participants that completed the full protocol.

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2. McEvoy MD, 2008ASA Annual Meeting: A2121



S-126.**ESTABLISHMENT OF AN ECHOCARDIOGRAPHY EDUCATION PROGRAM IN AN ACADEMIC INSTITUTION FOR THE PURPOSE OF ECHOCARDIOGRAPHY GUIDED ANESTHESIA MANAGEMENT IN HIGH RISK PATIENTS****AUTHORS:** T. R. Brakke¹, C. Montzingo², S. Shillcutt², S. Ellis²;**AFFILIATION:** ¹Anesthesiology, University of Nebraska Medical Center, Omaha, NE, ²University of Nebraska Medical Center, Omaha, NE.**INTRODUCTION:** An academic anesthesiology department with minimal experience in echocardiography established an education program to increase amplitude and ability of faculty anesthesiologists to provide transesophageal echocardiography in cardiac and intrathoracic procedures as well as high risk patients undergoing non cardiac or thoracic procedures.**METHODS:** We have developed a formal education program for faculty anesthesiologists to improve their skills and confidence in identifying high risk patients, monitoring patients intraoperatively, and guiding the anesthetic management based on the interpretation of the echocardiogram. The program began by selecting four faculty to complete a fellowship program at another academic institution, consisting of four weeks of study at that location as well as home study and completion of a standardized exam. Two more individuals were selected to complete two weeks of study to increase the number of trained faculty. These six physicians are the clinical educators for the remaining faculty.

The objectives of the course are to obtain confidence and experience placing a TEE probe, identify anatomy of the heart in a basic 12 view exam, objectively and subjectively assess contractile function, and review normal and abnormal structure and function of the heart valves. Participants are given an introduction to the assessment of diastolic function and the effect it has on fluid management intraoperatively. They are also able to perform basic hemodynamic calculations from TEE evaluation to better assess cardiac function.

The education program consists of six 1.5 hour lectures given weekly that review the assigned reading for that week. The participants have a six week time frame to obtain twenty of their own TEE exams on patients at their home institution. Those exams are interpreted by the participants and reviewed with a clinical educator. The participants are also expected to review twenty echoes on a website from the original training location and fill out a report online for each of those studies during the six week course. Those studies provide instant feedback and grade the participant as they finish their interpretations. The clinical educators are available to the students and provide them with feedback as well as assess the students progress throughout the course.

The lecture series, practical experience, and the graded exams are important tools to improve skills and meet the objectives of the program.

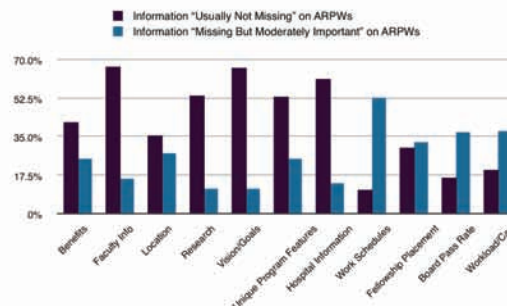
DISCUSSION: The microfellowship echocardiography program established at our institution has improved patient care by increasing monitoring in rescue situations, guiding fluid management, and increased TEE use in high risk noncardiac patients. It has increased our number of echocardiography studies twenty five times in the past year, and has provided basic echocardiography education to sixteen physicians, increasing the number of echo-trained physicians to 78.5% of faculty.**S-127.****WHAT DO APPLICANTS THINK OF ANESTHESIA RESIDENCY PROGRAM WEB SITES?****AUTHORS:** L. Chu¹, D. Lowe², A. Macario¹;**AFFILIATION:** ¹Stanford University, Stanford, CA,²Anesthesiology, University of Southern California, Los Angeles, CA.**INTRODUCTION:** The National Residency Matching Program (NRMP) and the Electronic Residency Application Service (ERAS) utilize internet-based tools to enable applicants to manage their residency applications. However, little is known about applicants' use of anesthesia residency program websites (ARPWs) as an information resource during the residency application process. There is also a dearth of evidence to guide development of high quality ARPWs. The purpose of this study was to survey applicants to anesthesia residency to 1) determine how ARPWs are used in the application process, 2) determine the type of information applicants seek to find online, and 3) identify characteristics important in high quality ARPWs.**METHODS:** We conducted a cross-sectional survey of all 572 applicants to the Stanford Anesthesia residency program in 2007. Human subjects approval was obtained. The survey was completed by applicants from June 1 to July 24, 2008. Participants were invited by email to submit the survey anonymously using an online survey administration program. Non-responders were sent a second and third invitation to participate.**RESULTS:** Of the 572 requests, 210 surveys were completed. Ninety-eight percent of responders used the ARPW during the application process. Approximately one-third of applicants rated information provided on department websites as "very important" in their decision to apply to a given program, and 42% found the website useful when preparing for interviews. Rank-list decisions were most influenced by impressions formed during the interview experience (72%), and personal communications with faculty, residents and staff (56%). However, 40% rated the website information as "important" in their final rank decisions. Deemed as most important on ARPWs were: vision/goals (66%), hospital information (61%), research (54%), unique program features (53%), residency benefits (42%), and geographic location (36%). Many applicants noted that information about work schedules (53%), workload/cap (38%), board pass rate (37%), and career fellowship placement (33%) were "missing but moderately important." (Figure 1) In general, the majority of applicants stated that a minority of ARPWs provided adequate quality in content, design, and overall experience (42%). Forty-four percent of applicants agreed that rich video multimedia content provides information about a program that is otherwise difficult to convey through text or photos.**DISCUSSION:** These results suggest that ARPWs are widely used by applicants and influence the application and rank process. However, the majority of websites can be improved to better meet the needs of these residency applicants. More research is required to determine optimal content, design, and overall experience for ARPWs.

Figure 1. Information that residency applicants sought online.

S-128.

ANESTHESIOLOGY RESIDENT PERSONALITY TYPE CORRELATES WITH FACULTY GLOBAL ASSESSMENT OF RESIDENT PERFORMANCE

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INTRODUCTION: People tend to develop behaviors, skills and attitudes associated with their underlying personality type (Jung and Myers) (1). Faculty global evaluation of resident's performance should be based on the resident's knowledge, skill and attitude. However, the resident's underlying psychological type may be a factor in this evaluation.

METHODS: Following IRB approval, all residents in the Department of Anesthesiology were requested to participate in this study. Residents were administered the Meyers-Briggs Type Inventory (MBTI) and their personality preference type scored (www.paladinexec.com).

Preference type is based on a four-letter designation. The way the resident prefers to get energy or focus their attention; Extrovert [E] or Introvert [I]. The way they prefer to take in information; Sensing [S] or Intuition [N]. The way they prefer to make decisions; Thinking [T] or Feeling [F]. How they deal with the outer world; Judging [J] or Perceiving [P]. Senior Faculty (n=7) then provided a global assessment of performance (GAP) for each resident scored on a four-point Likert Scale (1 = Top Quartile, 4 = Bottom Quartile). The GAP score was based on knowledge, skills, and attitude of each resident as compared to all residents currently in the training program. Utilizing Statistical Analysis Software (SAS, Cary, NC), resident MBTI preference were then compared with the average of the faculty GAP score (T-Test and ANOVA with bonferroni criteria).

RESULTS: Out of 46 eligible residents, 36 (78%) chose to participate. All 36 residents completed the MBTI and had GAP scores. The mean GAP score was 2.23 (S.D.= 0.70), better for Extroverts [E] vs Introverts [I] (p=.0048) and for Sensing [S] vs Intuition [N] (p=0.017) (Table). An association between the two letter temperament (S/N and T/F) and GAP score was also observed (p=.0027). The average GAP score was better for the SF than NF temperament (p=.0016). There was no statistical association between T/F or J/P and GAP score.

MBTI Type	Number	GAP (mean)	p-value
Introvert (I)	15	2.25	I vs E
Extrovert (E)	21	1.69	0.0048
Sensing (S)	31	1.88	S vs N
Intuition (N)	5	2.15	0.0117
Sensor-Feeling (SF)	7	1.61	SF vs NF
Intuition-Feeling (NF)	3	3.29	0.0016

DISCUSSION: Anesthesiology residents that prefer extroversion [E] and sensing [S] were scored better on global performance evaluation. When physicians have been categorized by specialty and the two-letter temperament (2), anesthesiologists were more likely to be SF or ST. Career interests and differences in learning styles have been linked with psychological type (1,3). Though each preference has effects on learning styles, the most important difference according to Myers is the way the learner takes in information; between sensing [S] and intuition [N] (1). Knowing and understanding the personality types of residents in a training program might allow faculty to design more appropriate learning experiences and evaluation methods.

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S-129.

EFFICACY AND SAFETY OF BOUGIE-GUIDED ILMA FOR BLIND ENDOTRACHEAL INTUBATION USING CONVENTIONAL TUBES IN PATIENTS WITH NORMAL AIRWAY: A COMPARATIVE CONTROLLED STUDY

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INTRODUCTION: Several clinical studies have shown that adequate ventilation and blind tracheal intubation could be achieved in most cases with the intubating laryngeal mask airway (ILMA) ¹ by using Fastrach™ silicone wire-reinforced tube (FTST) ². Some authors advocated the use of polyvinyl chloride tube (PVCT) successfully although it proved to exert forces and pressures seven to ten times higher than silicon tubes ³. It can be hypothesized that by introducing gum elastic bougie (GEB) via ILMA, confirmation of blind endotracheal positioning would be relied on tracheal rings sensation and distal hold up sign. Simply enough, ILMA can be removed and a conventional PVCT will be easily railroaded over GEB. This controlled comparative study was therefore prospectively designed to use GEB as an introducer into the trachea via ILMA and to evaluate the safety, usefulness, and success rate of such technique when followed by PVCT blind intubation over GEB.

METHODS: Patients were randomly assigned to equal-sized groups (n = 30) for blind endotracheal intubation via ILMA using FTST in the control (ILMA-FTST) group and GEB guided ILMA for blind endotracheal intubation using conventional PVCT in the study (ILMA-GEB-PVCT) group. After induction of anesthesia with fentanyl, lidocaine, propofol and atracurium, direct laryngoscopy grade I and II were only included in this study. ILMA was inserted and after confirmation of adequate ventilation, FTST intubation was performed in the control group while GEB tracheal introduction in the study group relied on tracheal ring sensation and hold up sign. After removal of ILMA, PVCT was railroaded over GEB. In both groups, correct position of the ETT was predicted by using air aspiration test and confirmed with capnography.

RESULTS: Successful endotracheal advancement of FTST and GEB via ILMA was comparable between groups in first (66.7% versus 80%), second (40% versus 66.7%) and third (50% versus 50%) attempts. The total attempts status (endotracheal, esophageal, unable to bypass ILMA) was (58.7, 15.2, 26.1 % respectively) in the control group and (76.3, 21.1, 2.6 % respectively) in the study group.

DISCUSSION: This study demonstrates usefulness, efficacy, and safety of using GEB as an intermediate transacting intubating device between ILMA insertion and blind endotracheal PVCT intubation. This technique can prove its effectiveness for managing patients with predicted or unpredicted difficult intubation with the necessity of fiberoptic bronchoscope availability as a rescue device. GEB-ILMA-PVCT technique can be used in training junior staff for the usage of ILMA as ventilatory aid; and GEB as an effective intubator, in conditions with cannot ventilate; cannot intubate.

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S-130.**ANESTHESIA RESIDENTS' PERCEPTIONS OF CULTURAL COMPETENCY TRAINING****AUTHORS:** L. W. Chinn¹, N. R. Chinn², M. Davidson², K. Louis²;**AFFILIATION:** ¹Anesthesia, UMDNJ, Newark, NJ, ²UMDNJ, Newark, NJ.

INTRODUCTION: Cultural competency is defined as a set of behaviors, attitudes, and culture within a business or operation of a system that takes into account the person's cultural background, cultural beliefs, and their values and incorporates it into the way health care is delivered to that individual(1). The purpose of this project is to analyze the perception of anesthesia residents as it pertains to how cultural competency is taught, using an educational module for learning and self assessment.

METHODS: Following institutional review board approval, 26 residents in the Anesthesiology program were given a pre-examination to determine their knowledge on various alternative treatment options and folk beliefs of different cultures in their medical community. Residents' perceptions about their knowledge of both cultural competency and the various methods of teaching cultural competency in a formal curriculum were also assessed with a pre-survey. Residents were given a printed set of cultural competency modules created for self study. Seven days were allowed for residents to study the material. Residents were then asked to complete a post-examination and post-survey to assess their knowledge and perception of the curriculum respectively.

RESULTS: Residents on average correctly answered 33% of the knowledge questions on the pre-examination which improved to 56% on the post examination. There were no significant differences in the answers to the survey questions based on ethnicity, age, sex, or marital status. Six pre-survey questions were repeated on the post survey. Comparison of pre and post-survey responses revealed no significant differences in resident responses for five out of the six repeated questions. The percentage of residents who feel that they use culture specific treatment approaches significantly doubled from 16% pre-survey to 32% post survey. Furthermore 48% of the residents felt the modules are useful for clinical practice. Finally, 60% felt that the information contained in the module is valid.

DISCUSSION: Resident demographic background plays little or no role in how cultural competency is learned. The significant difference observed in the question "you use cultural specific treatment approaches often" may be attributed to residents becoming more aware of their own practices since the residents had only seven days to read the modules and answer the post survey. Despite residents remaining largely neutral on questions related to cultural competency and stereotypes, most residents (60%) felt that cultural competence training is a useful tool. This suggests that regardless of how cultural competency training makes people feel individually, residents recognized its validity in helping physicians deliver quality culturally competent health care.

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S-131.**WOULD A 5-MINUTE ABBREVIATED COGNITIVE TEST DETERMINE COGNITIVE RECOVERY POSTOPERATIVELY? A PILOT STUDY****AUTHORS:** F. Chung¹, E. Farcas², J. Stygal³, S. Newman³, D. Wilkinson⁴, PQRS Group⁵;**AFFILIATION:** ¹Anesthesia, University Health Network, Toronto, ON, Canada, ²University Health Network, Toronto, ON, Canada, ³University College of London Medical School, London, United Kingdom, ⁴St. Bartholomew's Hospital, London, United Kingdom, ⁵PQRS Group, PQRS Group, ON, Canada.

INTRODUCTION: The quality of recovery is very important after anesthesia and surgery, especially cognitive recovery. Most of the psychomotor and cognitive tests are complicated, time consuming and impractical. Five abbreviated cognitive tests were chosen by a group of anesthesiologists, neuropsychologist and statistician with special interest in the quality of recovery after anesthesia (*Postoperative quality of recovery scale PQRS group*). The objective of this study was to determine whether it is feasible to use the 5-minute short form cognitive test postoperatively and to evaluate the degree of cognitive recovery in patients after anesthesia in the postoperative period.

METHODS: REB approval and consents were obtained from inpatient and ambulatory surgical patients. The cognitive tests were 1. Orientation to name, place and date of birth; 2. Digits forward; 3. Digits backward (testing sequential memory); 4. Word recall repeating a list of words (testing verbal memory); 5. Word association: Generating words beginning with a letter (testing executive function frontal lobe). Patients were assessed by a research assistant 1-2 hours before surgery, 15, 40 min after the end of anesthesia, 1 day and 3 days after surgery. Demographic data were collected. The baseline score before surgery was considered the normal score for each patient. The difference of the score at the different time interval from the baseline score was calculated. The frequency and the percentage of patients returning to preoperative baseline score at the different time intervals postoperatively were calculated.

RESULTS: 217 patients consented to the study. The demographic table is shown in table 1.

Table 1. Patient Demographics N=217

	Mean (sd)	
Age (yrs)	47.9 (14)	
Duration (mins)	94.3 (64)	
	Frequency (n)	Percent
Male:Female	87:130	40:60
ASA status		
1	58	27.2
2	111	52.1
3	43	20.2
4	1	0.5
Inpatient	69	31

The frequency and percentage of patients returning to preoperative baseline score at the different postoperative time intervals are shown in Table 2.

Table 2. No. and percentage of patients returning to preoperative normal baseline at different time intervals

	15 min n=217	40 min n=214	1 day n=196	3 day n=161
	n (%)	n (%)	n (%)	n (%)
Date, name, place	68 (31.3)	176 (82.2)	196 (100)	161 (100)
Digits forward	13 (6.0)	61 (28.5)	129 (65.8)	107 (66.5)
Digits backward	15 (6.9)	47 (22.0)	102 (52.0)	75 (46.6)
Word list	3 (1.4)	31 (14.5)	44 (22.4)	27 (23.0)
Word generation	1 (0.5)	13 (6.1)	21 (10.7)	18 (11.3)

CONCLUSIONS: The abbreviated short form 5-minute cognitive tests are practical and easy to use in the postoperative period. Using the abbreviated cognitive tests, a large percentage of patients did not return to their normal preoperative baseline at 1 and 3 days after surgery.

S-132.

COMPUTERIZED PHYSICIAN ORDER ENTRY; NOT A FAIL-SAFE SYSTEM

AUTHORS: S. L. Oswald;

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INTRODUCTION: Anesthesiologists are critically aware that medication errors are a major cause of preventable adverse outcomes. Such errors represent a compelling problem in a variety of settings from the outpatient clinic to the post anesthesia care unit. In an attempt to eliminate this problem, computerized physician order entry (CPOE) systems have been implemented by many hospitals and clinics. However, these systems are not foolproof. As evidence, we present a case of human factor driven errors resulting in the near death of an infant prescribed post-procedure pain medication.

CASE REPORT: A two month old infant presented for routine immunizations. A physician intended to prescribe acetaminophen for post-immunization discomfort using CPOE. The patient's grandmother reported to the clinic the following day that the infant had been lethargic for the past 9 hours after receiving two doses of the prescribed medication. Clinic personnel instructed her to call 911 and the infant was rushed to the emergency room (ER), unarousable and hypopneic. Further investigation of the baby's electronic health record revealed that acetaminophen with codeine instead of acetaminophen alone had been prescribed.

The root cause analysis revealed multiple breakdowns in the prescribing process. Using the CPOE system, the prescriber usually identifies formulary medications by typing the first few letters of the medication in a "search" field. Entering "aceta" produces a drop-down menu of the first 50 medications beginning with those letters. In this formulary, the "aceta" list does not include acetaminophen with codeine. However, in this case, the physician inadvertently typed "acetam," producing a list including acetaminophen with codeine, the medication accidentally chosen.

DISCUSSION: Although computerized order entry systems reportedly reduce medication errors by 80%, they do not prevent all forms of human error and are less effective in reducing error in the pediatric population. Potential solutions to decrease computerized prescription errors include tall man letter alerts for high-risk medications or any drug combination that includes a high-risk medication. Alternatively, the formulary could be rewritten for combination medications such that the name of the high-risk medication appears first. Computerized order systems do not eliminate the human factor interface and ordering systems must consider the human element in their design. As anesthesiologists, we must never underestimate the ability of the human mind to overcome a computer's "error-proof" processes as we move toward automated anesthesia record-keeping systems. Shulman stated while "clinicians embrace CPOE, they should not make the assumption that CPOE removes errors; in fact different types of errors emerge."

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S-133.

MEDICATION ERROR IN A PATIENT WITH SPINAL MUSCULAR ATROPHY

AUTHORS: M. Flanigan¹, J. D. Colson², C. Payne²;

AFFILIATION: ¹Anesthesiology, West Virginia University, Morgantown, WV, ²West Virginia University, Morgantown, WV.

INTRODUCTION: Medication errors continue to be a source of preventable morbidity and mortality. The anesthetic management of a patient with spinal muscular atrophy (SMA) is complicated by local anesthetic toxicity and a difficult airway.

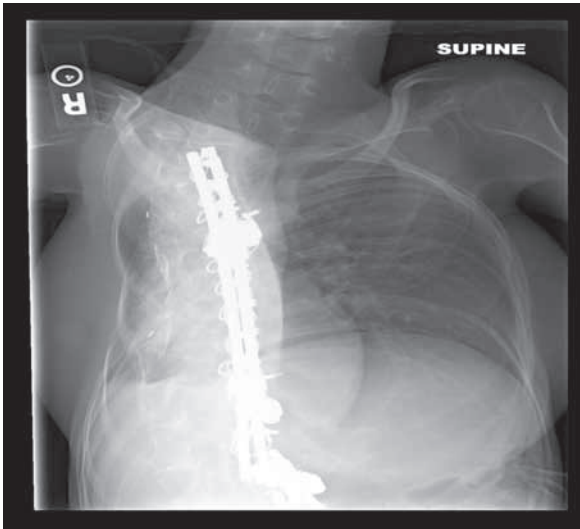
METHODS: A 19-year-old primigravida presented for medically-recommended pregnancy termination under paracervical block plus monitored anesthesia care (MAC). She had subtype II SMA with typical severe kyphoscoliosis, restrictive lung disease and marked contractures in all extremities. She was 16 kilograms and had a Mallampati class III airway, with a high arched palate, and a cervical spine fixed in levorotary extension. After antacid prophylaxis, standard anesthetic monitors were placed and supplemental oxygen provided. Sedation was by intravenous midazolam and propofol infusion while the surgeon performed a paracervical block. Spontaneous respirations were augmented by mask. Surgery ended and the infusion discontinued. She appeared to be unresponsive with irregular respirations. Generalized tonic-clonic movement manifested, which subsided after additional propofol and lorazepam, however the patient remained obtunded. Oxygen saturation remained over 97% but hypercarbia was present.

RESULT: Upon inquiry, it was found that 20 mls of 1% lidocaine plain was used. Intubation by direct laryngoscopy failed, as did attempted fiberoptic intubation. Controlled ventilation was possible via a #2 laryngeal mask airway. For continued ventilatory support, a cricothyrotomy was performed, and she was transferred to the surgical intensive care unit. Within hours, she awoke and weaned from the ventilator. The cricothyrotomy was decannulated at 72 hours, and she was discharged the following day.

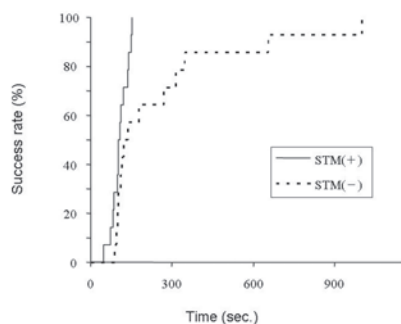
DISCUSSION: SMA is a neurologic disease characterized by muscle wasting, weakness, skeletal deformities, and contractures. Kyphoscoliosis and restrictive lung disease are frequent sequelae. Pregnancy in SMA patients can be complicated by muscle weakness and respiratory compromise. 1 To avoid the risks of general anesthesia, a paracervical block and MAC was planned. The paracervical block technique provides anesthesia to the perineum. 2 Injection of an excessive dose of local anesthetic, into a highly vascularized site resulted in a toxic drug level. 3 The patient experienced seizure activity without hemodynamic instability. The postictal state required airway security for protection and support. Endotracheal intubation was unsuccessful by direct laryngoscopy and fiberoscopy. A cricothyrotomy was performed to provide a definitive airway. 4 The original anesthetic plan was complicated by a medication error. This necessitated an urgent diversion from the planned anesthetic. Better communication between the perioperative teams may well have averted this complication. Establishing a protocol where the local anesthetic and dosing are confirmed would serve to prevent the occurrence of such errors.

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Equipment & Monitoring

S-134.**NOVEL SKIN-TRACTION METHOD IS EFFECTIVE FOR REAL-TIME ULTRASOUND-GUIDED INTERNAL JUGULAR VEIN CATHETERIZATION IN INFANTS AND NEONATES WEIGHING LESS THAN 5 KG****AUTHORS:** M. Morita¹, H. Sasano², T. Azami², S. Ito², K. Sobue²;**AFFILIATION:** ¹Department of Anesthesiology and Medical Crisis Management, Nagoya City University Graduate School of Medical Sciences, Nagoya City, Aichi, Japan, ²Nagoya City University Graduate School of Medical Sciences, Nagoya City, Aichi, Japan.**INTRODUCTION:** We have developed a novel skin-traction method (STM), by which the point where the skin is punctured over the internal jugular vein (IJV) is stretched upward with several pieces of surgical tape in the cephalad and caudad directions to facilitate IJV catheterization. In this study we examined not only whether STM increases the cross-sectional area and diameter of the IJV, but whether it also facilitates real-time ultrasound-guided IJV catheterization in infants and neonates weighing less than 5 kg with congenital heart disease.**METHODS:** This was a prospective study conducted from December 2006 to June 2008. We enrolled 28 consecutive cases. The patients were randomly assigned to a group to which STM was applied (STM group) or a group to which it was not applied (non-STM group). Before catheterization, the cross-sectional area and diameter of the right IJV in a flat position and 10° Trendelenburg position with and without STM were measured. Then, we catheterized IJV and determined durations from first skin puncture to the following: A) first blood back flow, B) insertion of guidewire, and C) insertion of catheter. The number of punctures, success rate, complications, and rate of compression of IJV when advancing the needle were also examined.**RESULTS:** STM significantly increased cross-sectional area of the IJV in a flat position and anteroposterior diameter in both positions. The time until insertion of catheter was significantly shorter in the STM group than in the non-STM group (165.9 ± 98.4 sec. vs. 324.6 ± 310.4 sec., $P=0.044$) (Figure 1). The time until insertion of guidewire was also much shorter in the STM group (33.6 ± 22.6 sec. vs. 178.7 ± 284.6 sec., $P=0.074$). The rate of compression of IJV when advancing the needle was lower in the STM group.**DISCUSSION:** The mechanism of stretching the IJV in the anteroposterior direction with STM appears to involve lifting the skin over the IJV. STM stretches not only the IJV but also tissue such as muscle over the IJV, releasing pressure on the IJV. The strength with which skin is stretched upward appears to prevent IJV compression when advancing the needle. In conclusion, with real-time ultrasound guidance, STM shortened the time for IJV catheterization significantly, while increasing cross-sectional area and anteroposterior diameter, and preventing vein compression when advancing the needle. STM is a novel method to facilitate IJV catheterization in infants and neonates weighing less than 5 kg.**S-135.****TRANSESOPHAGEAL ECHOCARDIOGRAPHY IN NEONATES UNDERGOING CARDIAC AND VASCULAR SURGERY****AUTHORS:** V. Collange¹, C. Védérinne², R. Hénaine², J. Lehot², M. Cannesson²;**AFFILIATION:** ¹Anesthesiology and Intensive Care, Louis Pradel Hospital, Lyon, France, ²Louis Pradel Hospital, Lyon, France.**INTRODUCTION:** During pediatric cardiac surgery transesophageal echocardiography (TEE) is rarely used because TEE probe insertion and manipulation can induce hemodynamic and respiratory compromise, especially in neonates. Recently, the intraoperative use of a miniaturized transesophageal echocardiography transducer has been described in a neonate undergoing a Norwood procedure for hypoplastic left heart syndrome (HLHS) (*Circulation* 2008;117:702-3). In the present study, we describe our experience with the intraoperative use of this miniaturized transducer in neonates weighing less than 3.5 Kg and undergoing cardiac and vascular surgery.**METHODS:** We studied all neonates weighing less than 3.5 Kg referred to our institution for cardiac or vascular surgery from November 2007. We used a new phased-array intracardiac echocardiographic catheter (AcuNav, Acuson-Siemens Corp., Mountain View, CA, USA). After lubrication, the catheter was carefully inserted (naso-esophageal introduction) following induction of anesthesia and nasotracheal intubation. The transducer has a 64-element phased-array oriented in a longitudinal plan with multiple frequencies from 5.5 to 10 MHz with maximal tissue penetration of 12 cm and was connected to a commercially available echocardiograph (CV 70, Acuson-Siemens Corp., Mountain View, CA, USA). Data obtained with this transducer were compared with conventional transthoracic echocardiographic images obtained in the postoperative period.**RESULTS:** Twenty six neonates presenting with the full panel of congenital heart disease requiring cardiac surgery during neonatal period (from aortic coarctation to HLHS) were imaged with this miniaturized transducer. Mean age was 10 ± 15 days, and mean weight was 3.2 ± 0.2 Kgs. Naso-esophageal insertion of the transducer was easy and lasted less than 10 seconds in all neonates.

Two-dimensional images of the left atrium, right atrium, left ventricle, right ventricle, mitral valve, aortic valve, pulmonary valve, tricuspid valve and aorta were recorded for each patient when that structure existed.

Visual estimation of left and right ventricular systolic function was assessable in all patients. Pulsed Doppler mitral flow, pulsed Doppler pulmonary venous flow and the atrial septum with residual defect or patent foramen ovale were obtained for each patient. In four cases, intraoperative examination revealed residual ventricular septal defect, in three cases it revealed a mitral valve insufficiency and in two cases it revealed an aortic valve insufficiency. This data were confirmed by postoperative transthoracic echocardiography.

DISCUSSION: These data show that this miniaturized transducer can be used easily in neonates undergoing cardiac surgery. A wide range of both functional and anatomic informations can be assessed with color and pulsed Doppler with potential clinical applications.

S-136.

A COMPARISON OF NONINVASIVE AND INVASIVE ARTERIAL BLOOD PRESSURE AS MEASURED BY THE PHILIPS MP70 MONITOR

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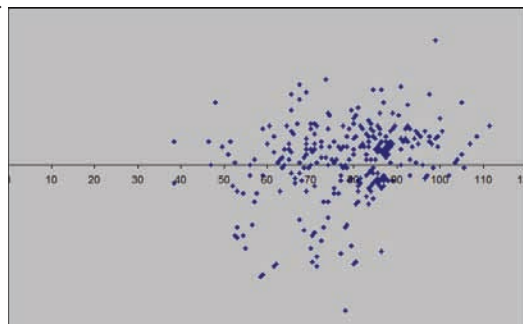
INTRODUCTION: Arterial blood pressure monitoring is part of the standard of care for anesthesia and perioperative management. Arterial blood pressure can be measured by invasive and noninvasive means. Invasive arterial blood pressure monitoring is the gold standard against which other methods of monitoring are compared. Inaccurate measurements of arterial blood pressure can lead to inappropriate interventions. In this study, simultaneous measurements of noninvasive and invasive arterial blood pressure using the Philips MP70 monitor are compared for accuracy.

METHODS: 305 paired measurements were obtained from eleven adult patients on the neurosurgical service at Stanford University Medical Center. IRB approval was obtained for the study. Blood pressure measurements were taken while the patients were under general anesthesia. Appropriately sized and placed blood pressure cuffs were used for noninvasive measurements. Invasive blood pressures were obtained via arterial cannulation on the contralateral arm with a 20 gauge arrowhead catheter. Transducers were calibrated with the Biotek DPM-1B calibrator and zeroed with the transducer at the level of the heart. Noninvasive measurements were cycled an average of every 15 minutes during the case. Bland-Altman plots were created to assess agreement between the two measurements systems.

RESULTS: Arterial blood pressures measured noninvasively correlated with invasive measurements yielding Pearson r values of 0.68, 0.66 and 0.48 for systolic (figure 1,) diastolic and mean pressures respectively ($P < 0.01$.) Mean differences with 95% confidence intervals were -3.7 mmHg (-17.3 to 9.9,) -2.4 mmHg (-12.6 to 7.8,) and 1.7 mmHg (-13.2 to 16.6,) for systolic, diastolic and mean pressures respectively.

DISCUSSION: The statistically significant poor correlation between the noninvasive and invasive measurements of arterial blood pressure with the Philips monitor indicate that there may be inaccuracies in the algorithm used by the monitor to calculate blood pressure values based on incoming data. The mean arterial pressures had a Pearson's correlation coefficient of 0.48. The noninvasive mean arterial pressure varied from the invasive measurement by 1.7 mmHg +/- 14.9 mmHg for 95% of measurements. For the systolic pressures, the Pearson's correlation coefficient was 0.68. The mean difference of -3.7 mmHg, indicates that the noninvasive systolic pressure was on average 3.7 mmHg higher than the invasive systolic pressure, with a standard deviation of 13.6 mmHg for 95% of measurements. For the diastolic measurements the Pearson's coefficient was 0.66. The mean difference of -2.4 mmHg indicates that the noninvasive pressure was on average 2.4 mmHg higher than the arterial pressure with a standard deviation of 10.2 mmHg. Given the critical role of arterial blood pressure monitoring in anesthetic management, these discrepancies in noninvasive and invasive blood pressure measurements indicate the need for further analysis of the Philips MP70 monitor.

Figure 1. Bland-Altman plot of mean arterial pressures



S-137.

ANESTHESIOLOGISTS LACK OF VIGILANCE AND ELECTRONIC MEDICAL RECORDS

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INTRODUCTION: Records produced by Anesthesia Information Management Systems (AIMS) should reflect the American Society of Anesthesia (ASA) Standards for Basic Monitoring [1]. Some may consider such gaps in monitoring to indicate lessened vigilance by the anesthesiologist [2]. Gaps in intraoperative monitoring have been described [3]. We hypothesized that the missing data would be in non-critical periods of the intraoperative records.

METHODS: We reviewed the intraoperative records of all patients undergoing surgery between 12/06 and 5/08. We collected intraoperative electronic records on over 30,000 patients. A blood pressure "Gap" was defined as no blood pressure measurement (Non-Invasive or Invasive Blood Pressure) in a 10 minute period. Each intraoperative record was divided in the following periods: Patient In-Room (In); First Time Out (TO); Induction (I); Surgery Start (SS); Surgery End (SE); Emergence (E); Patient Out of Room (Out). Each "Gap" was then assigned to the time period where it occurred.

RESULTS: There were 30,986 cases reviewed during this period. Of these intraoperative records, 38.6% (11,957) had at least 1 gap in blood pressure monitoring for 10 minutes or more. These "Gaps" occurred in the following periods: In-TO: 29.7% (3,546); TO-I: 12.6% (1,506); I-SS: 10.8% (1,287); SS-SE: 18.7% (2,236); SE-E: 12.4% (1,484); and E-Out: 15.9% (1,898).

DISCUSSION: Lack of vigilance, even with the use of electronic medical records, allows for the appearance of "gaps" in physiologic monitoring. We found that most gaps occurred when the patient was entering/leaving the room, and this could be explained by the time that the provider takes to start the records or stop them. But it is of concern that 18.7% of the gaps (>10min) in blood pressure are during the actual case. Monitors might be started but not set to cycle, creating gaps to appear if not checked continuously. We plan to further study these events in order to determine possible etiologies, and possible solutions (computer generated reminders or alarms) that trigger the anesthesiologist to recognize and prevent the occurrence of monitoring gaps.

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Where Gaps Occur

Period		Total	%
Patient In-Room - 1st Time Out	In-TO	3,546	29.7
1st Time Out - Induction	TO-I	1,506	12.6
Induction - Surgery Start	I-SS	1,287	10.8
Surgery Start - Surgery End	SS-SE	2,236	18.7
Surgery End - Emergence	SE-E	1,484	12.4
Emergence - Patient Out of Room	E-Out	1,898	15.9
Total Cases		11,957	100.0

S-138.

INTRODUCTION AND EVALUATION OF A HEAD-MOUNT DISPLAY IN ULTRASOUND-GUIDED NERVE BLOCKS

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INTRODUCTION: During conventional ultrasound (US) -guided nerve blocks, US images were displayed away from the interventional site, leading practitioners to either divide their attention between the patient and the display screen, or focus all their attention on the display. Therefore, both smooth good hand-eye coordination and US imagining skills to guide the block needle to the target tissue were difficult for the trainees to perform. Meanwhile a head-mount display (HMD), recently available commercially, was aimed at providing a portable, inexpensive means of visual information. Thus, we made a brief introduction to the HMD and a simulation study to determine whether the HMD would improve visual circumstances in US-guided blocks.

EQUIPMENTS: The devices consisted of: (1) HMD, Data Glass 3A® (SIMAZU Inc., JP); (2) US system, S-Nerve® (Sonosite Inc., USA) with high frequency liner probe; (3) US phantom, Blue Phantom® (Advanced Medical Technologies, USA); and (4) echogenic needle, Insulated block needle Type CCR® (Hakko, JP). The HMD was connected to the VGA video port of the US system.

METHODS: Ten anesthesiologists with least experiences in US-guided blocks were enrolled in this study and randomly divided to two groups: HMD group (n=5); and US display (USD) group (n=5). In USD group, the display of the US system was placed at 50 cm above the phantom. After the needle was placed in the phantom at an angle of 30 degrees relative to the US probe surface, inline US scans were performed. One independent investigator measured the time visualizing the entire needle in-plane on the US display. A comparison between two groups was performed with a Wilcoxon's signed rank test.

RESULTS: There was no statistically significant difference between groups with respect to the scanning time. Wide inter- and intra-individual variations were found in both groups. In HMD group, the practitioners had no occasion to look away from the interventional site, and thereby they could focus all their attention on the block procedures. On the other hand, in USD group, the correct alignment between the US probe and the needle was missed whenever each practitioner turned to look into the US device display.

DISCUSSION: Given the time for trainees visualizing the entire needle in-plane on the US display, significant superiority of the HMD was not demonstrated in this simulation study. In HMD group, however, even the less-experienced practitioners were found to focus all their attention on the block procedures with good hand-eye coordination at least as far as the observations of their procedures. In conclusion, the HMD will have possibilities to improve overall clinical outcomes in US-guided nerve blocks, particularly for well-experienced practitioners. Further study was needed to determine potential clinical implications of the HMD in US-guided nerve blocks.

S-139.

A COMPARATIVE STUDY OF TRACHEAL INTUBATION CHARACTERISTICS USING MACINTOSH OR AIRTRAQ LARYNGOSCOPE

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INTRODUCTION: Airtraq™ (AOL) Optical Laryngoscope [King Systems Corporation] is a newly introduced intubation aid. Till date there are no detailed comparative studies on the tracheal intubation characteristics of AOL as compared to conventional Macintosh Laryngoscope (ML). This study compared the laryngoscopy & intubation time [LIT], Percentage of Glottic Opening score [POGO] and postoperative sore throat [PST] when using AOL or ML.

METHODS: Following approval by IRB, 20 ASA I & II non-obese patients of either sex [age range 20-50 years] undergoing general anesthesia for elective surgery [non-malignant, non-head & neck surgery] were included. Patients with predicted difficult laryngoscopy & intubation were not be included. After informed consent, patients were randomly divided into 2 groups on a random basis using Chit-in-a-box technique. Patients of Control Group [n = 10] were intubated using ML, while patients of Study Group [n = 10] were intubated using AOL.

Following a uniform premedication, anesthesia was induced with 1-2 µg/kg of fentanyl and 2 mg/kg of propofol. After adequate muscle relaxation with vecuronium bromide 0.1 mg/kg, all laryngoscopies and intubations were carried out by the same anesthetist with over one year experience with ML and more than 25 intubations with AOL. Laryngoscopy time was calculated from introduction to the removal of AOL or ML from the mouth. POGO scoring [100 = full glottic view, 0 = no portion of glottis visualized] was done by the attending laryngoscopist. Following successful intubation, patient received 60% N2O in O2 with isoflurane titrated to keep blood pressure \pm 20% of preoperative blood pressure. Postoperatively, sore throat was assessed by an independent observer blinded to the nature of laryngoscopy [AOL or ML]. Presence of an unpleasant sensation in the throat [which was not previously present] just prior to discharge from the recovery room [RR] and 24 hours later was recorded as evidence of PST.

Unpaired 't' test was used to compare LIT and POGO score while 'Z' test for proportions was used to analyze statistical significance of the incidence of PST

RESULTS: The LIT score has been significantly improved after with AOL compared to ML (14.4 ± 2.7 , 26.1 ± 3.6 sec, $P < 0.05$, t-test). No difference in the PST score was observed with ML and AOL ($P = 0.17$). There were significant ($P < 0.03$, two sample t-test) differences between POGO scores of the two Blades ML 70 ± 48 and AOL 100 ± 0 .

DISCUSSION: With limited number of patients in this study, the AOL compared well with ML in patients predicted to be normal intubation. The insertion of AOL was easy and faster with better visualization of the glottis with better POGO score. Thus AOL may be used routinely for teaching in normal cases and should be available for difficult intubation carts.

S-140.

THE IMPACT OF INSERTION SPEED ON THE ENDOTRACHEAL TUBE ADVANCEMENT WITH THE AIRWAY SCOPE

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INTRODUCTION: The Airway Scope (AWS) is a novel intubation device with some advantages to provide a high-quality view of the glottis. It, however, remains difficult for less experienced practitioners to place the endotracheal tube (ETT) in the trachea even though using AWS. The main difficulty will result from unexpected downward advancement of the ETT. Thus, this simulation study aimed to assess the downward advancement of the ETT from the standpoint of its insertion speed during AWS procedures.

EQUIPMENTS: Our experimental setup consisted of; the AWS, ETT of ID 7.0 mm (RUSCH Limited,GA); and a digital video camera (CASIO Computer Limited, Tokyo, Japan). A backboard was attached on the left side of the AWS blade. Perpendicularly to the optical axis of the AWS, a target line was drawn on the backboard at 2 cm ahead of the AWS blade tip, where the glottis would be approximately located in clinical practice of the AWS.

METHODS: The ETT, with its cuff deflated and lubricated, was advanced through the tube guiding channel of AWS at various speeds. In all of twenty trials, the ETT tip movement was captured on video and stored on a PC for later analysis. Insertion time (IT) was defined as the time needed to advance the ETT from the outlet of the tube guiding channel of AWS to the target line, while downward drift of the ETT (DD) was defined as the distance between the lower edge of the AWS blade and the upper aspect of the ETT tip along with the target line. Both IT and DD were measured on the video-clip using the image analysis software Image Pro-Plus (Version 5.1, Media Cybernetics, Silver Spring, MD). By using the simple linear regression analysis with Graphpad Prism 4.03 (GraphPad Software Inc., San Diego, CA), a mathematical model was obtained to represent the relationship between IT and DD.

RESULTS: The difference between maximum and minimum DD values was 8.4 mm. Accordingly, the slower insertion was positively associated with the downward advancement of ETT. DD was found to be significantly correlated with IT, based upon simple linear regression analysis ($r^2=0.89$).

DISCUSSION: Generally, less experienced anesthesiologists will tend to advance the ETT at a slower speed. As a result, unexpected downward advancement of the ETT will occur more often among them. In conclusion, given the lack of detailed data with a variety of ETTs, the direction of the ETT advancement will be associated with its insertion speed. The knowledge of these relationships is very informative for trainees and will successfully ensure a rapid intubation with AWS.

S-141.

THE EFFECT OF A PRE-INDUCTION DE-FASCICULATING DOSE OF MUSCLE RELAXANT ON THE BIS SCORE

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INTRODUCTION: A tremendous amount of attention has been devoted to decreasing the incidence of awareness under anesthesia because of the potentially harmful psychiatric effects that it can have on patients. One technique thought to limit the risk is monitoring of the patient's brain activity via a processed EEG during general anesthetics. The most widely used processed EEG monitor is the Bis monitor, however, the algorithm used to create the Bis "score" is proprietary so it is not possible for the practitioner to know what inputs effect the reading. Since EMG activity is also used in the algorithm, it is possible that a patient given a paralytic agent might have a falsely decreased score that would lead the practitioner to believe that the patient is deeply sedated when they are not. Previous work has shown that a large dose of a paralytic agent can cause a significant drop in the Bis reading¹. This study was undertaken to determine the effect of a small dose of a non-depolarizing muscle relaxant on the Bis score.

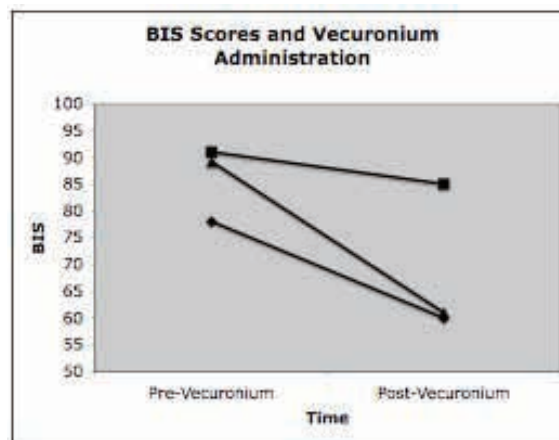
METHODS: After IRB approval three patients were consented to take part in this study as part of the larger BAGRECALL study of intraoperative awareness. A free-standing Bis Vista monitor (Aspect Medical) was used to gather the processed EEG data. Each patient was given a small dose of midazolam as a premedicant and when a stable Bis reading was achieved a defasciculating (.01mg/kg) dose of vecuronium was given three minutes prior to induction. The Bis readings before and after the defasciculating dose were recorded.

RESULTS: The Bis reading decreased in all three cases. See figure 1. The average decrease was 17.3. There were no respiratory or patient discomfort issues associated with the administration of the defasciculating dose of muscle relaxant.

DISCUSSION: These data suggest that even a small dose of a non-depolarizing muscle relaxant can have significant effects on the Bis reading. Thus, practitioners must be cognizant of the risk of lighter than expected levels of sedation when the Bis monitor is used in conjunction with even small doses of muscle relaxants.

REFERENCE: 1. Messner et al., Anest Analg 2003, 97:488-91.

Figure 1. The baseline BIS scores and those 3 minutes post administration of a 1/10 induction dose of vecuronium of three patients prior to induction.



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S-142.**ACCURACY OF THE EDWARDS FLOTRAC/VIGILEO CARDIAC OUTPUT ASSESSMENT SYSTEM: A META ANALYSIS****AUTHORS:** R. Poland¹, A. Peterson¹, G. R. Manecke²;**AFFILIATION:** ¹UCSD Medical Center, San Diego, CA,
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Recently Edwards Lifesciences, LLC, introduced the FloTrac/Vigileo, a system with which cardiac output (CO) can be assessed from the arterial pressure wave without the need for external calibration(1). Since then, numerous investigations of its “accuracy” (agreement with PAC) have been reported, with varying results. We hypothesized that a greater understanding of its performance would result from pooling the data from the available studies. We aimed to determine the clinical factors and scenarios affecting its agreement with PAC.

METHODS A Medline search was undertaken to find all prospective studies of FloTrac accuracy relative to intermittent thermodilution PAC in the peer-reviewed medical literature. Inclusion criteria included use of the Bland Altman analysis. Weighted averages of bias, precision, limits of agreement, and percentage error were calculated. The data was pooled for overall agreement, and was broken down for agreement intraoperatively (before/without CPB, after CPB) and in the ICU.

RESULTS 14 studies, with a total of 2800 datapoints were discovered and examined for agreement between Intermittent thermodilution cardiac output with PAC (ICO). Overall precision was 0.9 L/min, Bias=0.29 L/min, lower limit of agreement -1.47 L/min, and upper limit of agreement 2.05 L/min. The closest agreement was found in the operating room without use of CPB (precision=0.58 L/min, percentage error=30) and the least agreement was immediately after CPB (precision=1.09L/min, percentage error=48). A trend showing improved accuracy with later operating systems was noted (precision 0.8 L/min with v. 1.07 vs. 1.17 L/min with earlier versions).

Time	Bias	Precision	LLA	ULA	%Error
OR no CPB	0.23	0.58	-0.91	1.37	30
OR after CPB	0.34	1.02	-1.66	2.34	45
ICU	0.31	1.06	-1.77	2.39	38
Global	0.29	0.90	-1.47	2.05	34
Global v.1.07	0.17	0.80	-1.40	2.07	33

DISCUSSION The latest operating system of the FloTrac/Vigileo system generally shows acceptable agreement with ICO, with closest agreement in the operating room without CPB. Agreement is poor after CPB. This may be due to rapid thermal changes affecting PAC precision (2,3), as well as rapid changes in cardiac function and vascular tone.

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S-143.**NOVEL AIRWAY BYMIXER-FLOW MEASUREMENT OF VCO₂ AND VO₂ CAN DETECT ANAEROBIC THRESHOLD DURING EXERCISE****AUTHORS:** A. Rosenbaum¹, P. H. Breen²;**AFFILIATION:** ¹University of California-Irvine, Orange, CA,
²Anesthesiology, University of California-Irvine, Orange, CA.

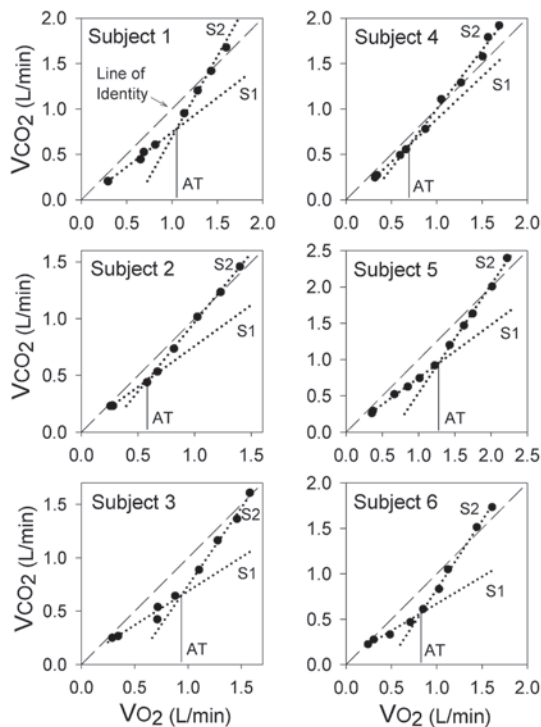
INTRODUCTION: During exercise testing, as workload increases, airway CO₂ elimination (VCO₂) and O₂ uptake (VO₂) increase (figure, slope of line S1= R=VCO₂/VO₂). At the anaerobic threshold (AT), the addition of anaerobic metabolism increases VCO₂ relative to VO₂ to increase the slope of line S2. Lower AT in patients may correlate with poorer outcome during surgery (1). We have previously developed the bymixer (2), an accurate, fast-response hydraulic gas mixing device, which underlies our bymixer-flow measurement of VCO₂ and VO₂ in the anesthesia circle circuit (3). In this study, we hypothesize that the bymixer-flow measurement can also detect AT during preoperative exercise studies.

METHODS: We have previously developed a bymixer-flow device for spontaneous ventilation (4). The inspiratory and expiratory arms were joined by a two-way non-rebreathing valve. A fast-response humidity sensor and pneumotachometer cuvette were placed between the valve and the mouth piece. The bymixer was attached to the expiratory arm. A breathing filter protected both the circuit and the bymixer from contamination. After IRB approval, airway VCO₂ and VO₂ were measured during stationary cycle exercise in 6 healthy volunteers. Exercise load increased by 25 watts every 1.5 min until exhaustion was reached. Lines S1 and S2 were determined by least squares linear regression. The AT was detected by the algebraic intersection of lines S1 and S2.

RESULTS: The figure displays the performance of each subject. Average (±SD) of S1 slope was 0.73±0.12 (coefficient of determination, R²=0.978±0.028). Once the AT was reached (VO₂ = 895±251 mL/min), S2 slope significantly increased (p<0.05) to 1.46±0.19 (R²=0.988±0.012). Each subject reached AT after 5-6 minutes. At maximal exercise (140-180 watts), VO₂ increased by 5-6 fold.

DISCUSSION: We have demonstrated that our new spontaneously-breathing bymixer-flow device can measure airway VO₂ and VCO₂ and detect AT during preoperative cycle ergometry exercise studies. Our relatively sedentary subjects reached AT at VO₂ values only 2.9 (±0.6) times greater than baseline VO₂. Our bymixer-flow measurement device is much less expensive and complicated than traditional exercise monitors and is the same technology that we use during anesthesia to measure VO₂ and VCO₂. We believe that our bymixer-flow device can assess exercise tolerance in patients preoperatively and determine their anesthesia risk (1). Further, we believe, during anesthesia and surgery, that lower AT (compared to the preoperative value) will first signal inadequate tissue perfusion (e.g. hypovolemia, cardiogenic shock), far earlier than measurement of anaerobic lactic acidosis by blood gas and pH analysis.

REFERENCES: 1. Chest 1999; 2: 355-62; 2. Anesthesiology 2004; 100: 1427-37; 3. Can J Anesth 2007; 54: 430-40; 4. Anesth Analg 2008; 106: 509-16. **Support:** NIH grant HL-42637 and UCI Clinical X grant.



S-144.

PUPILLARY DILATION AND FACIAL MICROGRIMACING DURING GENERAL ANESTHESIA AND SURGERY

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INTRODUCTION: Sensory stimulation may reach brain centers during anesthesia (1). Nociception during general anesthesia may be indicated by micro grimacing (autonomic pain signaling in the limbic system) and pupillary dilation (2). This study examined if micro grimacing was associated with pupillary dilation (brainstem arousal).

METHODS: 46 consented patients having general anesthesia for lower abdominal surgery were monitored with the "grimacing" algorithm of the FACE system (5 sec epochs of integrated voltages: GRIM (Ratio2) = [(corrugator - frontalis)+(orbicularis oculi-frontalis)] / [(2 X frontalis) + corrugator + orbicularis oculi] x100. Pupillometry (NeuroOptics) measures were obtained every 15 minutes and when GRIM >20 for >1 minute (operationally defined as "grimacing"). The resting pupil diameter was recorded automatically for each pupil. End-tidal gas concentrations and vital signs were recorded by an automatic record keeping system (CompuRecord). Data were integrated by coordinated time codes among the three systems, accurate to within 1 second. Following data collection, blinded raters (a) extracted episodes for pupil diameter measurements when GRIM was >20 and during prior, baseline epochs for that patient (Fig 1), and (b) removed FACE data artifacts from the datasets (e.g., during pupillometry when eyelids were manually opened).

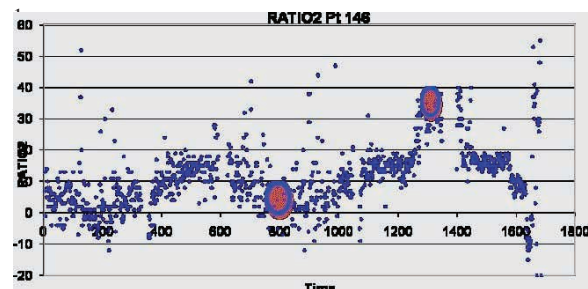
RESULTS: GRIM patients were more likely male and had lower pre op systolic and diastolic BP's (p<0.05) but all other pre op and intra op anesthetic variables did not differ between GRIM and NO GRIM patients (see Table 1).

Seventeen episodes of intra operative micro grimacing were identified from patients with complete data sets (Figure example shows NO GRIM Ratio2 baseline to left, GRIM Ratio2 >20 to right Blue circles show where pupillometry data were obtained for NO GRIM versus GRIM comparisons. Table 2 shows relationships among variables related to GRIM and NO GRIM episodes.

GRIM responses were accompanied by increased pupil size, averaging 0.18 mm (p= 0.03) larger during GRIM than in immediately prior NO GRIM baselines.

DISCUSSION: Within each patient, comparing instances before and during GRIM responses to surgical stimulation, pupil size dilated. As animal studies have shown using isolated brain and torso preparations, painful transmission into the brainstem and limbic system continues when movement is abolished with 1.0-1.3 MAC torso anesthesia (1). The present study sought evidence that facial muscle micro-grimacing, originating in the limbic system and basal ganglia, would necessarily be accompanied by lower center brainstem activation (pupillary dilation) responding to afferent bombardment from surgical stimulation.

REFERENCES:



Pre and intra operative predictors of GRIM responses			
Mean and (St. Dev.)	GRIM	NO GRIM	p. =
Age (yrs)	47.4 (10.0)	45.4 (13.8)	n.s.
Gender (% female)	56%	81%	.02
Height (inches)	65.6 (3.4)	66.2 (3.4)	n.s.
Weight (lbs)	170.9 (39.7)	168.4 (47.1)	n.s.
Pre Op SBP (mm/Hg)	116 (16)	127 (17)	.05
Pre Op DBP (mm/Hg)	67 (10)	74 (12)	.02
Propofol (mg)	187.0 (62.8)	167.9 (46.3)	n.s.
Fentanyl (mcg)	295.0 (158.5)	296.7 (90.7)	n.s.
Surgical Time (min)	154.8 (118.2)	131.2 (85.7)	n.s.

Differences between baseline and GRIM response episodes		
Mean and (St. Dev.)	Difference from baseline to GRIM	p. =
Heart Rate (bpm)	+ 0.35 (11.3)	n.s.
Systolic BP (mm/Hg)	+ 0.79 (15.4)	n.s.
End Tidal Desflurane (%)	+ 0.19 (1.17)	n.s.
GRIM (Ratio2)	+ 45.0 (22.2)	.000
Resting pupil diameter (mm.)	+ 0.18 (0.2)	.03

S-145.

HEART RATE VARIABILITY AS A PREDICTOR OF SPINAL ANESTHESIA-INDUCED HYPOTENSION IN ELDERLY PATIENTS SCHEDULED FOR HIP FRACTURE SURGERY

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BACKGROUND: Several studies suggested that heart rate variability might be used as a significant predictor of hypotension induced by spinal anesthesia. We carried out this study to determine specific criteria of parameters of heart rate variability to predict hypotension induced by spinal anesthesia.

MATERIALS AND METHODS: After the approval of Institutional Research Committee, informed consent was obtained from the patients. We studied 47 patients (age: 60-97 years) scheduled for hip fracture surgery. Exclusion criteria were as follows: diabetes mellitus; lack of sinus rhythm; medications affecting HR (e.g., beta-blockers or anti-arrhythmic drugs). Besides routine monitoring, 256-second recording of HRV was obtained prior to spinal anesthesia (FM-150, Fukuda Denshi, Tokyo). Power spectrum densities were calculated for total power (TP), low frequency (LF), and high frequency (HF). Spinal anesthesia was introduced using 2.5-3.5 ml of 0.5% isobaric bupivacaine through 25-G needle at the level of the L3-L4 interspace. A decrease in systolic blood pressure (SBP) by 30% or greater, or SBP less than 90 mmHg was defined as hypotension. We assessed hypotension until 30 min after the administration of spinal anesthesia. Subjects were classified into either hypotensive (HYPO) or non-hypotensive (NON-HYPO) group. Intergroup comparisons were performed using Mann-Whitney-U test or chi-square test. A p < 0.05 was considered significant. Data were expressed as median (interquartile range). A receiver operator characteristic curve (ROC) was constructed for each of the significant predictive variables, and the areas under the ROC curves (AUR) were determined. The threshold value, sensitivity, specificity, and likelihood ratio were also determined.

RESULTS: The demographic data of patients in both groups are shown in the table 1. In HYPO group, LF and LF/HF were significantly lower than those of NON-HYPO group. ROC curve analysis revealed a sensitivity of 21% and a specificity of 97% for LF < 15 ms²/Hz (area: 0.72, likelihood ratio: 5.9). The sensitivity and specificity of LF/HF < 0.35 ms² were 42%, and 97%, respectively (area: 0.78, likelihood ratio: 11.8). The sensitivity and specificity of hemoglobin < 10.0 g/dL were 53%, and 89%, respectively (area: 0.69, likelihood ratio: 4.9).

CONCLUSION: Preoperative LF < 15 ms²/Hz and LF/HF < 0.35 ms² significantly correlated with the hypotension after administration of spinal anesthesia in the patients undergoing hip fracture surgery. We suggest that preoperative measurement of LF and LF/HF is useful for the prediction of hypotension induced by spinal anesthesia, especially, in the elderly population.

Demographic data of HYPO and NON-HYPO groups

	HYPO	NON-HYPO	p
n	19	28	
Age (year)	79.9 (72.3, 82.0)	77.5 (72.0, 82.0)	0.16
Sex (m/f)	4/15	8/20	0.56
Hb (g/dL)	9.8 (9.5, 11.8)	11.4 (10.8, 12.6)	0.03
0.5% iso-baric bupivacaine (ml)	3.0 (2.8, 3.0)	3.0 (2.8, 3.0)	0.30
LF (ms ² /Hz)	36.2 (22.5, 92.8)	107.1 (60.3, 203.8)	0.01
HF (ms ² /Hz)	60.4 (41.7, 103.5)	84.2 (33.0, 216.0)	0.66
LF/HF	0.56 (0.27, 1.11)	1.43 (0.80, 2.70)	0.001
TP (ms ² /Hz)	285.0 (212.2, 965.4)	685.8 (322.9, 1162.1)	0.19

S-146.

DYNAMIC CHANGES IN THE ARTERIAL WAVEFORM DETERMINED WITH THE LIDCO SYSTEM DO NOT CORRELATE WITH FILLING PRESSURES IN PATIENTS WITH LOW VENTRICULAR EJECTION FRACTION AFTER CARDIAC SURGERY

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INTRODUCTION: Right and left ventricular filling pressures are commonly used to guide fluid management. Cardiac output measurement devices based on the arterial pulse contour like the PiCCO (Pulsion Medical Systems, Munich, Germany) and the LiDCO (LiDCO Ltd. Cambridge, UK) systems allow determination of stroke volume variation (SVV) and pulse pressure variation (PPV). These dynamic measures are frequently used to optimize preload although it has been shown for the PiCCO that merely percentage changes in SVV and PPV appear to be valuable predictors of fluid responsiveness (1). In contrast to the PiCCO, there are hardly any data available for the LiDCO device, which uses lithium dilution to calculate stroke volume. Therefore, the purpose of this investigation was to evaluate the relationship between SVV and PPV determined with the newer minimally invasive LiDCO system and central venous (CVP) as well as pulmonary artery occlusion pressure (PAOP).

METHODS: After institutional approval we studied 29 patients with low left ventricular ejection fraction (LVEF < 40%) after cardiac surgery during routine ICU treatment while patients were still mechanically ventilated. Via an indwelling pulmonary artery catheter CVP and PAOP were measured simultaneously with SVV and PPV. Linear regression was employed to assess the degree of association between the dynamic variables of volume load and the corresponding filling pressures (Sigma Stat 2.03, San Jose, CA, USA). A P-value < 0.05 was considered to be significant.

RESULTS: A total of 530 data pairs were used for analysis. There was a fair correlation between CVP and PAOP ($r^2 = 0.5$; $P < 0.05$) and between SVV and PPV ($r^2 = 0.7$; $P < 0.05$). The correlation coefficients between CVP and SVV and PPV, respectively, were 0.005 and 0.01 (both $P > 0.05$) and those between PAOP and SVV and PPV 0.01 and 0.03, respectively (both $P > 0.05$).

DISCUSSION: These findings indicate that in the setting of postoperative management of cardiac surgery patients with compromised LVEF, absolute values of preload cannot be used interchangeably with dynamic changes in the arterial waveform determined with the LiDCO system. Similar to the PiCCO device, relative changes in SVV and PPV after volume challenges, and not the isolated values that are shown on the screen, might better allow prediction of fluid responsiveness (1).

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S-147.

THE QUANTITATIVE ASSESSMENT OF DEPTH OF ANESTHESIA BY HEART RATE VARIABILITY

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INTRODUCTION: The cortex is one of the main targets for general anesthetic drugs in the central nervous system. The extent of the contribution of the autonomic nervous system (ANS) has yet to be clarified [1]. Heart rate variability (HRV) is an important quantitative marker of cardiovascular regulation by the autonomic nervous system [2]. Several HRV indices estimated from the ECG including spectral analysis have been considered as measures of ANS activity.

HRV has been shown to change significantly from the awake to the unconscious state [3]. The objective of this study was to assess the feasibility of using HRV as a unique way to characterize the contribution of ANS activity under general anesthesia (GA). We present an analysis of the data of subjects undergoing the gradual induction of (GA).

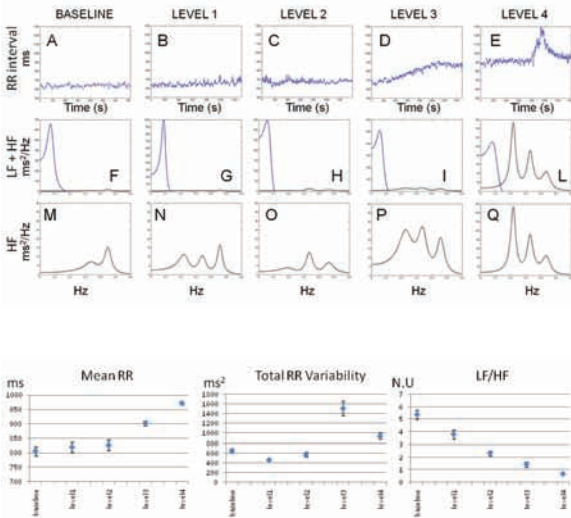
METHODS: Healthy patient volunteers were studied. GA was gradually induced with intravenous propofol at target effect-site concentrations of 0,1,2,3, and 4 $\mu\text{g/ml}$ using STANPUMP a computer-controlled delivery system. To access loss of consciousness (LOC), subjects were given an auditory task. (loss of response = LOC) R-wave peaks were detected from the EKG signal using a derivative and threshold automatic algorithm. R-wave markers were tested to eliminate artifacts and correct eventual undetected beats, or beats erroneously detected. A parametric autoregressive model with separation in the standard LF and HF frequency components associated to the sympathovagal balance [2] was implemented to analyze two 5 min segments for each of the 5 epochs.

RESULTS: Spectral analysis was performed on 5 subjects. LOC was obtained at the 3 $\mu\text{g/ml}$ propofol level for 4 subjects, and at the 2 $\mu\text{g/ml}$ level for 1 subject. Figure 1 shows the five segments of R-R interval series, each recorded from the same subject after 0,1,2,3, and 4 $\mu\text{g/ml}$ propofol infusion (panels A-E). Panels F-L show the respective spectral analysis. Panels M-Q show the zoomed HF components. Averaged results (Figure 2, with standard error bars) show the expected gradual decrease of mean heart rate towards LOC, accompanied by a marked increase in total HRV power due to bradycardia before LOC (level 3). More importantly, the sympathovagal index (LF/HF) shows a significant gradual decrease, strongly correlated with propofol levels both before and after LOC is reached.

DISCUSSION: Traditional spectral analysis of HRV may give a significant measure of depth of anesthesia, indicating a progressive increase of vagal activation, paralleled by a decrease in sympathetic activity.

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S-148.

EVALUATION OF THE LMA SUPREME, A NEW SUPRAGLOTTIC AIRWAY, IN 100 PATIENTS

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INTRODUCTION: The LMA Supreme is a new single use supraglottic airway which combines features of the LMA Proseal and LMA Fastrach. It has a semi-rigid airway channel and can be inserted without the need for an introducer or the insertion of fingers into the patient's mouth. It had a low pressure cuff, a bite block, a gastric tube channel and a fixation tab to tape the device in place. We evaluated this new airway in 100 patients.

Method: We obtained IRB approval and consent from all patients. We induced anesthesia with propofol, we did not use neuromuscular blockers in this study. We chose the size according to the patient's weight: size 3 if <50 kg, size 4 if 50 to 70 kg and size 5 if >70 kg. We inserted the LMA Supreme with the patients' heads and necks in neutral position, with minimal neck movement. We measured the time to achieve ventilation as confirmed by capnography, at inflation pressures < 15 cmH₂O. We confirmed suitable fit when the fixation tab was 0.5 to 2.5 cm from the lip. We measured the leak pressure at a standardized intracuff pressure of 60 cmH₂O. We set a fresh gas flow of 3 L/min, closed the anesthesia breathing circuit expiratory valve, and noted the stable aneroid manometer pressure reading at which the leak was in equilibration with the fresh gas flow.

RESULTS: We inserted the LMA Supreme successfully at the first attempt in 96 patients and at the second attempt in 4 patients. The time to achieving ventilation was 16.5 (sd 7.0) [range 7.0 - 48.0] sec. The leak pressure was 25.0 (sd 6.5) [range 10.0 - 48.0] cmH₂O. The gastric tube was inserted at the first attempt in all 100 patients. There was no visible blood on removal of the LMA Supreme in 93 patients and minor blood staining in 7 patients. Seven patients had mild sore throat postoperatively. One patient had left lingual nerve palsy, with loss of two point discrimination over the left anterior two thirds of the tongue. This patient had had surgery in the left lateral position. There was full recovery after 4 weeks.

DISCUSSION: Our results suggest that the LMA Supreme is easy to insert, and ventilation can be rapidly achieved. The high first attempt success rate and the ease of insertion with minimal neck movement may be advantages compared to the LMA Proseal. However, the low seal pressures in some patients may limit its use if positive pressure ventilation at high pressures is required. The rigidity of the airway channel may have contributed to lingual nerve palsy in one patient and we suggest caution in its use in patients who are in lateral position during surgery.

S-149.

SUPINE TO LATERAL FLEXION EFFECT ON INTRAOPERATIVE ELECTROCARDIOGRAM AND HEMODYNAMIC PARAMETERS

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INTRODUCTION: Electrocardiogram (ECG) and hemodynamic monitoring are used in diagnosing patient intraoperative events. Patient positional changes may trigger a false monitor alarm or clinical misinterpretation leading to a potential unnecessary intervention^{1,2}. Distinguishing between a positional vs. true ischemic ECG or hemodynamic change is important. This study analyzed the association between body position change during open nephrectomy on ECG and hemodynamic monitoring when placing a patient intraoperatively from a supine to lateral-flexed position.

METHODS: Prospective cohort study. ECG and hemodynamic measures from 66 partial nephrectomy patients placed from the supine to lateral-flexed position were evaluated. The following data were recorded in these two patient positions: ST segment changes of ECG Leads II / V, mean arterial blood pressure (MAP), and central venous pressure (CVP). Supine data were collected after induction of general anesthesia and placement of invasive monitors (arterial and CVP catheters) and then repeated in the lateral-flexed position. A change in ST of ≥ 0.5 mm, as well as a change of 20% or more in MAP and CVP from baseline, were specified *a priori* as clinically relevant. Covariable-adjusted (for age, gender, height, weight, lateral-flexed side, and degree of bed angle flexion) mean differences in MAP and CVP were estimated using multivariable linear regression; there were too few episodes to estimate a covariable-adjusted association between position change and odds of ST segment change ≥ 0.5 mm.

RESULTS: Univariablely, mean CVP significantly differed between the two positions (mean difference [95% CI] of 4.0 mmHg [2.8, 5.2], $P < 0.001$), while mean MAP did not (mean difference [95% CI] of 4 mmHg [0, 9], $P = 0.054$). After adjustment for covariables, the mean difference [95% CI] was estimated at 4.3 mmHg [0.1, 8.6] ($P = 0.023$) for MAP and at 3.9 mmHg [2.7, 5.1] ($P < 0.001$) for CVP. Of the 58/66 patients with available EKG data, 13 (22%, 95% CI of [13%, 36%]) had an ST change $\geq \pm 0.5$ mm.

CONCLUSION: Lateral-flexed positioning was independently associated with an increased MAP and CVP from a supine baseline position. The CVP increase may be explained by an increase in transmitted intrathoracic pressure due to external compression and restriction of the thorax when externally taped to secure the chest wall and positive pressure ventilation. These findings should be considered when an intraoperative patient position change occurs from supine to a lateral-flexed position.

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S-150.

ANESTHESIOLOGISTS' RELIANCE ON AUTOMATED RECORDKEEPING SYSTEMS - TOO MANY GAPS IN THE RECORD?

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INTRODUCTION: Institutions using Anesthesia Information Management System (AIMS) differ in the frequency of real-time data storage (i.e. blood pressure, heart rate etc). [1] Regardless, American Society of Anesthesia (ASA) standards for basic anesthetic monitoring dictate that blood pressure should be measured at least every 5 minutes [2]. It is unclear whether previous findings of missing data or "gaps" during physiologic monitoring are unique to specific institutions or software implementations. [3] We analyzed blood pressure data from cases performed over an 18-month period to determine the frequency of gaps in monitoring intraoperative blood pressure.

METHODS: We reviewed over 30,000 intraoperative records of patients undergoing surgery between 12/06 and 5/08. A "Gap" in blood pressure measurements was defined as the absence of all 6 blood pressure values (i.e. systolic, mean, diastolic for both Non-Invasive or Invasive values).

RESULTS: There were 30,985 cases reviewed during this period. Of these intraoperative records, 38.8% (11,958) had >1 gap in blood pressure monitoring for 10 minutes or more. Analyzing the length of time during the gaps, we found that 19.8% (2,371) were of 10 min; 62.7% (7,500) were between 10-20 min; and 17.4% (2,087) were greater than 20 min.

DISCUSSION: Intraoperative AIMS allow anesthesiologists to rely on automated recording of physiologic data. However, lack of monitoring or attention allows for gaps in the anesthetic record. Specifically, blood pressure monitors can be started and not set to cycle, and if not checked continuously, periods of more than 10 minutes pass without new measurements. We recommend a study to analyze the intraoperative periods where these gaps occur and possible solutions (time alarms, reminders, etc) that could prevent gaps in automated recordkeeping systems.

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Number of Blood Pressure Gaps		
Time of Gap (min)	# of BP Gaps	%
10	2,371	19.8
15	5,571	46.6
20	1,929	16.1
25	808	6.8
30	374	3.1
35	223	1.9
>40	682	5.7
Total	11,958	100.0

S-151.**HYPERCAPNIC HYPERPNOEA DURING EMERGENCE WITH THE QED-100 SHORTENS THE TIME TO AWAKE IN THE OR AND ORIENTED IN THE PACU**

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INTRODUCTION: A more rapid return of responsiveness occurs after inhaled anesthesia when hypercapnia and hyperpnoea are used during emergence (1-4). The benefits extend into the post anesthesia care unit as the patient continues to recover more rapidly (5). This study measured the decrease in time to meet recovery criteria in the PACU when hypercapnic hyperpnoea was used during emergence.

METHODS: Written informed consent was obtained from 22 adult ASA class I-III patients scheduled to undergo eye surgery. Anesthesia was provided with 6% desflurane and a remifentanyl infusion. At the end of surgery patients were randomly assigned to one of the two treatment groups. In the experimental group a QED-100™ (Anecare Inc., Salt Lake City, UT) was placed between the endotracheal tube and the anesthesia breathing circuit and the minute ventilation was doubled.

RESULTS: When the QED-100™ was used to provide hypercapnic hyperpnoea during emergence (respiratory rate was doubled and the EtCO₂ was elevated to 48 mmHg, rather than 35 mmHg) the time from the end of surgery to when patients opened their eyes to command was 4.1 ± 1.4 min whereas the time for the control group was 6.5 ± 2.3 min (P = 0.009). The time from the end of surgery until the patient became oriented and could correctly state their full name, date, month and year of birth and the current year was 10.9 ± 5.1 min for the hypercapnic group and 18.2 ± 9.7 for the control group (P = 0.039). Table 1 lists the time to reach other measures of recovery.

Time to meet Discharge Criteria (min)	Alert & oriented	Aldrete score>8	Conversant Cooperative	Stable vitals for 30 min	Met all Discharge Criteria
Hypercapnic	8.4±3.7	10.5±2.9	12.6±5.4	37.6±3.9	53.0±15.2
Control	13.9±6.7	13.0±8.1	21.8±12.2	40.1±3.5	62.9±28.8
P value	0.028	0.346	0.034	0.120	0.323

DISCUSSION: When the QED-100™ provided hypercapnic hyperpnoea during emergence patients woke up 2.4 min faster. The benefits of hypercapnic hyperpnoea extended into the PACU where the patients were oriented sooner (could correctly state their name and birthday). An awake and oriented PACU patient may be at lower risk for airway obstruction and respiratory depression (6). Better predictability of recovery times can allow for better planning of recovery room care and discharge.

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S-152.**COMPARISON OF TIME TO RECOVERY OF T₄/T₁ RATIO (TOF-WATCH® SX) WITH TIME TO RE-APPEARANCE OF T₄ (PERIPHERAL NERVE STIMULATION) IN SUBJECTS ADMINISTERED SUGAMMADEX 4.0 MG/KG 15 MIN AFTER ROCURONIUM**

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INTRODUCTION: Administration of sugammadex 15 min after rocuronium provides effective, dose-related recovery from neuromuscular blockade (NMB). Various techniques can evaluate recovery from NMB, with objective assessments considered to be the most accurate. This study compared time to recovery of the T₄/T₁ ratio to 0.9, measured with acceleromyography (TOF-Watch® SX), with manual detection of time to re-appearance of T₄, measured using a peripheral nerve stimulator (PNS), in adult patients administered sugammadex 15 min after single- or multiple-dose rocuronium.

METHODS: This multicenter, randomized, parallel-group, active- and within-subject controlled study enrolled patients aged 19-64 years and ASA Class I-III who were scheduled to undergo surgery under general anesthesia requiring the use of rocuronium. Anesthesia was induced using intravenous propofol and an opioid, and maintained with sevoflurane. Rocuronium 0.6 mg/kg was given for intubation and NMB maintained using 0.15 mg/kg. Patients were randomized (1:2) to receive single-dose sugammadex 4.0 mg/kg (highest recommended dose for routine reversal) or 1 mg/kg (added to limit bias in assessment of re-appearance of T₄), respectively, 15 min after the last dose of rocuronium. Neuromuscular monitoring was performed with TOF-Watch® SX on one arm and a PNS (Ministim® Model IV) on the other arm. The PNS assessor was blinded to the TOF-Watch results. Primary efficacy variables were time from start of administration of sugammadex 4.0 mg/kg to recovery of the T₄/T₁ ratio to 0.9 (TOF-Watch® SX) and re-appearance of T₄ (PNS).

RESULTS: Ninety out of 91 randomized patients received sugammadex. With TOF-Watch® SX, median (95% confidence interval [CI]) time to recovery from start of sugammadex 4.0 mg/kg (n=61) administration to recovery of the T₄/T₁ ratio to 0.9 was 1.4 (1.3-1.7) min. Using the PNS, median (95% CI) time from start of administration of sugammadex 4.0 mg/kg to re-appearance of T₄ was 0.8 (0.7-0.8) min. The median (95% CI) difference between these times was 0.5 (0.5-0.8) min. Median time to re-appearance of T₄ was similar for TOF-Watch® SX and PNS in the 4.0 mg/kg group (0.8 min for both). SAEs were experienced by 4 patients in the 4 mg/kg group, none were considered drug-related. Sugammadex 4.0 mg/kg was well tolerated with no evidence of residual NMB or re-occurrence of NMB.

DISCUSSION: Re-appearance of T₄ measured by PNS occurred 0.5 min before recovery of the T₄/T₁ ratio to 0.9, measured by TOF-Watch® SX. Future sugammadex studies using a PNS should take into account individual differences as, while the mean difference between time to re-appearance of T₄ (PNS) and time to recovery of T₄/T₁ to 0.9 (TOF-Watch® SX) observed was 0.8 min, the maximum difference was 2.3 min.

S-153.

PREOPERATIVE CEREBRAL INFARCTION CAUSES BISPECTRAL INDEX ASYMMETRY

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INTRODUCTION: The effect of bispectral index (BIS) monitor on preventing awareness during anesthesia has been controversial(1, 2). BIS requires electroencephalogram (EEG) on only unilateral forehead. We hypothesized that BIS could be asymmetric, which could cause incorrect assessment of depth of anesthesia. During recovery period from monohemispheric cerebral infarction, asymmetric response in the brain can occur(3). Then we studied the effect of preoperative cerebral infarction on the BIS differences between left and right brain during propofol-based anesthesia in patients, and present here a remarkable case.

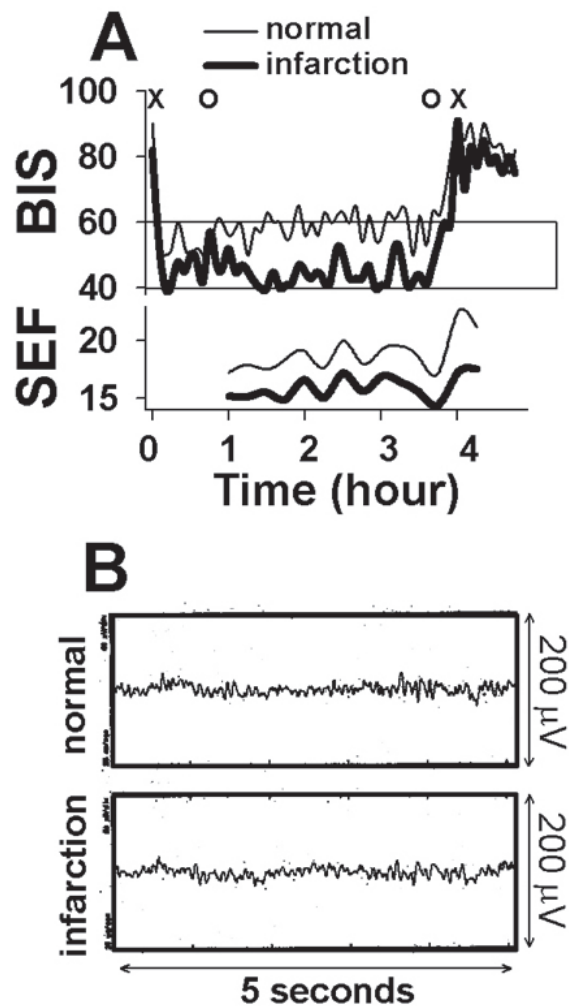
METHODS: We enrolled 10 normal patients aged 27-72 yrs and 6 patients 51-88 yrs with preoperative cerebral infarction who were scheduled to undergo general anesthesia. Following standard monitoring two BIS sensors were placed on the forehead symmetrically, and attached to two Aspect XP BIS monitors. Anesthesia was maintained with propofol, fentanyl or remifentanyl, and small dose of ketamine. BIS and 95% spectral edge frequency (SEF) were recorded every 15 min during operation. The mean values of BIS or SEF during operation were calculated.

RESULTS: In normal group, the mean BIS values (SD) between left and right were not significantly different; 54.3 (8.3) and 54.9 (8.0), respectively. The mean SEF values were also symmetric; 18.2 (2.5) and 18.3 (2.5), respectively. In contrast, in infarction group the mean BIS values on the infarction side were smaller than the opposite side; 51.5 (11.0) and 53.4 (10.9), $P<0.05$, respectively. However, the mean SEF values were not significantly different. The differences in BIS between left and right failed to reach significant difference; normal and infarction group, 1.1 (1.2) and 2.0 (1.8), respectively.

DISCUSSION: The figure shows a case, which we experienced prior to this present study, of representing remarkable BIS and SEF asymmetries in a 66 year-old man with cerebral infarction due to right middle cerebral artery occlusion. He was anesthetized with propofol 5-6 mg/kg/h, fentanyl 14.5 µg/kg and ketamine 0.1 mg/kg/h. The estimated effect-site concentration of propofol and fentanyl during operation were 2.7-3.4 µg/ml and 1.7-5.4 ng/ml, respectively. BIS values on infarction side were lower, around 40, than on normal side, around 60 (figure A). In addition, SEF was also asymmetric. However, we did not find any differences in raw EEG between on normal and infarction side (figure B). This BIS and EEG change in this case was not consistent with that of previous reports, in which cerebral ischemia suppresses EEG activity such as flat EEG(4, 5). We should consider that preoperative infarction can cause the BIS asymmetry without clear raw EEG asymmetry when assessing depth of anesthesia correctly.

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S-154.

THE AIRWAY SCOPE, A NEW VIDEO LARYNGOSCOPE: ITS USE IN 270 PATIENTS WITH DIFFICULT AIRWAYS

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INTRODUCTION: The Pentax Airway Scope AWS-S100 (Hoya, Tokyo, Japan) is a new video laryngoscope that enables laryngoscopy without alignment of the oral, pharyngeal and laryngeal axes.[1] We evaluated the Airway Scope in patients in whom airway management with a Macintosh laryngoscope had been difficult.

METHODS: We obtained IRB approval for this prospective study. The Airway Scope handle has a 6 cm LCD screen, and a flexible image tube with camera and LED light source mounted at the tip. The disposable polycarbonate PBlade completely encloses and protects the image tube, and has a channel to hold and guide the insertion of the tracheal tube. Intubation was diagnosed by a senior anesthesiologist to be difficult when no part of the vocal cords could be seen with a Macintosh laryngoscope despite external laryngeal pressure, when two attempts at intubation had failed, or when the anesthesiologist would have used alternative devices such as a flexible bronchoscope or LMA Fastrach had the Airway Scope been unavailable. We placed the patients' heads and necks in neutral position when using the Airway Scope, and applied manual inline stabilization in patients with cervical spine pathology. All the Airway Scope procedures were carried out by senior anesthesiologists who had used it at least 10 times prior to this study.

RESULTS: There were 187 males and 83 females patients with age 58.0 and mean BMI 24.5. The main causes of difficulty included limited head and neck movement due to cervical spine pathology, limited mouth opening, severe obesity, and anatomical variations such as retrognathia, maxillary overbite and short thick neck. Other causes included previous head and neck radiotherapy, epiglottic cysts, lingual tonsillar hyperplasia, pharyngeal tumors, Treacher Collins syndrome, Marfans syndrome and Goldenhaar syndrome. The Airway Scope enabled full glottis views in 260 (96.3%) and partial views in 9 (3.3%) patients. Tracheal intubation was successful in 268 (99.3%) patients, and successful at the first attempt in 255 (94.4%) patients. In two patients, the PBlade tip could not be positioned posterior to the epiglottis and it was not possible to direct the tracheal tube into the trachea, and flexible bronchoscopic intubation was then carried out. None of the patients had oxygen desaturation below 90%.

DISCUSSION: We found high success rates of laryngoscopy and intubation with the Airway Scope in patients with a wide variety of difficult airways. With the Airway Scope, we could easily guide the tracheal tube into the trachea, with minimal neck movement. The Airway Scope is lightweight, powered by ordinary AA alkaline batteries, water resistant and completely portable. Our results suggest that the Airway Scope is a promising device for difficult airway management.

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S-155.

TRACHEAL INTUBATION WITH VIDEO LARYNGOSCOPE IN PATIENTS WITH CERVICAL SPINE STABILIZATION: A RANDOMIZED TRIAL OF THE AIRWAY SCOPE AND GLIDESCOPE

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INTRODUCTION: Videolaryngoscopes including the GlideScope and Airway Scope enable laryngoscopy without the need to align oral, pharyngeal and laryngeal axes, and may be useful in patients with cervical spine pathology. The newer Airway Scope's disposable PBlade has a tube channel which guides a preloaded tracheal tube to the glottis. The GlideScope has no tube channel and intubation can frequently be difficult despite good glottis views. Our hypothesis is that the Airway Scope's tube guidance system improves the ease of tracheal intubation compared to the GlideScope in patients whose cervical spines are stabilized.

METHOD: We obtained IRB approval and patients' consent. We block randomized 70 patients to have tracheal intubation with the Airway Scope or GlideScope under general anesthesia. An assistant applied manual inline stabilization of the patients' heads and necks in neutral position without pillows throughout airway management. We checked the Cormack and Lehane grade of Macintosh laryngoscopy before using the videolaryngoscopes. With the Airway Scope, we centered the view on the glottis before sliding the tube down the PBlade tube channel into the trachea. With the GlideScope, we carried out tracheal intubation with the aid of a rigid stylet in the tracheal tube in all patients, after optimizing the glottis view. We limited intubation to 3 attempts within a maximum of 180 sec. Our primary outcome measure was the time for successful intubation, we considered a difference of at least 15 sec meaningful.

RESULTS: The groups were similar in BMI, Mallampati class, thyromental distance and Macintosh laryngoscopy grade. The tracheal intubation time was shorter with the Airway Scope (34.2 sec vs 71.9 sec, $p < 0.001$). The success of intubation was 35/35 with the Airway Scope compared to 31/35 with the GlideScope ($p = 0.057$) and the success rates within 60 sec were 33/35 and 22/35 respectively ($p = 0.001$). The videolaryngoscopy view was Grade 1 (IQR 1 - 1) with the Airway Scope compared to 2a (1 - 2b) with the GlideScope ($p < 0.001$).

DISCUSSION: We found a shorter time and higher success rate for intubation with the Airway Scope compared to the GlideScope, in the presence of cervical spine stabilization. The tube channel guidance system of the Airway Scope may improve the ease of intubation. The Airway Scope has other advantages: The LCD screen is part of the handle and can be viewed simultaneously as PBlade insertion into the mouth. The tube is preloaded such that its tip is just visible on the screen, whereas it can be difficult to insert the tube into view on the GlideScope screen. The Airway Scope is completely handheld, lightweight, water resistant and powered by ordinary AA sized batteries. It may be promising for airway management in patients requiring cervical spine stabilization.

S-156.

COMBINED USE OF STYLET AND INTRODUCER TOOL FOR PROSEAL LARYNGEAL MASK INSERTION IN PATIENTS WITH MANUAL-IN-LINE STABILIZATION

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INTRODUCTION: Manual in-line stabilization (MILS) of the patient's head and neck is known to cause failure in placement of the ProSeal[®] laryngeal mask airway (PLMA). This may be attributed to the creation of an acute angle between the oral and pharyngeal axis at the back of the tongue. This study was planned to observe whether shaping the entire PLMA into a C shape with the aid of stylet would help in its easy placement by aiding smooth negotiation of the acute oropharyngeal axis of patients with MILS.

METHODS: 20 patients undergoing general anaesthesia for elective orthopaedic procedures were randomly divided into 2 groups. In Group I [n=10] patients, PLMA was conventionally placed, while in Group II [n=10] PLMA was configured into a C shape using a well lubricated stylet in the drain tube till its tip. In patients of both the groups, attempt was made to place PLMA using manual in-line stabilization. The single attempt lasted to a maximum of 90 seconds. In Group II patients, as the preconfigured PLMA negotiated the oropharyngeal curve, and before going any further, the stylet was withdrawn about 4-5 cm and the device was further negotiated till its final placement. Withdrawal of the stylet by 4-5 cm restored the PLMA shape to original so that the alignment of the distal opening of the drain tube to the opening of the oesophagus was not altered. In Group I patients, PLMA was placed as per manufacturers guidelines. In patients with failure to place the PLMA within 90 seconds, conventional tracheal intubation was performed without using MILS.

PLMA placement time was calculated in seconds from entry of the PLMA distal tip between the incisors to its connection with the breathing circuit. At the conclusion of surgery PLMA was removed and inspected for the visual presence of blood stain. Presence of an unpleasant sensation in the throat [which was not previously present] just prior to discharge from the recovery room was recorded as evidence of sore throat.

Unpaired 't' test was used to compare inter-group PLMA placement time, while 'Z' test for proportions was used to analyze statistical significance of the successful PLMA placement rate, incidence of blood stain on the device and sore throat. $p < 0.05$ was considered as significant in this study.

RESULTS: Grp I vs Group II PLMA (seconds) was 50.7 ± 31.5 v/s $16.1 \pm 7.1^*$, Blood stain on PLMA 40 vs 20 %*, sore throat 4 vs 1*,

* = $p < 0.05$ as compared to group 1.

CONCLUSIONS: A 'C' shaped PLMA with introducer tool and lubricated stylet facilitates its first attempt placement in patients whose head and neck has been immobilized by MILS with significantly reduced incidence of traumatic device placement and postoperative sore throat.

S-157.

VISUAL STETHOSCOPE TO DETECT TRACHEAL TUBE POSITION

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INTRODUCTION: Advancing an endotracheal tube into the right bronchus produces unilateral breath sounds. We created a system of visualization of sounds (visual stethoscope) and made it possible to visualize breath sounds. The visual stethoscope allows real-time fast Fourier transform of the sound signal and three dimensional (frequency-amplitude-time) rendering of the results on a personal computer with processing of two individual sound signals simultaneously. (Figure)¹. The aim of this study was to evaluate whether the visual stethoscope can detect endobronchial intubation.

METHODS: Fifteen adult patients undergoing scheduled urological surgery participated in this study. After the induction of general anesthesia, the trachea was intubated with an endotracheal tube. The fiberoptic bronchoscope was used through the endotracheal tube, to measure the distance from the fore-tooth to the carina of the trachea. During an anesthesiologist advanced the endotracheal tube from trachea to bronchus, an another anesthesiologist who does not know the position of the tracheal tube auscultated breath sounds to detect change of breath sounds and/or disappearance of unilateral breath sounds. The auscultation was performed every one centimeter advancement of the tracheal tube. Simultaneously, two precordial stethoscopes connected to a microphone were placed at the left and right sides of chest were used to record breath sounds during the procedure. Subsequently at a later date, in another place, we randomly inputted the recorded breath sounds to the visual stethoscope to visualize the breath sounds. The same anesthesiologist who did auscultation of the breath sounds observed the visualized breath sounds on the LCD screen which processed by the visual stethoscope to find change of breath sounds and/or disappearance of unilateral breath sound. We compared the decision by using auscultations with the decision by using the results of the visualized breath sounds. Results of the study were presented as mean \pm SD (cm). Plus and minus numbers means that the tip of endotracheal tube was located at the bronchial side and at the tracheal side of the carina, respectively. A paired Student's t-test was used for statistical analysis. Statistical significance was taken as $P < 0.05$.

RESULTS: Results of the study were shown in the table. * $P < 0.05$ for Auscultations vs Visual stethoscope.

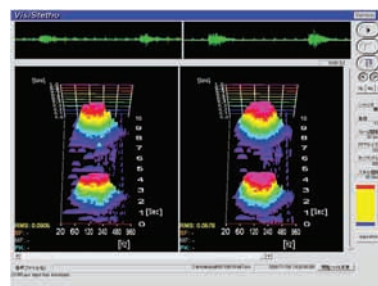
DISCUSSION: During the advancement of the tracheal tube, the alteration of the shape of the visualized breath sounds using the visual stethoscope was appeared before the auscultation detected the change of the breath sounds. Unilateral breath sounds disappeared when the tip of endotracheal tube was advanced beyond the carina in both groups.

REFERENCES:

1) Pediatric Anesthesia, 18, 339, 2008.

Table

	Auscultations	Visual stethoscope
Change of breath sounds*	0.7 ± 1.0	-0.3 ± 0.8
Disappearance of unilateral breath sound	2.7 ± 1.4	2.4 ± 1.2



S-158.**EFFECTIVENESS AND SAFETY OF MCGRATH LARYNGOSCOPE FOR LARYNGOSCOPY AND TRACHEAL INTUBATION IN PATIENTS WITH CERVICAL SPINE IN-LINE IMMOBILIZATION**

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BACKGROUND: Manual in-line immobilization, while necessary in the absence of radiological evidence of an intact cervical spine, complicates laryngoscopy and tracheal intubation in trauma patients. The McGrath video-laryngoscope is a newly designed airway adjunct that aims to facilitate laryngoscopy and tracheal intubation. The goal of this study was to determine the effectiveness and safety of this device as compared to traditional laryngoscopy using simulated difficult laryngoscopy with manual in-line c-spine immobilization in elective surgical patients following the induction of general anesthesia.

METHODS: After obtaining IRB approval and informed consent, ASA I and II patients undergoing elective surgical procedures were recruited. After a standardized induction of anesthesia and muscle relaxation and with the patient's C-spine immobilized by a trained assistant, the Cormack/Lehane (CL) glottic view and percent of glottic opening (POGO) score were evaluated using both the McGrath (MCG) and Macintosh (MAC) laryngoscopes in randomized order. The first device was used solely to grade the view whereas the second device was used for both grading the glottic view and tracheal intubation. Failure to intubate, the time to intubate (TTI) for the second device, hemodynamic changes, and complications were recorded.

RESULTS: Forty patients (23 males/17 females) have hitherto been recruited in this on-going study. The mean (\pm SD) age, weight, height, and BMI were 56.1 (\pm 14.9) yr, 85.1 (\pm 17.6) kg, 1.69 (\pm 0.10) m, and 29.9 (\pm 6.0) kg.m⁻² respectively. The results of the study are summarized in the table below. The CL views with the MCG appeared to be better compared with the MAC (Grade I/II/III/IV scores were 39/10/0/0 for MCG vs. 10/10/16/4 for MAC). In addition, the mean POGO score was higher for the MCG compared with the MAC (mean \pm SD POGO score of 77.5 \pm 24.5 for MCG vs. 13.7 \pm 22.9 for MAC). In contrast, the mean TTI was greater for the MCG group (21.4 \pm 8.0 seconds for MAC vs. 39.9 \pm 20.5 for MCG). Tracheal intubation using the MCG was successful in all 21 patients. However, of the 19 tracheal intubation attempts employing the MAC, only 10 were successful. The remaining 9 required intubation using the MCG as a back-up.

CONCLUSIONS: The McGrath video-laryngoscope appeared to provide a superior view of the glottis during manual in-line immobilization compared to direct laryngoscopy with a Macintosh laryngoscope. While the former required a longer TTI, tracheal intubation was successful in all patients. In addition, all intubation failures with a Macintosh blade were resolved with the use of the McGrath video-laryngoscope. The results of this study suggest that the McGrath laryngoscope is a more effective device for laryngoscopy and tracheal intubation in patients with in-line immobilization of the C-spine compared to the Macintosh laryngoscope.

	Laryngoscopy Device	
	Macintosh 3	McGrath 3
Cormack-Lehane Grades (n=40)	1	39
	2	1
	3	0
	4	0
Mean (\pm SD) POGO (n=40)	13.7 (\pm 22.9)	77.5 (\pm 24.5)
Successful Intubation	Y	21
	N	0
Mean (\pm SD) TTI (Sec.)	21.4 (\pm 8.0)	39.9 (\pm 20.5)
Complications	Y	3
	N	18
Sore Throat	Y	2
	N	19

S-159.**A PROSPECTIVE, RANDOMIZED COMPARISON OF INTUBATING CONDITIONS WITH AIRTRAQ® OPTICAL LARYNGOSCOPE, THE STORZ DCI VIDEO LARYNGOSCOPE®, MCGRATH® VIDEO LARYNGOSCOPE, GLIDESCOPE® VIDEO LARYNGOSCOPE, AND MACINTOSH LARYNGOSCOPE IN RANDOMLY SELECTED ELECTIVE ADULT SURGICAL PATIENTS**

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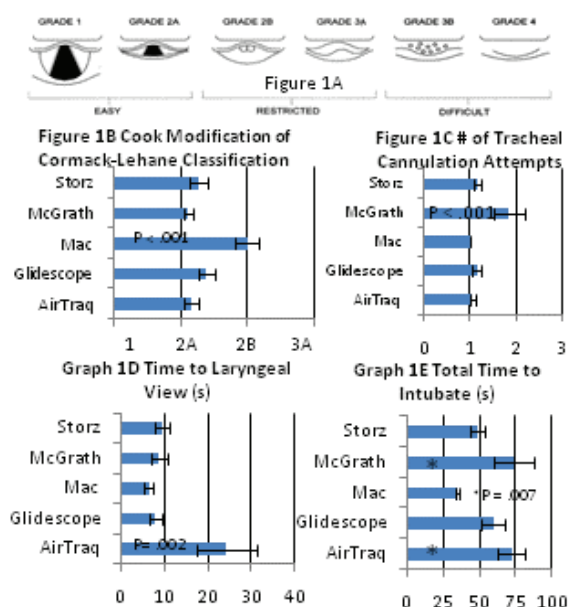
INTRODUCTION: Historically, optical and video laryngoscopes have been used as alternative airway management devices for the difficult airway, and as rescue devices. Although developed to improve the laryngeal view for tracheal intubation and to decrease physiological stress, their use by experienced laryngoscopists has not been compared in a prospective, randomized, head-to-head comparison for routine airway management in adult surgical patients. The objective of this study is to determine whether these devices offer superior intubating conditions for routine surgical management, over the Macintosh laryngoscope, which is the current standard.

METHODS: Eligible subjects for this IRB approved study included elective adult surgical patients with an ASA status between 1 and 3 requiring general endotracheal anesthesia. Subjects with a BMI > 40, or undergoing surgery in close proximity to the neck were excluded. Prior to surgery, subjects received a pre-anesthesia evaluation with particular attention to the airway using the Mallampati classification system, atlanto-occipital joint extension, thyro-mental distance, temporomandibular joint function, inter-incisor distance, and dental assessment. Subjects were randomized for intubation with one of the five laryngoscopes in equal proportions and seven board certified anesthesiologists intubated based on availability. The following data were recorded: total intubation time, maximum neck extension, glottic view, assessed by the anesthesiologist using the Cook modification of the Cormack-Lehane grading system (Fig. 1A), and ease of tracheal intubation. Subjects were queried about soreness or painful swallowing in the Post Anesthesia Care Unit and a week later via a phone call. ANOVA was applied to all measures to assess any significant differences among the devices, and a post hoc analysis was utilized to determine where those differences lay. Standard error bars on figures 2 through 5 indicate standard deviation. P<0.05 was considered significant.

RESULTS: Data was collected from 100 patients, 63 male, age 49 \pm 16 years, weight 77 \pm 19kg, height 171 \pm 11cm. The Macintosh laryngoscope offered inferior laryngeal view compared to all study groups (Fig. 1B). The number of tracheal cannulation attempts is the same for all devices except the McGrath video laryngoscope (Fig. 1C). The time to laryngeal view is the same for all devices except the AirTraQ Optical laryngoscope (Fig. 1D). Total time to intubate is faster with the Macintosh laryngoscope than with the AirTraQ Optical laryngoscope and the McGrath video laryngoscope (Fig. 1E).

DISCUSSION: The optical and video laryngoscopes in this study appear to offer superior laryngeal view and, in most cases, comparable intubating conditions to the Macintosh laryngoscope, even though intubation with the Macintosh laryngoscope is faster. This study is ongoing.

REFERENCES: 1) Anesthesiology 2003; 98: 1269-77. 2) Internet Journal of Airway Management 4, 2006-2007.



S-160.

MODIFIED PENTAX-AWS® PRODUCES LESS HEMODYNAMIC RESPONSES THAN CONVENTIONAL MACINTOSH LARYNGOSCOPE DURING NASAL INTUBATION

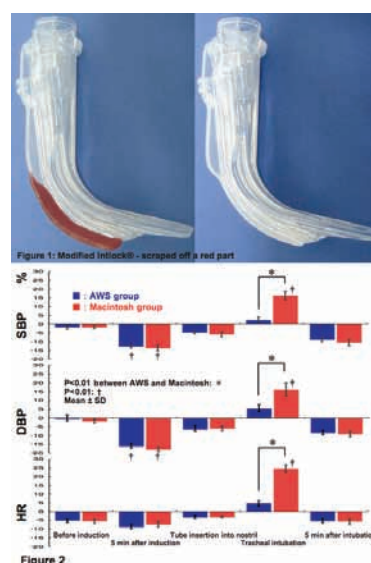
AUTHORS: N. Matsuura¹, T. Ichinohe², Y. Kaneko²;

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INTRODUCTION: Many researches have been performed about the hemodynamic changes caused by pharyngeal compression during tracheal intubation. (1,2) Sudden and abrupt hemodynamic changes can sometimes induce the adverse events such as cerebral vascular or myocardial accidents to patients. The PENTAX-AWS® (PENTAX, Tokyo, JAPAN) is a novel video laryngoscope comprised of a LCD monitor, through which the larynx can be directly observed by an anesthesiologist without laryngoscopy. Because PENTAX-AWS® might cause less compression force and produce less hemodynamic changes than conventional Macintosh laryngoscope, we compared hemodynamic responses during nasal intubation using these two laryngoscopes.

METHODS: After obtaining approval from the institutional ethical committee of Tokyo Dental College and written informed consent, 40 patients without cardiovascular underlying diseases scheduled for elective maxillofacial surgery under general anesthesia were randomly assigned to AWS group (n=20) or Macintosh group (n=20). Systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate (HR) were non-invasively monitored at entering the operating room, immediately before induction, five minutes after induction, tracheal tube insertion into nostril, tracheal intubation and five minutes after tracheal intubation. The shape of the Intlock® blade of the AWS® was modified appropriate for nasal intubation. (Figure 1)

RESULTS: Significant increases in SBP, DBP and HR were observed in the Macintosh group during tracheal intubation. In contrast, in the AWS group, there were no increases in SBP, DBP and HR during tracheal intubation. (Figure 2)



DISCUSSION: The present study indicates that nasal intubation using modified AWS cause little influence on hemodynamic variables in comparison with that using conventional Macintosh laryngoscope because of its minimal pharyngeal compression force. This study also suggests that modified AWS was useful for tracheal intubation in patients with cardiovascular underlying diseases.

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S-161.

EVALUATION OF THE BIS MONITOR AS A GAUGE OF POST-ANESTHESIA RECOVERY

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INTRODUCTION: The Bispectral Index (Bis) monitor has been used in the operating room during general anesthesia to gauge patients' levels of consciousness. The Bis score is a dimensionless measure from 0 to 100, where 40-60 is considered general anesthesia. The Bis (Aspect Medical Systems) has been marketed as a device that is helpful in decreasing the problem of intraoperative awareness. No previous work has examined the Bis index as a measure of post-anesthesia recovery of normal consciousness. This study aims to determine if the Bis score can predict whether or not a wakeful yet sedated patient has reached a threshold level of consciousness at which they are capable of forming memories.

METHODS: After obtaining informed consent a Bis monitor was left on the forehead of eleven patients following surgery for up to two hours after extubation. The patients in this study were deemed at "high risk" for awareness based on the B-Unaware Trial criteria¹. Every twenty minutes a different phrase was repeated to the patient. At each repetition, the corresponding Bis score was recorded. The following day, the patient was interviewed to determine which phrase(s), if any, he or she freely recalled. The previous day's Bis score corresponding to the first recalled phrase was then identified.

RESULTS: Upon analysis, the Bis scores for the first remembered words fell in the range of 79 to 97 with an average score of 88 and a standard deviation of 6. Furthermore, only six of the eleven patients had recall of any of the phrases and the other five did not demonstrate any correct free recall of the words spoken to them in the PACU. This, in the face of Bis index scores above 90.

DISCUSSION: While the Bis index score of 40-60 intraoperatively is supposed to preclude awareness during anesthesia, little is known about the recovery profile of the Bis index. Specifically, there is no data correlating the Bis index and the ability to form memories (which may or may not be necessary for the development of awareness during anesthesia). The results of this study suggest that taken in isolation, Bis scores well into the 90s frequently are not associated with the ability to form memories in the immediate post-operative period. The Bispectral Index score is highly variable amongst and within patients in the PACU and is not a reliable predictor of memory formation.

REFERENCES: 1. *N. Engl. J. Med.* 358(11):1097-108, 2008.

S-162.

MILD HYPERCAPNIC HYPERVENTILATION WITH THE QED-100™ ATTENUATES AGE-RELATED DIFFERENCES IN EMERGENCY AND RECOVERY FROM SEVOFLURANE ANESTHESIA

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Background: Mild hypercapnic hyperventilation significantly decreases emergence and recovery time from inhaled anesthesia in relatively younger patients (1-4). The effect of that in elderly patients has not yet been clarified. Therefore, we examined the age-related effect of mild hypercapnic hyperventilation on emergence from inhaled anesthesia.

METHODS: We enrolled 28 patients aged 45-64 yrs and 28 patients aged over 65 yrs with ASA physical status I - II scheduled for elective ophthalmic surgery. Induction and maintenance of anesthesia were standardized with a protocol consisting of remifentanyl, propofol, vecuronium, and 1.5% sevoflurane in air/O₂. To develop mild hypercapnic hyperventilation, we used the QED-100™ (Anecare Laboratories, Inc.) according to previous reports (1, 3). Patients were randomly assigned to a control or QED-100™ group for each age group. The minute ventilation in the QED-100™ group was doubled during emergence. The QED-100™ includes a re-breathing circuit to maintain hypercapnia, and a charcoal filter to absorb anesthetic vapor. In the control group, we left the minute ventilation unchanged. We recorded the following time from discontinuing sevoflurane to recovery, respiratory and hemodynamic parameters, BIS number, and complications after emergence.

RESULTS: The times to adequate response, extubation and leaving the operating room were shorter in the QED-100™ group ($P < 0.05$). The decrease of time to adequate response in elderly patients, 41.5%, was larger than that in middle-aged patients, 27.5%. In the control group, the elderly patients required more time to each event than the middle-aged patients ($P < 0.05$). Figure 1 shows the linear regression analysis of time to adequate response and age. The QED-100™ significantly deleted age-related changes in emergence time. During emergence the time-response, BIS curves were sigmoidal. The QED-100™ shifted the sigmoid curve to the left in both the middle-aged and elderly groups. There were no statistically significant differences in hemodynamics or complications.

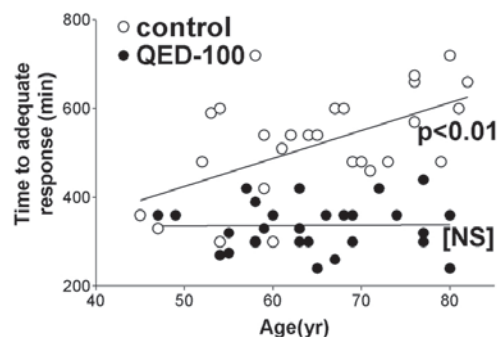


Figure 1. Linear regression analysis of time to adequate response and age

DISCUSSION: Since all patients inhaled the same concentration of sevoflurane, emergence in the elderly patients was slower due to age-related decreases in MAC-awake. However, the QED-100™ attenuated these age-related changes in recovery time and BIS. Mild hypercapnic hyperventilation may show increased benefit for elderly patients.

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1. Sakata DJ, Gopalakrishnan NA, Orr JA, White JL, Westenskow DR. Hypercapnic hyperventilation shortens emergence time from isoflurane anesthesia. *Anesth Analg* 2007; 104:587-91.
2. Gopalakrishnan NA, Sakata DJ, Orr JA, McJames S, Westenskow DR. Hypercapnia shortens emergence time from inhaled anesthesia in pigs. *Anesth Analg* 2007; 104:815-21.
3. Sakata DJ, Gopalakrishnan NA, Orr JA, White JL, Westenskow DR. Rapid recovery from sevoflurane and desflurane with hypercapnia and hyperventilation. *Anesth Analg* 2007; 105: 79-82.
4. Katznelson R, Minkovich L, Friedman Z, Fedorko L, Beattie WS, Fisher JA. Accelerated recovery from sevoflurane anesthesia with isocapnic hyperpnoea. *Anesth Analg* 2008; 106: 486-91.

S-163.

TOWARDS VALIDATION OF INADEQUATE ANALGESIA BY FACIAL GRIMACE RESPONSES TO SURGICAL STIMULATION DURING GENERAL ANESTHESIA

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INTRODUCTION: A validated signal of analgesia may add to anesthetic monitoring. Changes in the relative activation of muscles of facial expression during painful stimulation have been previously demonstrated at up to 95% T1 depression during neuromuscular blockade (1). Pupil size increases during painful stimulation during anesthesia (2). We asked if, during surgery, a grimace response compared to non-grimace changes in patterned facial activity would show changes in pupil size.

METHODS: The present study was designed as a **cross-validation** of **pupil size** and **patterned facial response** during lower abdominal surgery. Facial muscle activity was measured using 5 second epochs of integrated voltage spontaneous surface EMG from the corrugator (C), frontalis (F), orbicularis oculi (O) areas. After differential amplification with both active electrodes 1 cm apart and an active ground, these three independent signals were sent to a microprocessor to compute the Ratio2 algorithm: $(C-F) + (O-F) / (C+2F+O) \times 100$. The resulting scale has a zero midpoint meaning equivalent voltages among the three muscle areas. Numbers above zero indicate higher activity of the C and/or O areas relative to F area, i.e. toward grimacing. Numbers below zero indicate relatively higher F activity than C and/or O.

64 patients consented to have facial muscle monitoring recorded during anesthesia. Pupil size (PS) measurements were made every 15 minutes and after 1 minute of Ratio2>+20 using the NeuroOptics handheld pupilometer.

Prior to induction patients received midazolam + fentanyl. Induction with propofol followed by muscle relaxant facilitated endotracheal intubation. Anesthesia was maintained with desflurane (no nitrous oxide) and fentanyl with supplemental muscle relaxation. All vital sign and anesthetic data were captured automatically by CompuRecord for later integration into the database.

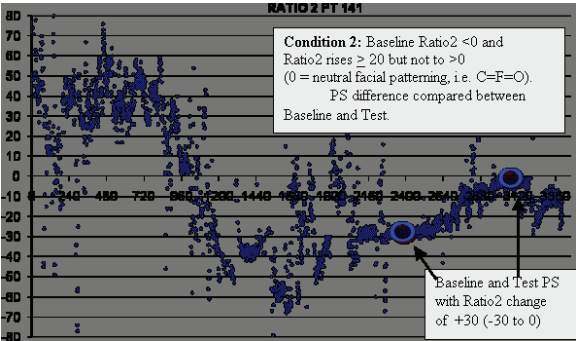
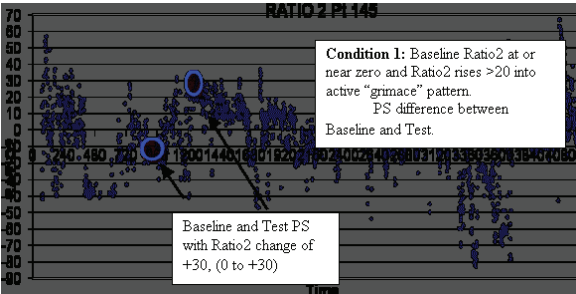
RESULTS: *Condition 1:* Blind raters selected the episodes with PS recordings when Ratio2 >+20 for > 1 minute. Baseline PS (Ratio2 ≤ 0) measurements during an immediately prior period was used as the PS comparison (within subjects changes in PS) (Fig 1). *Condition 2:* Blind raters separately chose data records with PS recordings where Ratio2 had risen >+20 but finished not >0 (see Fig 2).

Condition 1 (n=28) was compared to Condition 2 (n=15) for changes in PS. Pupil size **increased** in Condition 1 (+0.20 mm) and **did not increase** in Condition 2 (-0.10 mm) (p= 0.03). See Table 1.

DISCUSSION: These comparisons are a strong test of whether nociception (PS dilation) requires an activation of grimacing (greater C and O than F activity) or an equivalent change in patterning without grimacing. These data suggest that active grimacing patterning (basal ganglia) is accompanied by pupil dilation whereas equivalent changes without grimacing is not.

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1. Memory and Awareness in Anaesthesia IV, 2000, London: Imperial College Press, pp. 41-52.
2. *Anesth Analg*, 1993;76:1072-8.



Change from Baseline to Test in Conditions 1 & 2

Change in:	Condition 1 (st.dev) (n=28)	Condition 2 (n=15)	p =
Heart rate (bpm)	+ 1.2 (12.1)	- 6.2 (12.4)	n.s.
Systolic blood pressure (mm/Hg)	- 1.6 (14.6)	+ 0.64 (23.0)	n.s.
End tidal Desflurane (%)	+ 0.23 (1.36)	- 0.03 (1.19)	n.s.
Pupil size (mm)	+ 0.19 (0.43)	- 0.35 (1.03)	.03

S-164.

CORRELATION OF BASELINE BISPECTRAL INDEX SCORE AND CHRONIC USE OF SEDATIVE AND PAIN MEDICATIONS

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INTRODUCTION: The bispectral index (BIS) monitor is a method of anesthesia monitoring that reports consciousness based on EEG recordings. Use of the monitor may have value in preventing anesthesia awareness (AA) during the administration of general anesthesia.^{1,2} Although readings taken during general anesthesia have been used to evaluate the use of BIS in the prevention of AA, no study has assessed whether preoperative BIS readings may vary in the population and thus require consideration when designing a BIS target range for general anesthesia. To evaluate whether chronic use of pain and sedative medications affect baseline BIS, we compared groups of patients with significant histories of benzodiazepine or opioid use to patients without a history of use of either of these medications.

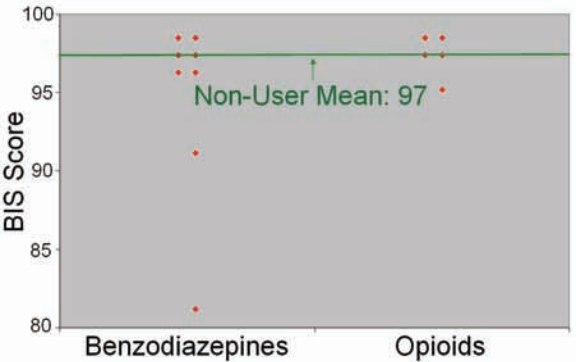
METHODS: Twenty-eight patients were screened as part of the BAGRECALL study of patients at high risk for AA using criteria from the B-Unaware trial.² Patients were considered users of benzodiazepines or opioids if they reported taking the respective medication regularly at their preoperative assessment. Each patient was connected to a BIS Vista™ monitor (Aspect Medical Systems, Norwood, MA) via a BIS Quatro™ Sensor (Aspect Medical Systems) placed on the forehead. Preoperative readings were recorded before the administration of any drugs and were monitored over time to ensure stability.

RESULTS: In patients without a history of chronic benzodiazepine or opioid use, the mean baseline BIS score was 97 (n=15; 95% confidence interval [CI], 96 - 97). The mean in patients chronically using benzodiazepines was 94 (n=8; 95% CI, 90 - 98) and the mean in patients chronically using opioids was 97 (n=5; 95% CI, 96 - 98). Figure 1 shows single patients in each group represented as individual points with the arrow pointing to the mean of non-user patients. Neither the difference between the control and benzodiazepine groups nor the difference between the control and opioid groups were significant (p=0.12 and 0.42, respectively) using two-tailed, unpaired t-tests.

DISCUSSION: Chronic pain or sedative medication use does not appear to alter baseline BIS. The benzodiazepine users display a trend toward a lower baseline BIS, but with the current data this trend is not significant.

REFERENCES:

1. Lancet 2004, **363**(9423):1757-63.
2. N Engl J Med 2008, **358**(11):1097-108.
We would like to acknowledge the funding support of FAER in the ongoing BAGRECALL study.



S-165.

A HEAD TO HEAD COMPARISON OF STRYKER SNAP II AND BIS VISTA INDICES DURING ANESTHESIA AND AT AWAKENING

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AFFILIATION: ¹Anesthesiology, The Ohio State University, Columbus, OH, ²The Ohio State University, Columbus, OH.

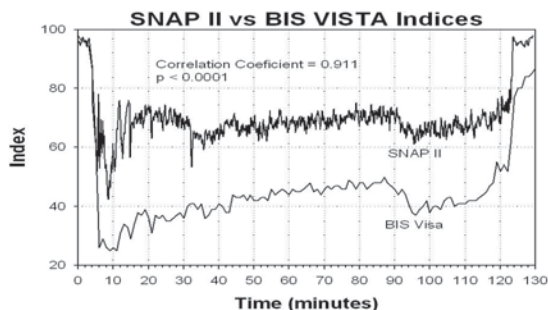
INTRODUCTION: Closely monitoring and accurately predicting level of consciousness during anesthesia is beneficial to both the physician and the patient. In this study we compared the SNAP II (Everest Biomedical Instruments, Chesterfield, MO) and BIS VISTA (Aspect Medical Systems, Newton, MA) indices, head to head, during isoflurane anesthesia to determine which indicator was more sensitive to the return to the baseline value taken prior to induction. This study was modeled after Wong et al. (see reference) which compared the SNAP II and the BIS XL.

METHODS: With institutional approval and written informed consent 25 subjects received isoflurane during abdominal surgery while standard SNAP II and BIS VISTA monitors were applied to the subjects' forehead. Prior to surgery, baseline values for both the SNAP II and BIS VISTA monitors were obtained and the indices were recorded throughout the surgery in order to compare the indices and to determine which metric had a quicker return to baseline. Each monitor reports level of consciousness on a 0-100 scale, with 100 being fully conscious. We performed Bland-Altman analysis on the data from the monitors and determined the time it took for each monitor to return to within 2 standard deviations (95% confidence interval) of baseline value following suspension of anesthesia.

RESULTS: Here we report the results of one representative case. The two indices were correlated ($r=0.911$, $p<0.0001$). We found that there was a systematic difference between the two indices with the BIS VISTA always lower in value than the SNAP II at any point during the case (see figure). In all 25 cases studied, the SNAP II reached its baseline window before the BIS VISTA (Median=6.3min 25th %tile=1.6min 75th %tile=8.4min v Median=9.5min 25th %tile=8.1min 75th %tile=15.3min, $p=0.003$). In fact the BIS VISTA never reached its baseline window before extubation and the end of the study in the 25 cases studied.

DISCUSSION: Although the SNAP II and BIS VISTA both measure the state of consciousness and are well correlated, there is a clear systematic difference between the indices and, therefore, the monitors are not directly interchangeable. The SNAP II returned to its baseline window faster than the BIS VISTA. That does not necessarily mean that the SNAP II is more sensitive than the BIS VISTA to unintentional awareness. This result may be strictly a mathematical phenomenon since the SNAP II reports per second data while the BIS VISTA reports moving-averaged data per minute. The moving average process acts like a low pass filter that will smooth the data over time and attenuate rapid changes in the index.

REFERENCES: BJA 2006; 97:181-6



S-166.

THE BISPECTRAL INDEX APPROPRIATELY IDENTIFIES PATIENTS WITH BENZODIAZEPINE TOLERANCE

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INTRODUCTION: The bispectral index (BIS) monitor is an electroencephalograph-based method of anesthesia monitoring that may have value in preventing anesthesia awareness (AA) during the administration of general anesthesia.^{1,2} Little work has been done, however, on the use of BIS in the preoperative setting. To determine if BIS could be used to assess the effect on consciousness of preoperative benzodiazepines, as well as quantify the effect of tolerance on BIS score, we compared the effect of midazolam on the BIS score of patients with and without a significant history of benzodiazepine use.

METHODS: Twenty-eight patients were screened within the larger BAGRECALL study using criteria from the B-Unaware trial² specific for patients at risk for AA. Patients were considered benzodiazepine users if they were taking prescription benzodiazepines regularly at preoperative assessment. Each patient had a BIS Quatro™ Sensor (Aspect Medical Systems, Norwood, MA) placed on his or her forehead attached to a BIS Vista™ monitor (Aspect Medical Systems). Baseline BIS score was noted before the administration of any drugs, and another reading was taken three minutes after the administration of midazolam. The difference between the readings before and after midazolam was used to compare the effect of midazolam on consciousness.

RESULTS: The mean reduction of BIS score in non-users was 15, from 97 to 82 (n=20; 95% confidence interval [CI], 12-19), compared to a reduction in users of 8, from 94 to 86 (n=8; 95% CI, 3-13). The difference in mean was significant on a two-tailed, unpaired t-test ($p=.02$).

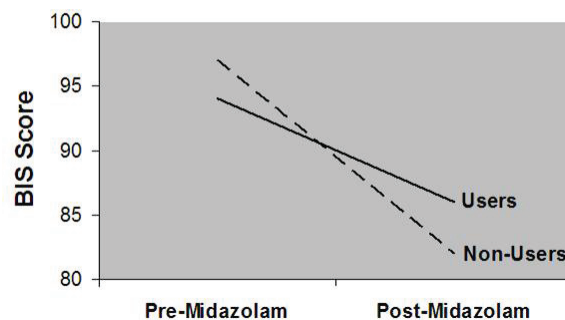
DISCUSSION: BIS score appears to quantitatively reflect tolerance to benzodiazepines. Taking tolerance into account when administering anesthesia may be important in the prevention of AA due to the variability this may introduce into the BIS target range for general anesthesia.

REFERENCES:

1. Lancet 2004, **363**(9423):1757-63.
2. N. Engl. J. Med. 2008, **358**(11):1097-108.

We would like to acknowledge the funding support of FAER in the ongoing BAGRECALL study.

Mean Effect of Midazolam on BIS



S-167.**VARIATION OF THE CEREBRAL STATE INDEX DURING CAROTID CROSS-CLAMPING IN PATIENTS UNDERGOING CAROTID ENDARTERECTOMY**

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BACKGROUND: A risk during carotid endarterectomy (CEA) is cerebral ischemia due to clamping of the carotid artery. The Cerebral State Monitor (CSM, Danmeter A/S, Odense, Denmark) is a level of consciousness monitor that generates the parameter cerebral state index (CSI), which is derived from the electroencephalogram. The monitor reports CSI on a 0-100 scale, with 100 being fully conscious. The CSM is also marketed as a depth of anesthesia monitor. The CSM is a lower cost alternative to other EEG single-index monitors on the market today (reference). In this head-to-head pilot study we compared the CSI measured from the surgical and control hemispheres of patients undergoing CEA surgery to determine if the neurologic state of the patient changes during the procedure.

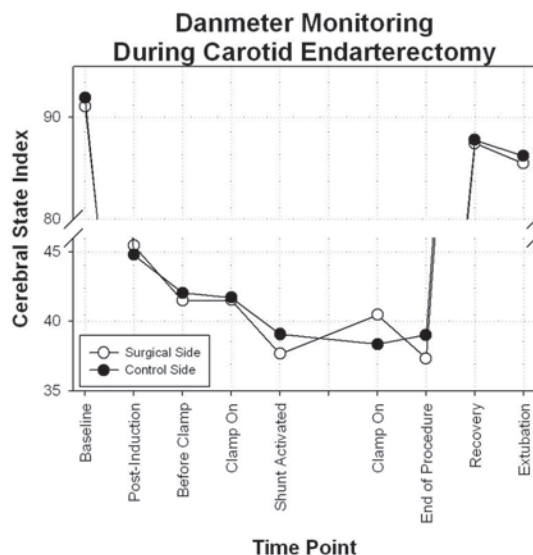
METHODS: With written informed consent eight patients undergoing carotid endarterectomy surgery entered the study. A CSM electrode set was placed on both the left and right side of the patient's head. Each electrode set was attached to a CSM, so that CSI measurements from both hemispheres - control (nonsurgical) hemisphere and surgical hemisphere - could be recorded simultaneously with the patients as their own control. We recorded CSI continuously (once per second) during the surgical procedure beginning from prior to anesthesia (baseline) to extubation. The surgical-side data were compared to the control-side data with particular focus on the point in time when the surgical side carotid artery was initially clamped (induced cerebral ischemia) and when the shunt was placed and activated (cerebral reperfusion).

RESULTS: The figure discloses the results of the study. There was a close agreement between the CSI from the surgical and control hemispheres from baseline to the application of the surgical-side clamping of the carotid artery. Clamping caused the surgical-side CSI to drop below the control-side CSI. Shunt activation, which restored blood flow to the surgical-side hemisphere, caused the CSI to rise above control. Reclamping the carotid at the end of the procedure caused the surgical-side CSI to again drop below the control-side CSI. The surgical- and control-side CSI remained in agreement throughout recovery and extubation. The control-side CSI was unaffected by clamping and shunting.

DISCUSSION: This early result with eight patients suggests that the CSI may indicate changes in cerebral blood flow and the monitor may also have value as a noninvasive indicator of neurologic state. It is not possible to draw any conclusions as to whether the monitor is measuring the effects of ischemia and reperfusion. We performed a power analysis (with power=0.8) using our data and determined that our study, as designed, would require a total of 45 patients to determine statistical significance at p=0.05.

REFERENCES:

British J Anaesth 2007;98(5):645-648



S-168.

COMPARISON OF INTRAOPERATIVE EARLOBE AND FOREHEAD PULSE OXIMETRY MONITORING IN VASCULAR SURGERY PATIENTS

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INTRODUCTION: Sensors for measuring peripheral oxygen saturation (SpO₂) are typically placed on a finger, and are dependent on pulsatile flow. Continuous SpO₂ monitoring may be compromised, however, in patients with peripheral vascular disease secondary to poor perfusion. SpO₂ can now be measured from a reflectance sensor placed on the forehead, where superficial blood flow is high (1). This new sensor may be more effective than traditional sensors in patients with poor peripheral perfusion since the forehead is resistant to adrenergic responses (2). We compared the forehead and ear (reportedly more reliable than the finger [3]) sites for SpO₂ monitoring, to evaluate their performance in vascular surgery patients.

METHODS: Following IRB approval, the Nellcor MAX-fast forehead probe and a Masimo SET earlobe probe were used to simultaneously and continuously monitor SpO₂ following induction of anesthesia in patients undergoing vascular surgery. Patients remained supine, and their anesthetic care was left to the discretion of the anesthesiologist. Arterial blood gases (ABG) were measured as clinically indicated. Data from the two sites was compared using Bland-Altman analysis.

RESULTS: Time paired SpO₂ data from both probes was collected from 20 patients for a total of 3,992 data pairs, with SpO₂ ranging from 85% to 100%. Neither probe site failed to display SpO₂ for more than 1 minute. All SaO₂s obtained from the ABGs were >97%, which closely matched the corresponding SpO₂s. A Bland-Altman analysis of the two sites showed a bias of 0.7% and limits of agreement of -2.6% to +4.0% (95% of data falling within this range). Figure 1 shows the Bland-Altman plot. Figure 2 suggests that the forehead site tended to yield higher values at lower (<93%) SpO₂, while the ear tended to display higher readings at higher (>92%) SpO₂.

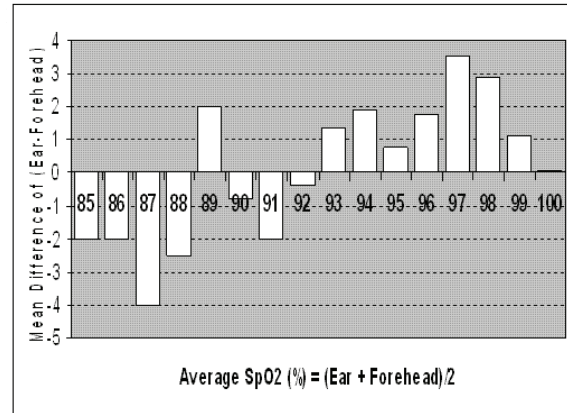
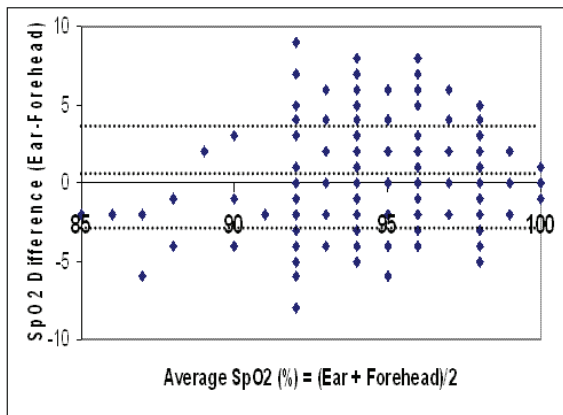


Figure 2

DISCUSSION: There is clinically acceptable concordance, and low observed sensor failure rates of the ear and forehead SpO₂ sites in patients undergoing vascular surgery. Our study was limited by a small number of low SpO₂ values, and a lack of correlation with true SaO₂ data from ABGs (since samples were not always available during mild transient hypoxemic episodes). Additional studies are needed to further delineate the discrepancies between the two monitors at lower SpO₂. Correlation with ABG at such times may be beneficial in determining which monitor performs better in vascular patients with poor perfusion.

REFERENCES:

- 1) Evaluation of a New Pulse Oximeter Sensor. American Journal of Critical Care 2007;16(2):146-152.
- 2) Comparison of forehead and digit oximetry in surgical/trauma patients at risk for decreased peripheral perfusion. Heart and Lung 2007;36(3):188-194.
- 3) Different Responses of Ear and Finger Pulse Oximeter Wave Form to Cold Pressor Test. Anesthesia and Analgesia 2001;92:1483-6.

S-169.**HIGH RESOLUTION PULSE OXIMETRY (HRPO) PATTERNS CORRELATE WITH AIRWAY OBSTRUCTION DURING VIDEO SLEEP ENDOSCOPY**

AUTHORS: C. B. Hunter¹, M. B. Gillespie², H. Moore², H. Beeson², F. J. Overdyk²;

AFFILIATION: ¹Anesthesia and Perioperative Medicine, Medical University of South Carolina, Charleston, SC, ²Medical University of South Carolina, Charleston, SC.

INTRODUCTION: Obstructive sleep apnea (OSA) confers perioperative risk, mandating improved preoperative recognition. HRPO differs from conventional pulse oximetry in having greater SpO₂ resolution (1%), and a shorter averaging time (1 sec). We have previously demonstrated that characteristic desaturation patterns (SatCycles) temporally correlate with airway obstruction during polysomnography.¹ Since the mechanism of upper airway collapse during sedation and sleep are often related², a fiberoptic may be used to identify the anatomic location of airway obstruction prior to sleep surgery in spontaneously breathing patients under deep sedation. We investigated whether SatCycles apparent on HRPO correspond to visual evidence of airway obstruction during videotaped sleep endoscopy.

METHODS: Patients identified by an otolaryngologist as candidates for radiofrequency ablation of airway structures to correct symptomatic OSA provided written informed consent. Patients wore a Konica-Minolta 300i HRPO at home for one night of sleep prior to surgery. The HRPO tracings were analyzed for the presence and duration of SatCycles, defined as a rapid, sinusoidal variation in SpO₂ (Figure 1). Berlin Questionnaire, Epworth Sleepiness Scale (ESS), Mallampati, BMI, and coexisting medical conditions were also recorded. Patients were induced with propofol/fentanyl/versed to a target bispectral index range of 50-70. (BIS; Aspect™ Med Systems). Spontaneous ventilation was maintained and sufficient oxygen was provided by an orally-placed nasal cannula to maintain a target SpO₂ in the 90-100% range. HRPO and audio (snoring) were recorded from the onset of sedation to completion of sleep endoscopy, whereas video was recorded during endoscopy only.

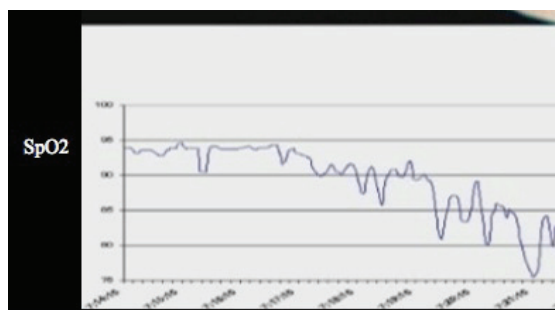
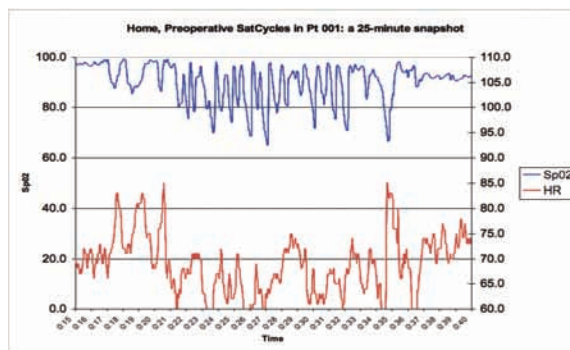
RESULTS: Nine adult patients were enrolled in the study, with mean BMI of 32, ESS of 12.5, Mallampati of 2.7, and all subjects were categorized as “high risk” for OSA by the Berlin Questionnaire. All subjects demonstrated preoperative, home SatCycles, with a mean duration of 90 min. SatCycle patterns were noted during periods of snoring prior and during video endoscopy (Figure 2). The anatomic location of the partial (snoring) and total airway obstruction during video endoscopy was found to occur at a variety of sites, including soft palate, lateral pharyngeal wall, tonsils, base of the tongue, and epiglottis. HRPO desaturation patterns accompanied these episodes of airway obstruction in all patients.

CONCLUSIONS: This study provides qualitative evidence, independent from sleep lab data, that distinctive HRPO patterns temporally accompany airway obstruction in patients with OSA. Further research will determine if quantification of the patterns (depth, duration, recovery) has predictive value for the degree and anatomic location of OSA, and can assign risk of perioperative respiratory complications in patients with sleep disordered breathing.

FOOTNOTES

¹ Overdyk FJ et. al. High Resolution Pulse Oximetry Detects Airway Obstruction-Screening Implications for OSAS. A1245, 2008.

² Eastwood PR et.al. Comparison of upper airway collapse during general anesthesia and sleep. The Lancet. 359: 1207-09. 2002 Apr.



S-170.

NEW PULSE COOXIMETER PROVIDES IMPROVED NON-INVASIVE MEASUREMENT OF HEMOGLOBIN

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AFFILIATION: ¹University of California Irvine Medical Center, Orange, CA, ²Anesthesiology, University of California Irvine Medical Center, Orange, CA.

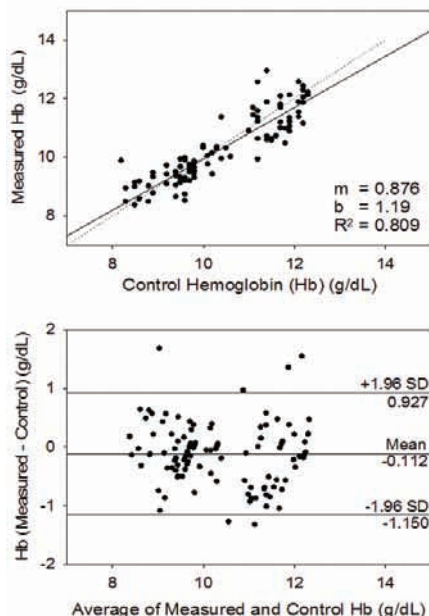
INTRODUCTION: Measurement of hemoglobin (Hb) concentration is an essential clinical tool that guides blood transfusion in surgical patients. Noninvasive hemoglobin measurement is an attractive modality that precludes vessel puncture, avoids exposure to blood and the hemoglobin analyzer, and improves patient comfort. Noninvasive hemoglobin measurement provides immediate and continuous data. Currently, the noninvasive Pulse Cooximeter¹ provides an accuracy of ± 1.0 g Hb/dL of blood¹. In this study, we test an improved instrument prototype with an increased signal-to-noise ratio performance.

METHODS: After IRB approval and informed written consent, we studied 9 patients undergoing surgery. These patients had arterial catheters placed for their primary anesthesia care. Noninvasive hemoglobin measurements were taken every 15 minutes by 3 prototype multi-wavelength blood constituent monitors (Masimo Labs, Irvine, CA). At the same time, arterial blood samples were drawn and analyzed with a standard blood analyzer (ABL800, Radiometer, Copenhagen, Sweden).

RESULTS: A total of 111 measurements were analyzed over a hemoglobin range of 8-12 g/dL. Average error was $0.91 \pm 5.11\%$, which corresponds to 0.11 ± 0.53 g Hb/dL of blood. For linear regression (figure, upper panel), slope, Y-intercept and R^2 were 0.876, 1.19 and 0.809 respectively. Limits of agreement (± 1.96 SD) were -0.11 ± 1.04 g/dL (figure, lower panel).

DISCUSSION: Compared to control values, this new prototype demonstrated accuracy of 0.11 ± 0.53 g/dL, better than the accuracy of the first generation Pulse Cooximeter (± 1.0 g/dL). However, we predict that with a much bigger sample size the actual accuracy will be in the range of ± 0.7 g/dL. We believe that non-invasive Pulse Cooximetry measurement of Hb is revolutionary and a valuable tool for clinical management in and out of the operating room. We plan further studies with a larger sample size over a wider hemoglobin range.

REFERENCES: 1. Curr Opin Anaesthesiol, 2008; 6: 805-10



S-171.

EFFECT OF PRELOAD CHANGES ON PLETH VARIABILITY INDEX DURING LIVER TRANSPLANTS

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AFFILIATION: ¹Anesthesia and Perioperative Medicine, UCSF, San Francisco, CA, ²UCSF, San Francisco, CA.

INTRODUCTION: Pleth Variability Index (PVI) is a measure of the dynamic changes in perfusion index (PI) that occur during the respiratory cycle. These variables are derived from the infrared light absorption waveform of a pulse oximeter (photoplethysmography). Theoretically PVI should reflect changes in intravascular fluid volume (preload). Reduction in preload should increase respiratory cycle induced changes in peripheral perfusion (increase PVI). The aim of this study was to determine if PVI would respond to acute preload changes during liver transplant operation.

METHODS: PVI and PI and pulse rate (PR) data were downloaded every 2 seconds from Masimo Radical 7 pulse oximeters. Data from 16 consecutive liver transplant operations were used for analysis. Data were extracted for three different epochs: 1) immediately before clamping (10 min average), 2) average during clamping, and 3) immediately after unclamping (10 min average) of the inferior vena cava (IVC). Student's t tests were used to analyze data. Data are mean \pm SD.

RESULTS: PVI increased in all individuals in response to IVC clamping (from 11.4 ± 4.3 to 25.2 ± 4.4 , $p < 0.0001$) and decreased in all individuals after unclamping (from 25.2 ± 4.4 to 8.9 ± 3.8 , $p < 0.0001$). PVI changed rapidly in response to clamping and unclamping of IVC. PI decreased from 2.9 ± 0.7 to 1.0 ± 1.4 , ($p < 0.0001$) in response to clamping and increased from 1.0 ± 1.4 to 1.9 ± 0.6 ($p < 0.0001$) after unclamping of the IVC. Clamping and unclamping of the IVC had no effect on PR.

DISCUSSION: These data demonstrate that PVI changed significantly in response to known acute changes in preload (clamping and unclamping of IVC). The decrease in PI during IVC clamping most likely reflects reduction of stroke volume and use of vasoactive drugs. These data suggest that PVI may have a role in monitoring intravascular volume in mechanically ventilated patients. Ongoing intraoperative studies will evaluate the clinical utility of PVI to assess intravascular fluid volume noninvasively.

S-172.**ORAL PLACEMENT OF THE PRO2 OXIMETER™****AUTHORS:** J. M. Berman;**AFFILIATION:** Anesthesiology, University of North Carolina, Chapel Hill, NC.**MATERIALS & METHODS:** The Pro2 reflectance oximeter™ (ConMed, Ithaca, NY) is currently approved for surface monitoring of SpO₂. This observational study was undertaken to determine the viability and safety of oral placement for monitoring SpO₂.

Institutional Review Board approval was obtained & data was on 46 patients undergoing excision or debridement and grafting of burns. The first 10 patients constituted a pilot study. Functionality was based on the ease of placement of the probe by the observers. Reliability was judged by comparing simultaneous SpO₂ readings from a Nellcor pulse oximeter (Tyco Healthcare, Pleasanton, CA). In the subsequent 36 patients simultaneous comparisons of both oximeters & co-oximetry data were made.

DEMOGRAPHICS: All subjects were patients in a university regional burn center. Age ranged from 1.5 to 78 years (mean age 43). Burn size ranged from 12% to 62% TBSA (mean burn 26.2 %). Males outnumbered females 34 to 12.**RESULTS:** The pilot study demonstrated that once the sensor was adequately positioned both oximeters consistently provided similar SpO₂ readings in all patients. To date we have analyzed 60 data sets using Two-Sample T Test. Data was judged consistently reliable in 44 of 46 patients. There was statistical difference between Co-oximetry saturation and the Nellcor value ($P = 0.008$) but no difference between Co-oximetry the PRO2 and ($P = 0.248$).

Variable	N	Mean	SE Mean	St Dev	Variance	CoefVar
Pro2	60	98.53	.23	1.75	8.136	2.91
Nellcor	60	99.28	.184	1.427	2.037	1.44
ABG	60	98.502	.226	1.749	3.059	1.78

DISCUSSION: The PRO2 reflectance oximeter is insertion into most oral cavities. The technical design and robust characteristics permit reliable function in the mouth. Positioning the sensor became more efficient over the course of the pilot study. It consistently yields reliable SpO₂ information in a patient population known to be fraught with challenges to SpO₂ monitoring.

Photoemission and detection are similar in all oximeters but their configuration on the small Pro2 sensor permit accurate monitoring in the oral cavity (Fig 1). The 3 photo emitters and 2 detector rings capture four SpO₂ values for computation per displayed measurement. These characteristics may translate to higher sensitivity even in low flow states.

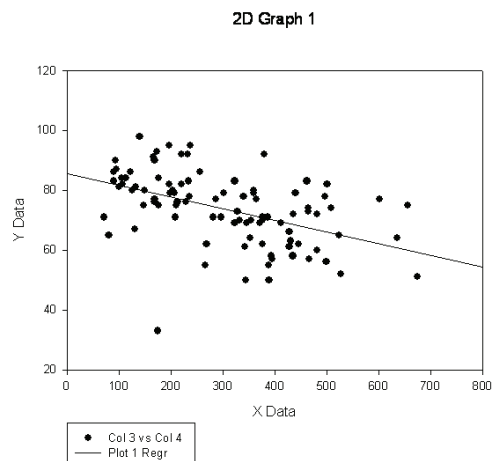
Difficulties with probe placement or reliability mostly occurred in the pilot evaluation & are now rare.

CONCLUSION: Oral placement of the PRO2 oximeter has thus far proved to be reliable and safe in children and adults undergoing excision and grafting of burns. Our evaluation continues and an expanded study in patients in low flow states is warranted and planned.**REFERENCES:**

1. Anaesthesia 2002;57:442-5
2. Anesth & Analg 2002; 94 (15):S26-30
3. MacLeod et al Anaesthesia 2005;60:65-71
4. Keogh,BF, Kopotic RJ, Curr Opin Anesthesiol 2005; 18:649-654

S-173.**BIS DOSE NOT CORRELATE WITH EFFECT-SITE CONCENTRATION OF MIDAZOLAM****AUTHORS:** M. Uchida¹, T. Nishikawa², K. Takeda³;**AFFILIATION:** ¹Anesthesiology, Saitama Kyoudou Hospital, Kawaguchi, Saitama, Japan, ²Anesthesiology, Saitama Kyoudou Hospital, Kawaguchi, Saitama, Japan, ³Fujita Health University, Department of Anesthesiology, Toyoake, Aichi, Japan.**INTRODUCTION:** Bispectral Index (BIS) is a reliable parameter indicative of sedation level. We previously reported that propofol suppressed the amplitude of motor-evoked potentials (MEPs) markedly in patients who had preoperative motor-deficits in upper or lower extremities (1) and midazolam could be substitute for propofol in these patients, because midazolam did not show any suppressive effect to MEPs' amplitude (2). However, we found out that BIS was kept relatively high values during midazolam anesthesia. So we hypothesized that BIS did not correlate with effect-site concentration of midazolam (mCe).**METHODS:** This study protocol was approved by the local ethical committee. Fourteen patients undergoing cervical vertebrae surgeries with ASA I or II were included in this study. Induction of anesthesia was performed with plasma target-site concentration of propofol (pCp) at 5 µg/ml, continuous infusion of remifentanyl at the rate of 0.3-0.5 µg/kg/min (γ) and bolus of lidocaine 0.5mg/kg without using muscle relaxant. MEPs was recorded as control at propofol effect-site concentration (pCe) at 2.0 µg/ml. When MEPs' amplitude was very small, propofol infusion was stopped and bolus of midazolam 2-8mg (0.03-0.12mg/kg) was infused, followed by continuous infusion of it at the rate of 4-7mg/kg/h (0.06-0.14mg/kg/h). When a transcranial electric stimulation was given to a patient to facilitate MEPs, bolus of midazolam 1-2mg was infused to avoid patient's awakening due to the stimulation. Remifentanyl was continuously infused at the rate of 0.2-0.6 γ for maintenance. When an operation nearly ended, midazolam and remifentanyl infusion were stopped and BIS was continued to monitor by the end of anesthesia. Propofol was infused in a target-controlled fashion by Diprifusor. pCe and mCe were simulated with TIVAtrainer (version 8). SigmaPlot 10.0 (HULINKS) was used in drawing regression line and three dimensional figure.**RESULTS:** Midazolam could not suppress BIS less than 60 even at high mCe.**DISCUSSION:** BIS dose not correlate with mCe and BIS is not a reliable parameter of the sedation level during midazolam anesthesia. A new device which can monitor sedation level more accurately is necessary to be introduced during midazolam anesthesia.**REFERENCES:** (1) Anesthesiology 2007;107:A1500

(2) Anesthesia & Analgesia 2008;106(3S):S124



S-174.

ANALGESIA-BASED SEDATION USING REMIFENTANIL IMPROVES MONITORING QUALITY OF BISPECTRAL INDEX VALUES DURING MECHANICAL VENTILATION IN THE INTENSIVE CARE UNIT

AUTHORS: K. Iwamuro¹, T. Koitabashi², T. Ouchi², Y. Hamada², E. Takano², R. Serita²;

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INTRODUCTION: Sedation of critically ill patients has several components including hypnosis and analgesia. Although hypnotic-based sedation using propofol or midazolam is commonly used, less analgesics cause frequent occurrence of agitation or arousal. Objective measurement of the hypnotic component using Bispectral Index (BIS) monitor is important to detect deep sedation. However, in light sedation, the contamination of noises decreases the reliability of BIS monitoring quality. The advent of remifentanyl, ultra-short acting opioid, made it possible to perform analgesia-based sedation (ABS). As a result of ABS, both the amount of hypnotics used (1) and the time on mechanical ventilation (2) could be reduced. In present study, we examined whether ABS improved the monitoring quality of BIS during mechanical ventilation.

METHODS: Twelve patients who underwent surgery and required mechanical ventilation post-operatively were enrolled in this study with written informed consent. The eligible patients were divided into following two groups. Patients in the remifentanyl group received remifentanyl (0.1 µg/kg/min) and propofol (1-2 mg/kg/hr). Patients in the control group received propofol (3-4 mg/kg/hr). The depth of the sedation was evaluated by both Richmond Agitation Sedation Scale (RASS) and BIS (A2000-XP, version 4.0, Aspect Medical Systems, Newton, USA). The monitoring quality of sedation was assessed by the correlation between RASS and BIS values.

RESULTS: There was a significant correlation between RASS and BIS values ($R^2=0.67$, $p < 0.05$) in the remifentanyl group, whereas there was no significant correlation in the control group. The sedation level in the control group was liable to underestimate with BIS monitoring.

DISCUSSION: As compared to the control group, the correlation coefficient between RASS and BIS values increased in the remifentanyl group. This improvement of BIS monitoring quality seemed to be brought by the decreased contamination of noises. In conclusion, ABS with remifentanyl makes BIS more precise during mechanical ventilation.

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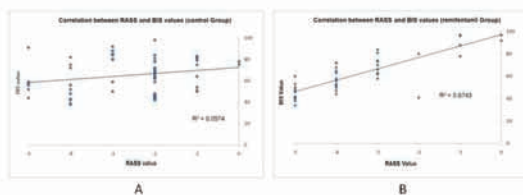


Fig.1

S-175.

KEY STEPS IN TREND ANALYSIS OF DATA FROM STUDIES THAT VALIDATE NEW METHODS OF CARDIAC OUTPUT MEASUREMENT

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INTRODUCTION: Unlike comparing two methods of cardiac output (CO) measurement where Bland and Altman is the accepted statistical approach, no accepted method exists in the literature to show that a device can reliably trend changes in cardiac output (Δ CO). This has recently become increasingly important with the development of new methods of CO measurement, such as pulse contour and Doppler, both methods that provide continuous measurements.

METHODS: We reviewed 150 comparative CO studies published between 1997 and 2007.

RESULTS: Twenty-seven articles addressed the issue of trending and compared serial CO measurements. Several analytical approaches were identified. Eight publications presented the data as plots of CO against time. Ten used the direction of Δ CO, twelve derived the absolute Δ CO and six the percentage Δ CO as measures of trending. Sixteen publications just plotted the Δ CO without any meaningful interpretation. Data analysis were performed by either calculating a trend score from the direction of Δ CO ($n=10$), using a regression plot on a four quadrants plot ($n=7$) or a Bland and Altman plot ($n=5$). In analyzing the four quadrants plot some papers exclude data which fell too close to the central (zero) intercept of the x and y-axis ($n=6$) and some went on to perform a receiver operator characteristic curve analysis to determine an optimal exclusion zone ($n=2$). However, there was little consensus as to how trend analysis should be performed.

DISCUSSION: In reviewing these 27 papers we concluded that experimental design was of paramount importance. Ideally, experimental design should be uniform with a series of data sets being collected after well defined therapeutic interventions. However, this approach is more applicable to animal work and in the clinical arena data collection is more heterogeneous. With heterogeneous clinical data the best approach is to plot the Δ CO for the reference (x-axis) and test (y-axis) methods on a four quadrants scatter plot. Regression analysis gives some indication of trending ability. Degree of deviation from the line of identity ($y=x$) provides some measure of trending, but is heavily dependant on the precision of the reference method. The concordance, or number of data pairs in which the direction of Δ CO agree, provides a more objective measure of trending. When trending is present the concordance rate is high. Unfortunately, data pairs where Δ CO is small often don't agree due to random effects. If study design is bias towards small Δ CO values, the concordance rate is adversely affected. Thus, exclusion of data where Δ CO is a small value is required. Exclusion zones of 0.5 to 1.0 L/min, or 15%, for Δ CO have been used and confirmed by receiver operator characteristic curve analysis. When the concordance rate is greater than 90 to 95% acceptable trending exists.

Liver/Transplantation

S-176.

THE USE OF MILRINONE FOR RAPID IDENTIFICATION AND SAFE MANAGEMENT OF SEVERE PORTO-PULMONARY HYPERTENSION (PPHN) DURING ORTHOTOPIC LIVER TRANSPLANTATION (OLT): A CASE REPORT

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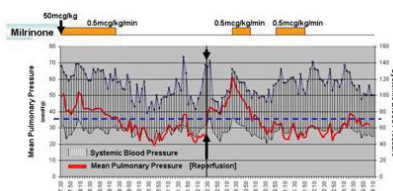
INTRODUCTION: The incidence of PPHN in patients with end-stage liver disease is 5%. ¹ Evidence indicates that proceeding with OLT in patients diagnosed with severe PPHN (mPAP>45mmHg) at the time of OLT surgery is associated with high perioperative mortality. ² We present a case of a patient with ESLD with markedly elevated mean PA pressure (mPAP=51mmHg) diagnosed at the time of surgery. Rapid assessment of reversibility of high PAP with Milrinone aided in the decision to proceed with OLT and contributed to the safe hemodynamic management during the procedure.

CASE REPORT: The patient was a 57 year-old male with hepatitis C cirrhosis who underwent OLT. Pre-transplant cardiac work-up included 2-dimensional echocardiography with estimated PAP of 66/20. A month later the patient presented for OLT. Following induction and Swan Ganz catheterization, PAP was 62/42mmHg (mean of 51mmHg). Calculated pulmonary vascular resistance (PVR) was 361.9 dynes/sec cm⁵. Transesophageal echocardiography (TEE) showed a mildly dilated right atrium and ventricle, and moderate to severe tricuspid regurgitation. All other causes that contribute to high PAP were ruled out. In order to determine the reversibility of high PAP a 50mcg/kg i.v. bolus of Milrinone was administered, that resulted in a decrease of the mPAP to 40mmHg with a re-calculated PVR of 203.64 dynes/sec cm⁵. We then decided to proceed with OLT and continued Milrinone at a maintenance infusion dose of 0.5mcg/kg/min. At this dose mPAP continued to trend downwards to 35mmHg in 2 hours without any significant decrease in systemic blood pressure (Figure 1). At reperfusion, PAP remained low at 45/27mmHg (mean of 30mmHg). However, shortly after reperfusion during the neo-hepatic stage mPAP rose to 61mmHg, and Milrinone was restarted at 0.5mcg/kg/min. PAP responded to Milrinone infusion with a decrease to a mean of 35mmHg. The post-operative course was uneventful and the patient was extubated on the 2nd postoperative day.

DISCUSSION: We describe a case of severe porto-pulmonary hypertension that was diagnosed by right heart catheterization at the time of surgery. We quickly determined reversibility of pulmonary hypertension with a bolus of Milrinone and proceeded with OLT. Further episodes of pulmonary hypertension were successfully managed with continuous Milrinone infusion and TEE monitoring. Reversibility via vasodilator trial after identification of high PA pressures may be an important indication of the feasibility of OLT. Milrinone may be useful for the rapid identification of the reversibility of high PAP and may be an effective agent to control abrupt increases in PAP during OLT.

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S-177.

VOLUME RESUSCITATION WITH HYDOXYETHYL STARCH (HESPA) NORMALIZES HYPERCOAGULATION BY TEG: A CASE SERIES

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INTRODUCTION: A significant number of patients who present for transplantation have a clinically hypercoagulable state.¹ The etiology of hypercoagulability in these patients includes: congenital coagulation disorders, diabetes, malnutrition due to short gut syndrome and chronic hyper-alimentation, and indwelling catheters. As such, these patients pose a significant peri-operative risk for life threatening thrombosis.² Hydroxyethyl starch (HES) is a widely used synthetic colloid with anti-platelet aggregation properties.³ We hypothesized that a fluid resuscitation regimen with HES (>20ml/kg), instead of Albumin or FFP could attenuate hypercoagulation in these patients as determined by TEG, with the potential to reduce thrombosis during and after surgery.

Case 1: A 14-year-old patient presented for an isolated intestinal transplant. Preoperative coagulation studies revealed: Platelets 713K, PT 12.5, and APTT 28.6. Baseline TEG (TEG-1) showed a hypercoagulable state (Figure 1). An infusion of HES was started and serial TEGs were performed at 15 ml/kg HES (TEG-2), 30 ml/kg HES (TEG-3), and after a total cumulative dose of 45ml/Kg HES (TEG-4) (Figure 1A). Fluid resuscitation with HES caused a gradual normalization of the hypercoagulable TEG during the case (Figure 1B). Surgery proceeded uneventfully.

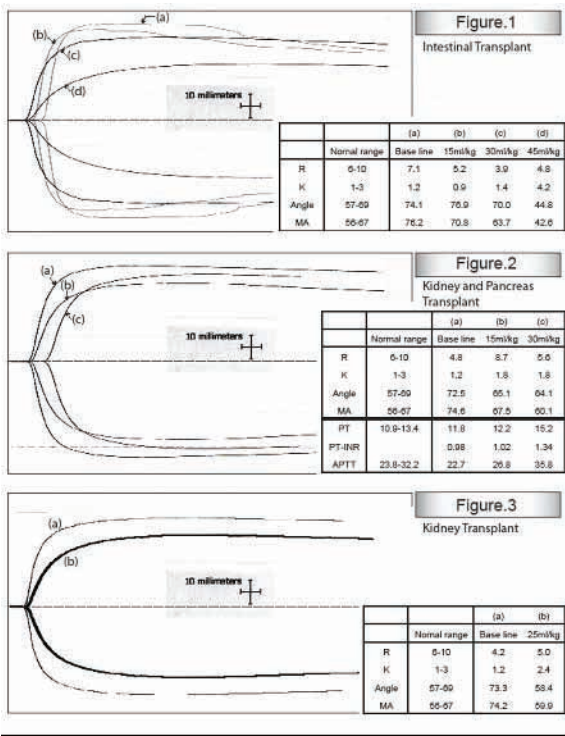
Case 2: A 55-year-old patient presented for combined kidney-pancreas transplantation. This patient had a history of ischemic heart disease and a coronary stent was placed in 2004. Pre-operative laboratory work-up revealed: Platelets 306K, PT 11.8 and APTT 22.7. Baseline TEG [Figure 2(a)] showed a hypercoagulable state. An infusion of HES was started and TEGs were performed at 15 ml/kg HES [Figure 2(b)] and after a total cumulative dose of 30 ml/kg HES [Figure 2(c)]. PT and APTT were also obtained coincident with TEG. Fluid resuscitation with HES caused a gradual reversal of hypercoagulation as evidenced by TEG and coagulation studies during the case (Figure 2). Surgery proceeded uneventfully.

Case 3: A 46-year-old patient presented for kidney transplantation. Pre-operative laboratory work up revealed: Platelets of 236K, PT 12.7 and APTT 27.6. Baseline TEG [Figure 3(a)] showed a hypercoagulable state. An infusion of HES was started and TEGs were performed at 25 ml/kg HES [Figure 2(b)]. Fluid resuscitation with HES caused a gradual reversal of hypercoagulation as evidenced by TEG during the case (Figure 3). Surgery proceeded uneventfully.

DISCUSSION: Transplant recipients often present with a hypercoagulable state. Synthetic colloids such as HES may attenuate this condition by reversing the hypercoagulable state thereby decreasing the likelihood of thrombosis. These preliminary data warrant a longitudinal study to determine whether changes in hypercoagulable TEG induced by high dose HES volume resuscitation can result in a decreased incidence of thrombo-embolism.

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S-178.

THE PORTOSYSTEMIC SHUNT: LIVER TRANSPLANT
MADE EASIER FOR THE ANESTHESIOLOGIST

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INTRODUCTION: The anesthesiologist may be challenged when the classic “piggyback technique” is surgically employed. The surgeon allows a small amount of caval flow to fill the heart as the liver is being sewn in. More often than not, the flow is not enough to maintain hemodynamics. Veno-Veno bypass is a well known technique that assure right heart filling but requires a perfusionist not excluding complications of adding extracorporeal blood flow. We report the use of a portosystemic shunt as the anhepatic phase approaches whereby the portal vein is attached above the vena cava clamp to assure adequate right heart filling and stable hemodynamics.

METHODS: 87 patients were designated to receive an intraoperative portosystemic shunt compared to 50 patients who received the “classic piggy back technique”. The challenges facing the anesthesiologist in terms of blood product administration, vasopressor utilization and hemodynamics during the anhepatic phase were compared.

RESULTS: Patients in the shunt group required fewer instances of cell saver (1.15% of cases vs. 8% of cases) as well as red blood cells (2.3% of cases vs 8% of cases) and those patients who were transfused required less total volume (cell saver: 250+0cc vs. 475+210cc; RBCs 250+0 cc vs. 313+125cc). Additionally, fewer patients in the shunt group required the vasopressors epinephrine (21% of cases vs. 60%), norepinephrine (22% vs. 66%), and phenylephrine (10% vs. 50%), however those patients who did receive vasopressors required statistically similar amounts. There was no statistically significant difference in either mean arterial pressure or heart rate between the two groups.

CONCLUSIONS: The use of a portosystemic shunt reduces transfusion needs and provides increased hemodynamic stability during the anhepatic phase of liver transplant. The costs of perfusionists, not excluding potential complications of veno-veno bypass were avoided. In no cases where portosystemic shunt was employed did the operative time exceed 15 minutes for shunt creation. Potential limitations of this technique include a small portal vein. Further studies comparing portosystemic shunts and veno-venobypass are warranted. There are suggestions in the literature that hemodynamic stability during the anhepatic phase improves primary graft function.

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S-179.

SURVIVAL IN CORONARY ARTERY DISEASE PATIENTS UNDERGOING ORTHOTOPIC LIVER TRANSPLANTATION (OLT)

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INTRODUCTION: Previous studies have reported increased mortality in coronary artery disease (CAD) patients undergoing orthotopic liver transplantation (OLT)¹. We hypothesize that current treatment strategies allow CAD patients to undergo OLT with minimal increase in risk.

METHODS: A retrospective review of (977) patients who underwent OLT at a major transplant referral center during a 55 month period (ending June 2008) revealed 115 patients who had left cardiac catheterization (LHC) prior to OLT, based upon a preoperative assessment algorithm. Catheterization results were categorized as positive ($\geq 50\%$ stenosis of any vessel) or negative ($<50\%$ stenosis) for CAD.

RESULTS: 16 of the 115 (14%) LHC patients were positive for CAD and 99 (86%) were negative. There were no differences between the CAD and non CAD groups in gender, MELD score, donor age, warm and cold ischemia times, re-transplantation rate, and h/o DM, HTN, renal failure. The CAD group tended to be older ($p=0.02$) and had a history of hyperlipidemia ($p=0.02$) when compared to the non CAD group. CAD treatment in the 16 patients with CAD consisted of medical management (11, all with $<70\%$ stenosis), percutaneous angioplasty (4), coronary stenting (7) and CABG (3).

Patient survival probabilities were similar between the CAD and non CAD groups. (Fig.1) CAD group: 84% at 6 months, 84% at 1 yr, 73% at 3 yrs. Non CAD group: 86% at 6 months, 80% at 1 year, 75% at 3 yrs Postoperative MI occurred in 9.5% in the CAD group and in 0% in the non CAD group. There was one MI-related death.

DISCUSSION: The incidence of positive angiography was 18% in this review, similar to previously published data in OLT patients. 2,3 Our study demonstrated no difference in post-OLT survival in patients with and without angiography proven CAD. This contrasts sharply from previous data that reported 50% mortality in patients with CAD undergoing OLT.¹

Our results demonstrate a significant improvement in survival in CAD patients undergoing OLT. We hypothesize that the aggressive CAD treatment strategies employed in this high risk patient subgroup are responsible. Further research including prospective studies in the management of CAD in this unique patient population is needed.

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S-180.

INITIAL EXPERIENCE OF CONTINUOUS INTRAVENOUS TREPROSTINIL TO MANAGE PULMONARY ARTERIAL HYPERTENSION IN PATIENTS WITH END STAGE LIVER DISEASE

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Background: Treprostinil is a prostacyclin analog with vasodilatory and antiplatelet properties that is used in the treatment of idiopathic pulmonary arterial hypertension (PAH). There is, however, only limited clinical experience using treprostinil to manage PAH in patients with end stage liver disease (ESLD).

METHODS: Three adult patients who had ESLD with PAH were identified being treated with continuous intravenous (IV) infusion of treprostinil for the last 3 years (1/1/2005 - 1/31/2008). The clinical data were recorded in the prospective manner and they were reviewed and analyzed retrospectively.

RESULTS: A 59 year-old woman with ESLD secondary to alcohol hepatitis had portopulmonary hypertension (PPH) with mean pulmonary arterial pressure (mPAP) of 44 mmHg and transpulmonary gradient (TPG) of 23 mmHg. Continuous IV treprostinil at 45 ng/kg/min for six months decreased mPAP to 23 (TPG to 8). A 53 year-old man had ESLD secondary to alcohol hepatitis with PAH due to multiple pulmonary embolisms [mPAP of 32 and TPG of 23]. Continuous IV treprostinil at 36 ng/kg/min for three months decreased mPAP to 23 and TPG to 14. Both patients underwent uneventful liver transplantation. A 48 year-old man had ESLD secondary to hepatitis C and PPH with mPAP of 60 and TPG of 44. Two years after continuous IV treprostinil at 106 ng/kg/min, his mPAP decreased to 44 and TPG to 30.

CONCLUSIONS: These results suggest that, for a selected group of ESLD patients with PAH, a continuous IV infusion of treprostinil appears to be safe and effective.

S-181.

EVALUATION OF BLOOD GLUCOSE AND ELECTROLYTES DISTURBANCES AMONG BRAIN-DEAD ORGAN PROCUREMENT CANDIDATES - A 2 YEAR STUDY AT MASIH DANESHVARY MEDICAL CENTER, TEHRAN, IRAN

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INTRODUCTION: Blood sugar and Electrolyte imbalances may be very important in care of brain dead, organ procurement donors as well as out come of recipients of organs. precise measure ments and correction of these imbalances directly affect final results of organ donation and subsequent organ transplantations.

METHODS: During a two year period 50 brain dead patients were studied. Electrolytes and Blood sugar were checked early after transporting to hospital and every 6 hours thereafter. Result of Lab. Findings collected and full filled in a questioner and analysed by proper statistical methods.

RESULT: 50 patients studied from an Electrolyte imbalance point of view. Na⁺ disturbance was present at 25 patient (50%), K⁺ disturbance at 4 cases (8-3%), and Ca⁺⁺ disturbance at all (100%) of cases. Cl⁻ & P⁴⁺⁺ disturbance were not clinical importance. (P = 0.118)

22 (44%) cases had normal blood glucose levels all time during pre-procurement care period and 28(56%) cases had some degrees of blood glucose imbalances during this period. (P<0.005) in 5 cases (10%) disturbance presented as both hypo&hyperglycemia. Severe disturbances presented in 16 cases (32%).

CONCLUSION: Blood sugar and Electrolyte disturbances are important factors in care of brain dead patients and can affect short and long -term out come of recipients of procured organs. Due to importance of electrolyte imbalance correction in better out come of transplant organ procurement it seems precise care and early correction of electrolyte imbalances is mandatory at brain dead donors.

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S-182.

THE EFFECT OF OCTREOTIDE ON HEPATIC ISCHEMIC-REPERFUSION INJURY IN RABBIT MODEL

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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 (1). Octreotide has been reported to reduce ischemic-reperfusion injury in the retina (2). This study was designed to investigate the effects of Octreotide on hemodynamics, liver function and inflammatory cytokine levels in a rabbit HIRI model.

METHODS: Twenty four adult New Zealand rabbits were randomly divided equally into 3 groups: sham group(Gr.A), ischemic-reperfusion group(Gr.B) and an Octreotide preconditioning group(Gr.C). The changes in mean arterial pressure (MAP) and heart rate (HR) at the time before ischemia (T1), 15min (T2), 30 min (T3) after ischemia, and 15 min (T4), 30 min (T5), 60min (T6), 120 min (T7), 240 min (T8) after reperfusion were recorded. Alanine aminotransferase (ALT), Aspartate aminotransferase (AST), Lactate dehydrogenase (LDH), Tumor necrosis factor-alpha (TNF-α) and Interleukin-1β (IL-1β) were measured in the serum, while Endotoxin (ETX) was measured in the plasma at T1, T3, T5-T8.

RESULTS: 1. The MAP and HR in Gr. B were lower than in Gr.A from T2 to T6 (P<0.05), while these parameters in Gr.C were lower than in Gr.A from T2 to T4 (P<0.05). However, the MAP and HR were higher in Gr.C compared with those in Gr.B from T2 to T6 (P<0.05).

2. The ALT, AST and LDH levels in Gr.B and Gr.C were higher than in Gr.A from T3 to T8 (P<0.05) with the highest time point at T7, however these parameters in Gr.C were lower than in Gr.B in this period (P<0.05). The ETX in Gr.B and Gr.C was higher than in Gr.A from T3 to T8 (P<0.05), however it was lower in Gr.C than in Gr.B in this period (P<0.05).

3. Both TNF-α and IL-1β in Gr. B and Gr. C increased from T3 and T5, with the peak value at T6 (p<0.05). These levels were, however, significantly lower in Gr. C than in Gr. B for these time points (p<0.05).

DISCUSSION: The current study demonstrated that Octreotide attenuated the hemodynamic changes noted during hepatic ischemic-reperfusion, and maintained liver function. The mechanism may be due to directly preserving hepatocytes, down-regulating the inflammatory cytokine such as TNFα, IL-1β and decreasing the ETX production. Octreotide appears to protect rabbits from hepatic ischemic-reperfusion injury.

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Table 2 The effect of Octreotide on ALT,AST,LDH

	T ₁	T ₂	T ₃	T ₄	T ₅	T ₆
ALT	80.74±13.22	77.95±11.62	83.09±12.05	82.39±12.18	87.31±10.83	87.43±11.81
B	76.57±11.09	99.88±8.85*	192.63±69.67*	239.13±103.28*	277.58±129.48*	228.74±85.81*
(w/L)	75.89±11.59	89.08±10.36**	136.16±48.51**	156.99±57.61**	184.12±78.42**	155.29±63.56**
A	51.21±12.30	50.88±11.18	52.40±14.35	50.75±13.54	51.93±13.49	52.31±11.49
AST	49.95±17.81	83.87±14.67*	174.66±94.84*	301.95±188.51*	582.16±317.70*	337.32±173.59*
B	50.51±11.64	69.79±14.01**	113.79±15.27**	181.94±58.85**	340.18±71.72**	223.59±64.62**
(w/L)	85.05±10.57	83.59±11.82	84.03±13.24	88.16±13.66	87.93±12.49	89.28±12.89
LDH	86.86±17.56	218.99±90.02*	483.55±286.61*	551.72±312.36*	993.71±584.15*	664.37±276.01*
B	96.68±14.14	152.59±55.63**	283.87±138.72**	287.80±105.61**	448.43±91.39**	302.71±206.33**
(w/L)						

S-183.

PROPOSED GUIDELINES FOR MANAGEMENT OF PREOPERATIVE SERUM POTASSIUM IN RENAL TRANSPLANTATION

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INTRODUCTION: The renal system remains primarily responsible for potassium homeostasis unless end stage renal disease is present. Limited information exists in proceeding with surgical procedures when serum potassium is ≥ 5.6 mEq/L^{1,2}. Renal transplant recipients are most often dialysis dependent and frequently demonstrate hyperkalemia. This study evaluated the effect of guidelines for preoperative potassium management in these patients and incidence of intraoperative hyperkalemia resulting in treatment.

METHODS: Retrospective data were evaluated from intraoperative automated anesthesia records of 408 renal transplants performed between April 2005 and September 2008. Preoperative guidelines were for dialysis if potassium > 6 mEq/L in deceased donor recipients or Kayexalate for several days prior to transplant for serial potassium levels > 4.5 mEq/L in living donor recipients. Patients were divided into two groups based on preoperative potassium: Group I had potassium ≤ 5.5 mEq/L and Group II had potassium ≥ 5.6 mEq/L. The incidence of intraoperative treatment (insulin, dextrose, HCO_3^- , Ca^{++} , and/or a diuretic) for hyperkalemia was determined. Group means were analyzed using the unpaired t-test and P-values are two-tailed. Data are presented as mean \pm SD.

RESULTS: The groups were comparable with respect to demographic characteristics. Table 1 summarizes the number of patients, preoperative potassium, peak intraoperative potassium, and incidence of hyperkalemia treatment in each group. 79 of 408 (19%) renal recipients required intraoperative therapy for hyperkalemia.

CONCLUSION: Utilizing the preoperative hyperkalemia guideline management described significantly ($P = 0.0013$) reduced the need for intraoperative hyperkalemia treatment when compared to a previous report of similar groups without guidelines (Table 2)³. No increase incidence of hyperkalemia related morbidity or mortality was identified in either study. These findings suggest a margin of safety exists with renal recipient patients prone to chronic hyperkalemia.

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Table 1

	N	Number (%) Treated for Hyperkalemia	Highest Intraoperative K ⁺
Group I	378		
K ⁺ ≤ 5.5 mEq/L (4.3 \pm 0.6 mEq/L)		75 (20%)*	4.8 \pm 1.0 mEq/L
Group II	30		
K ⁺ > 5.5 mEq/L (5.9 \pm 0.3 mEq/L)		4 (13%)	5.8 \pm 0.1 mEq/L
Groups I + II	408	79 (19%)	

* ($P < 0.001$, Pre vs Highest K⁺ within same group)

Table 2

	N	Number (%) Treated for Hyperkalemia	Intraoperative K ⁺ prior to Treatment
Group I	207		
K = ≤ 5.5 mEq/L (4.7 \pm 0.6)		47 (23%)	5.9 \pm 0.6 mEq/L
Group II	34		
K = ≥ 5.6 mEq/L (6.0 \pm 0.4)		18 (53%)*	6.0 \pm 0.5 mEq/L
Groups I + II	241	65 (27%)	

* ($P < 0.001$, Group II vs Group I needing treatment)

S-184.

CHANGES OVER TIME IN RED BLOOD CELL TRANSFUSION PRACTICE IN ADULTS UNDERGOING ORTHOTOPIC LIVER TRANSPLANTATION

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INTRODUCTION: In previous studies we have documented a change in transfusion practice in several surgical procedures over time^{1,2}. In more recent time periods there has been less overall red blood cell (RBC) transfusion, lower transfusion triggers and lower discharge hemoglobin (Hb) without a significant influence on morbidity or mortality. In orthotopic liver transplantation (LT) RBC transfusion has been decreasing over time. We hypothesized that part of this decrease is attributable to similar changes in transfusion practice as observed in our previous studies.

METHODS: Two cohorts of 100 successive patients undergoing primary LT at Mayo Clinic Rochester were retrospectively defined. One group (Early) had surgery in 1990-1991, the second (Late) in 2005-2006. Data were extracted from prospectively maintained institutional databases and patient records. Comparisons between the two time periods were made for patient demographics, intraoperative and postoperative transfusion requirements, recorded hemoglobin values and morbidity.

RESULTS: Late group patients were older (53 \pm 10 vs 48 \pm 11 yrs), more likely to be male (65 vs 35%) and more likely to have alcoholic liver disease or a tumor as a reason for transplant than Early group patients. Calculated MELD score was lower in the Late group (15.5 \pm 8.5 vs 18.9 \pm 9.8, $p < 0.001$). Anesthesia, surgery and anhepatic time were all significantly less in the Late group. Intraoperative RBC transfusion was significantly less in the Late group (median 2 (interquartile range 1-5) vs 11 (6-18) units, $p < 0.001$) as was intraoperative cell-salvage transfusion (2.1 (0-4.5) vs 3.4 (1.3-10.3) units, $p < 0.001$). Intraoperative transfusions of platelets, cryoprecipitate and fresh frozen plasma were all also significantly less in the Late group. Postoperative transfusions of RBC and all blood products were significantly less in the Late group. Preoperative, lowest recorded intraoperative, immediate postoperative and discharge Hb did not differ between groups. Late group patients had a significantly lower rate of reoperation within 30 days than Early group, otherwise post-operative morbidity and mortality did not significantly differ.

DISCUSSION: As anticipated overall transfusion and RBC transfusion decreased from the Early to the Late groups. However, this was not associated with evidence of a change in either transfusion trigger or target hemoglobin. This implies that the decrease in blood transfusion seen in liver transplantation over time is related to technical and patient factors. There may be scope for further reductions in RBC transfusion in liver transplantation without adversely influencing outcomes if a lower transfusion trigger and lower target Hb are adopted.

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S-185.

REGIONAL CITRATE ANTICOAGULATION IN CONTINUOUS VENOVENOUS HEMODIALYSES IN LIVER TRANSPLANT PATIENTS WITH A HIGH RISK OF BLEEDING

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INTRODUCTION: Systemic heparinization could be associated with a high rate of bleeding in liver transplant patients when used for anticoagulation during continuous renal replacement therapy (CRRT) (1). Regional anticoagulation could be achieved with citrate, which was first described by Morita in 1961 (2). However, the use of citrate as anticoagulant is associated with metabolic complications (3).

We evaluate the safety and efficacy of citrate as anticoagulant in liver transplant patients in the early postoperative period.

METHODS: We investigated retrospectively in liver transplant patients who developed an acute renal failure and required a CRRT where citrate was used as anticoagulant.

RESULTS: Between 3/2005 and 6/2006 30 patients (15 male / 15 female) with an average age of 45.2 ± 2.4 required developed an acute renal failure postoperatively and required a CRRT with citrate as anticoagulant. The mean MELD score was 19.3 ± 1.0. The mean CRRT treatment duration was 7.7 ± 0.9 days, whereas the mean life span of a filter was 22.2 ± 0.9 hours. The serum concentrations of sodium, potassium, calcium, bicarbonate, and the pH value did not differ significantly before, during, and after the treatment. (before citrate treatment: Na⁺: 141.2 ± 1.2 mmol/L, K⁺: 4.5 ± 0.1 mmol/L, Ca²⁺: 1.00 ± 0.00 mmol/L, HCO₃⁻: 23.7 ± 0.9 mmol/L, ph: 7.40 ± 0.00 (all values are given in mean ± SD), after citrate treatment: Na⁺: 141.6 ± 0.9 mmol/L, K⁺: 4.5 ± 0.1 mmol/L, Ca²⁺: 1.00 ± 0.00 mmol/L, HCO₃⁻: 24.7 ± 0.9 mmol/L, ph: 7.40 ± 0.00 (all values are given in mean ± SD). No bleeding episodes occurred during the whole treatment period.

CONCLUSION: Citrate as anticoagulant for CRRT in patients following liver transplantation is an effective and safe alternative to heparin.

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S-186.

ANESTHETIC MANAGEMENT OF LIVER TRANSPLANTATION WITH PROLONGED ANHEPATIC PHASE FOLLOWING UNINTENTIONAL TOTAL HEPATECTOMY

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INTRODUCTION: Liver transplantation for hepatic failure is usually performed in three phases: the dissection phase, the anhepatic phase, and the newhepatic phase. In both cadaveric and living donor procedures, the duration of the anhepatic phase is between 30 to 60 minutes. However, we are reporting this case where the anhepatic phase was about 22 hours.

CASE REPORT: A sixty-year-old Caucasian male, diagnosed with multiple metastatic lesions in liver, was scheduled for liver resection.

In the operating room, with appropriate monitors and pre-oxygenation, an uneventful induction was performed with combined narcotics and gas. An arterial line and central venous sheath were introduced followed by placement of a pulmonary artery catheter.

In the process of removing the diseased liver, the right hepatic vein was injured, which compromised the venous drainage of the remaining liver. The total hepatectomy was completed, and a porto-caval shunt was established followed by closure of skin. A continuous infusion of 10% dextrose and FFP were started, and the patient was transported to the ICU. The patient was immediately placed at the top of the cadaveric liver transplant list.

In ICU, careful hemodynamic monitoring and serial laboratory examination were performed to guard against hypoglycemia, coagulopathy, and acute anemia. To minimize acute renal failure, continuous renal replacement therapy (CRRT) was initiated. The ICU team now faced the challenge of maintaining homeostasis in the setting of a prolonged anhepatic phase.

Fortunately, a suitable donor was identified; and the patient returned to the OR for cadaveric liver transplantation. After successful completion of the procedure, the patient returned to the ICU in a stable condition. His postoperative hospital course was remarkable for acute tubular necrosis and sepsis, which resolved with conventional medical therapy, and he was discharged to rehabilitation.

DISCUSSION: Prolonged anhepatic phase has been reported before. Some of them were planned ^{1, 2, 3} while others were due to traumatic liver injury ⁴. A prolonged anhepatic phase begets a number of complications that include hypocalcaemia, hypoglycemia, coagulopathy, acid-base disturbances, and other metabolic perturbations. A later but equally concerning complication is oliguric renal failure.⁵ Successful medical management of the anhepatic phase requires the maintenance of normal coagulation status, acid-base levels and prevention of renal failure.

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S-187.

PARADOXICAL EFFECT OF CRYOPRECIPITATE ADMINISTRATION ON COAGULATION IN ORTHOTOPIC LIVER TRANSPLANTATION (OLT)

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INTRODUCTION: Conventional coagulation management of ESLD patients undergoing OLT includes blood component therapy based on TEG analysis to treat coagulopathy due to factor deficiency, thrombocytopenia and hemostatic derangements. Cryoprecipitate (Cryo) is administered to replenish serum fibrinogen levels when the coagulopathy is refractory to FFP and Platelets. However, it has been reported that exogenous fibrinogen administration may promote fibrin clot formation and platelet consumption. This is associated with fibrin formation over damaged vascular endothelium due to extensive dissection or over damaged hepatic endothelium due to ischemia-reperfusion injury causing enhanced consumption of platelets, a condition similar to DIC. ¹ This retrospective study attempted to identify similar effects of Cryo use on platelet recovery during and after OLT.

METHODS: We reviewed 122 OLT cases between 2007 and 2008 to evaluate Cryo use. We classified patients into two groups: those who did not receive Cryo (Group I) and those who did (Group II). We compared demographic, intra-operative hemodynamic, metabolic, and postoperative coagulation, laboratory and donor data.

RESULTS: Ninety-five patients underwent OLT without Cryo (I) and 27 patients received Cryo (II). Preoperative data analysis showed that patients in Group II had higher creatinine levels ($p=0.001$) and lower sodium levels ($p=0.001$), but other demographic and donor data were similar between the groups. In terms of intra-operative blood loss and blood product usage, patients in group II had larger blood loss ($p<0.001$) requiring more blood products ($p<0.002$), and received more platelets ($p=0.002$). Post-operatively, group II patients had significantly higher fibrinogen level ($p=0.01$) but lower platelet counts ($p=0.009$), and platelet recovery took longer to return to normal levels ($p=0.02$).

DISCUSSION: This preliminary study indicates that exogenous Cryo administration during OLT may paradoxically worsen coagulopathy by promoting platelet consumption secondary to increased formation of fibrin clot. Cryo is the only concentrated fibrinogen-containing product available in the United States. One unit of Cryo contains 150mg of fibrinogen and 10 units (1 pack) of Cryo can be expected to raise the fibrinogen level by a minimum of 30mg/dl with a half life of 3-6 days.¹ In OLT, Cryo has been used to treat refractory coagulopathy by replenishing fibrinogen. In light of these preliminary findings further assessment of the effects of Cryo and indications for its use in OLT are warranted.

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S-188.

POOR OUTCOME FOLLOWING ABORTED OLT DUE TO SEVERE PORTO-PULMONARY HYPERTENSION (PPHN)

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INTRODUCTION: The diagnosis of porto-pulmonary hypertension (PPHN) on the operating room table is not an uncommon occurrence.¹ Furthermore, proceeding with OLT in patients with high PA pressures (mean >45) is associated with a peri-operative mortality of greater than 70%. ² We sought to determine the progression of PPHN leading up to the day of surgery and patient outcome following aborted OLT in this cohort of patients.

METHODS: We carried out a retrospective analysis of all OLT cases performed at our institution from 1998 to 2008 to determine the incidence of aborted OLT cases due to severe PPHN. We tabulated the number of cases, reviewed preoperative evaluation data, recorded the date of first diagnosis of pulmonary hypertension, and calculated survival following the aborted OLT. Then, in order to determine the progression to severe PPHN we calculated the number of days from initial diagnosis to the day of surgery.

RESULTS: In our 10 year experience, 2150 cases of liver transplantation were performed in our institution. Of these, 6 cases (0.3%) were cancelled due to severe PPHN at the time of surgery. Prior echocardiographic evaluation on these 6 patients showed 2 with normal (mPAP 21), 2 with mild (mPAP 29, RVSP 46mmHg), and 2 with moderate PPHN (RVSP 52mmHg). In 5/6 progression to severe PPHN occurred on median over a period of 82 days (range = 10-229 days). Following aborted OLT, patient data and outcomes are reported in the Table. Three of six cases (50%) expired shortly after OLT was cancelled, and 2 (33%) were referred for vasodilator therapy then successfully transplanted at a later time.

DISCUSSION: Patients with ESLD diagnosed with severe PPHN at the time of OLT pose a significant challenge to the surgical team due to the risk of high perioperative mortality. However, cancellation of OLT was also associated with high mortality in our series of 6 patients. Although this is not a high number of cases, it is possible some may have gone undetected. Our preliminary study reveals that progression of mild to moderate PPHN to a more severe form (mPA >45) may occur over a shorter period of time (weeks to months) than previously expected. In order to identify severe PPHN at an earlier stage we recommend repeat TTE assessments of RVSP/PA pressure at more frequent intervals (at least every 2-3 months) among those patients on transplant waiting lists who have been diagnosed with some form of PPHD.

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Sex / Age	Time of First Diagnosis of PPHN			Last PA pressure measurement (days prior to surgery)			MELD score	PAP at time of surgery	Survival
/ Cause of liver disease	Date (days prior to surgery)	Methods / PAP (mmHg)	RA / RV Function	Date (days prior to surgery)	Methods / PAP (mmHg)	RA / RV Function	or Status	(mmHg)	/ days after aborted OLT
1. Female (48) / Cryptogenic	11	TTE / RVSP(63)	No	10	RHC / 42/23 (29)	Not documented	28	mPAP=45	Expired / 8
2. Female (69) / HCV	93	TTE / RVSP (38)	No	92	RHC / 33/15 (21)	Not documented	2B	mPAP=45	Transplanted / 10
3. Male (49) / HCV	243	TTE / RVSP (49)	No	229	RHC / Normal	Not documented	32	mPAP=50	Transplanted / 156
4. Female (66) / HCV	108	RHC / Moderate PH	Not documented	Same as first diagnosis			24	mPAP=50	Expired / 42
5. Female (66) / Cryptogenic, HCC	1620	TTE / RVSP (44)	No	55	TTE / RVSP (52)	No	25	mPAP=45	Expired / 170
6. Male (26) / Glycogen Storage Disease Type I	72	TTE / RVSP (46)	Mild RV enlargement	Same as first diagnosis			22	mPAP=49	Survived / 677 days without transplant

S-189.

COLD PRESERVATION LIVER INJURY INCREASES URINARY NEUTROPHIL GELATINASE-ASSOCIATED LIPOCALIN (NGAL)

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INTRODUCTION Acute kidney injury (AKI) after liver transplantation (OLT) is a major clinical problem. However, AKI after OLT is often diagnosed too late for any meaningful intervention. AKI is thought to be less frequent in living related liver transplantations (LRLT) compared to transplantations from cadaveric donors. Urinary Neutrophil Gelatinase-associated Lipocalin (NGAL) is a novel, highly sensitive biomarker for renal injury. We hypothesized that urinary NGAL increases after liver transplantation in cadaveric liver transplantation recipients and but not in living related liver transplant recipients (LRLT).

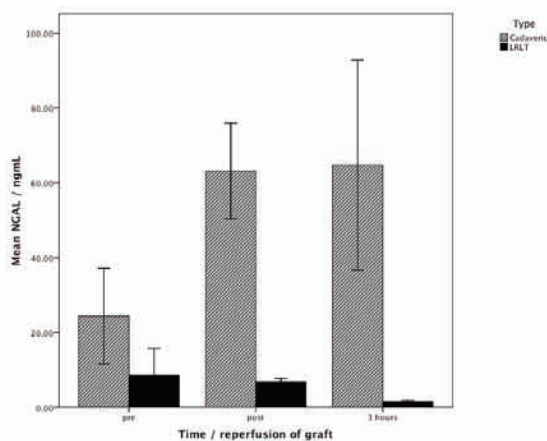
METHODS We measured urinary NGAL in six cadaveric and three living related liver transplant recipients before surgery, immediately after reperfusion and then three hours later.

NGAL was determined using a commercially available ELISA (Antibodyshop, Gentofte, Denmark).

RESULTS In cadaveric liver transplantations urinary NGAL increased significantly immediately after reperfusion (from 24.4 +/- 12.7 ng/ml to 63.2 +/- 12.8 ng/ml; $p = 0.02$) and remained elevated 3 hours after reperfusion (64.7 +/- 28.0 ng/ml). In comparison urinary NGAL in LRLT was lower at baseline compared to cadaveric liver transplant recipients and did not increase after reperfusion (from 8.6 +/- 7.9 ng/ml at baseline, 6.7 +/- 1.0 ng/ml, $p = 0.8$ immediately after reperfusion and 1.5 +/- 0.3 ng/ml, $p = 0.5$ three hours later, Figure 1).

Four of the six patients receiving cadaveric liver transplants compared to none of the LRLT ($p = 0.06$) developed postoperative AKI defined as an increase of serum creatinine by more than 50% (RIFLE risk).

DISCUSSION Urinary NGAL increased in cadaveric liver transplants but not in living related liver transplants. This case series is the first to utilize urinary NGAL to confirm previous studies that cadaveric liver transplant recipients but not LRLT recipients sustain renal damage and potentially develop acute kidney injury. Future studies will have to evaluate the utility of urinary NGAL as an early postoperative predictor of renal injury after liver transplants.



S-190.

EXTENDED DONOR CRITERIA LIVER TRANSPLANTS ARE AT INCREASED RISK FOR POSTOPERATIVE ACUTE KIDNEY INJURY

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INTRODUCTION Acute kidney injury is a devastating complication after liver transplantation. Previous studies suggest that patients receiving liver transplants with extended donor criteria (EDC) have a similar 6 months, 1 year and 3 year survival compared to patients receiving liver transplant through regular waitlist allocation (RA)(1). There is no data about the incidence of postoperative incidence of acute kidney injury (AKI) comparing EDC and RA liver recipients.

METHODS Pre-, intra- and postoperative data for the consecutive cadaveric liver transplants were collected prospectively and matched to donor data obtained from the UNOS database.

Acute kidney injury was defined as an increase of serum creatinine by more than 0.3 mg/dl as suggested by the Acute Kidney Injury Network (AKIN).

RESULT 278 patients undergoing liver transplantations at Columbia University Medical Center were enrolled: 112 from EDC and 166 from RA donors. Patients receiving EDC donor livers were older (55.8 versus 51.9 years, $p = 0.01$), had lower model of endstage liver disease (MELD) scores and had longer cold ischemic time (9.4 versus 7.8 hours, $p = 0.02$). 156 patients developed AKI (56%), 84 with RA donors and 72 with EDC donors. Patients receiving EDC livers were more likely to develop AKI than patients receiving RA livers (odds ratio 1.76, CI (95%): 1.07 to 2.87, $p = 0.02$).

DISCUSSION: The incidence of AKI in liver transplantation recipients is very high. Despite having lower MELD scores, patients receiving EDC liver transplants were more likely to develop postoperative AKI than patients with RA liver donors. This may be due to a prolonged cold ischemic time in RA liver donation. While the long-term mortality may be similar in these groups our results suggest that EDC livers are more likely to cause renal injury than RA livers.

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S-191.

MASSIVE ENDOBRONCHIAL BLEED IN A LIVER TRANSPLANT RECIPIENT: CHALLENGE TO THE ANESTHESIOLOGIST

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INTRODUCTION: We present a case of massive intrabronchial hemorrhage and acute respiratory failure in an intubated liver transplant (LT) recipient following therapeutic drainage of pleural effusion. The bleed can be very rapid due to the associated coagulopathy. This scenario poses immense challenge to the anesthesiologist.

CASE REPORT: A 63 year old lady with hepatitis C cirrhosis, with complications of pleural effusion and ascites was subjected for LT. Pre-operative evaluation of cardiovascular and renal functional status were within normal parameters. Following are the coagulation parameters: platelet count = 50,000/cc, Prothrombin Time = 20, International normalized ratio = 1.9. During the peri-operative period of LT, the patient was hemodynamically stable and maintained good oxygen saturation (O_2 sat) with an uneventful reperfusion of the liver graft. Coagulation status was corrected with the aid of thromboelastogram using fresh frozen plasma, cryoprecipitate and platelets. Transesophageal echocardiography was used to assess volume status and ventricular functioning of heart instead of pulmonary artery catheter. Right pleural effusion was drained with a pigtail catheter which resulted in O_2 de-saturation up to 40% (below baseline) along with hypotension. Positive end expiratory pressure with 100% oxygen and rapid infusion device resulted in prompt improvement in oxygenation saturation to 90% and blood pressure respectively. Massive blood loss was noticed from the endotracheal tube (ETT) which raised the suspicion of bronchio-vascular injury. An estimated 400 ml of fresh blood was aspirated from the ETT. A fiber-optic bronchoscopy revealed the source of bleeding in the right bronchus. Arterial blood gases revealed respiratory acidosis with pH = 6.91 pCO_2 = 127 mm Hg and pO_2 = 66 mm Hg. A bronchial blocker was inserted on the right side to prevent blood spillage over to the left bronchus followed by a right-sided thoracotomy revealed bronchio-vascular injury which was repaired promptly. A selective left lung ventilation and tracheobronchial suction improved oxygenation saturation to 96%. Follow up arterial blood gases after above maneuvers showed corrected respiratory acidosis of pH 7.47, pCO_2 39 mmHg and pO_2 77 mmHg. Patient had an uneventful recovery with extubation on the third post operative day.

DISCUSSION: The role of topical vasoconstrictors has been reported in patients with endo-bronchial bleeding¹. However, when the bleeding is massive, as in this case, immediate diagnosis and isolation of lung using an endobronchial blocker² avoids spillage into the opposite lung and thus prevents hypoxemia. Extracorporeal membrane oxygenation³ may be used if previous mentioned maneuvers are unsuccessful. These measures provide adequate ventilation and oxygenation until surgical control of bleeding is done. Other conditions that must be ruled out are: (a) pulmonary artery rupture secondary to PA catheter¹; (b) massive pulmonary embolism; (c) airway trauma; (d) injury to inflamed airways. Prompt intervention is life saving in such scenarios.

S-192.

HYPOMAGNESEMIA DURING MULTI-VISCERAL TRANSPLANTATION: A CASE REPORT

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INTRODUCTION: Hypomagnesemia is a frequent, often underdiagnosed and hence undercorrected cause of metabolic alkalosis in liver or multi-visceral transplantation. Following massive blood transfusion, citrate intoxication and furosemide administration can cause hypomagnesemic alkalosis.¹ However it is not seen commonly in the **dissection** phase. We present a case report of intraoperative alkalosis in the dissection phase associated with hypomagnesemia and its correction.

CASE REPORT: The patient was a 20 year old lady diagnosed with pancreatoblastoma metastatic to the liver and intestine. She had received 3 prior doses of chemotherapy, the last dose 20 days earlier. She was on oral hydromorphone and clonazepam therapy and also had fentanyl and clonidine patches. She had no prior history of cardiorespiratory illness and the pretransplant workup was within normal limits. The patient was on total parenteral nutrition (TPN) 1.5-2 L/day and the preoperative laboratory workup was normal. She had a chemotherapy port in the left subclavian vein. She was taken to the OR for transplantation of liver, intestine and pancreas. After placement of essential monitoring, she was induced with propofol, fentanyl and midazolam and intubated with cisatracurium. Two 20 G arterial lines were placed in the right femoral and left radial arteries and 12 Fr triple lumen and 8 Fr double lumen catheters placed in the right IJV. The blood gas analysis showed metabolic alkalosis (pH of 7.5, PCO_2 of 39, K^+ of 3.5 and HCO_3^- of 31). At this point no diuretics had been given and the volume status was assessed to be adequate with a CVP of 12mm Hg. Owing to her preoperative history of TPN and cisplatin therapy, metabolic alkalosis due to hypomagnesemia was suspected and 2 grams of magnesium infusion started. Repeat blood gas analysis showed adequate correction (pH of 7.4, PCO_2 of 42, bicarbonate value of 27.9 and BE of 3.3). The repeat TEG also showed an improvement in the k and R values over the baseline. Postoperatively she continues to be hypomagnesemic and receives magnesium supplements.

DISCUSSION: Hypomagnesemia is often undetected due to lack of intraoperative ionic magnesium monitoring. It is associated with increased intraoperative arrhythmias, and worsening of reperfusion injury.^{2,3} It can also worsen hypocoagulability in patients with impaired coagulation.⁴ Hence optimization of magnesium levels is of primary importance. However as it is not usually monitored, it is often an occult cause of bleeding and alkalosis. Our suggestion is that its monitoring should therefore be made mandatory in all cases of transplantation.

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Neuroanesthesia

S-193.

NO DIFFERENCE IN DEGREE OF NEUROAPOPTOSIS FOLLOWING EXPOSURE TO EQUIANESTHETIC DOSES OF ISOFLURANE, SEVOFLURANE, AND DESFLURANE IN NEONATAL MICE

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INTRODUCTION: Volatile anesthetics facilitate surgical procedures and imaging studies in hundreds of thousands of neonates and infants each year. Neuroapoptosis following exposure to the volatile anesthetic isoflurane has been recognized in several animal models, raising concerns about the safety of pediatric anesthesia.¹ However, it remained unknown whether the more contemporary anesthetics sevoflurane and desflurane trigger neuroapoptosis in the developing brain to a similar extent as isoflurane. Accordingly, the present study compared the degree of neuroapoptosis following exposure to isoflurane, sevoflurane, and desflurane in neonatal mice.

METHODS: After obtaining approval by the Institutional Animal Care and Use Committee (IACUC). 7-day-old C57BL/6-CD1 F1-hybrid mouse littermates (n= 33) were randomized to either 6 hours of 1.5% Isoflurane, 7.4% Desflurane, 2.9% Sevoflurane in 30% oxygen, or room air (Control). These concentrations were previously determined to represent 0.7 Minimum Alveolar Concentration in neonatal mice. Pups were euthanized immediately following anesthesia exposure, brains were quickly removed, cut into coronal sections, and snap frozen on dry ice. Biopsies were taken from thalamus, neocortex, and hippocampus, and stored at -80 °C until analysis. For analysis, brain samples were homogenized at 4°C with a cell lysis buffer, containing protease inhibitors. Total protein concentration was determined by Bradford assay. Caspase 3 activity was measured using a colorimetric activity assay kit (Chemicon). Absorbencies were compared to a standard curve to calculate units of caspase. Comparisons were made using the Kruskal-Wallis test.

RESULTS: In 7-day-old mouse pups, a 6-hour exposure to isoflurane, sevoflurane, or desflurane led to significant increases in neuroapoptosis, as measured by caspase 3 colorimetry compared with unanesthetized controls (Figure 1). No differences were detected among the three anesthetics in the three brain regions examined, except for a lower degree of neuroapoptosis in thalamus in desflurane-treated animals.

DISCUSSION: Isoflurane-induced neuroapoptotic cell death has been documented in several neonatal animal models, questioning the safety of pediatric anesthesia. The present study reveals similar degrees of neuroapoptosis in neonatal mice treated with equianesthetic doses of isoflurane and the more contemporary anesthetics sevoflurane and desflurane. These results suggest that there might not be any benefits or disadvantages in using any of the three most commonly used volatile anesthetics in pediatric anesthesia, as they relate to developmental neuronal apoptosis.

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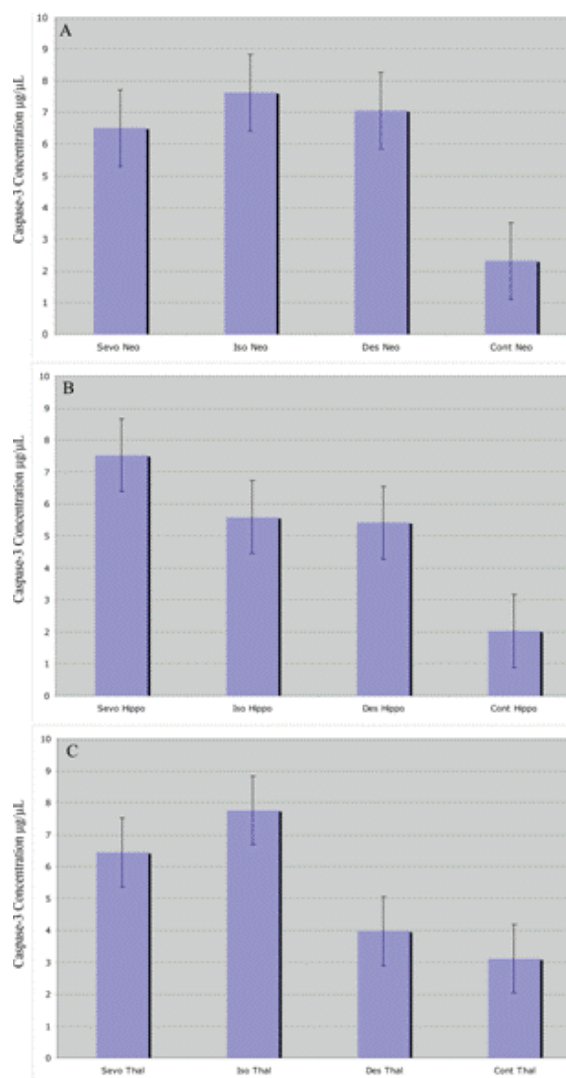


Figure 1. : Exposure to Equianesthetic doses of Sevoflurane, Isoflurane, and Desflurane cause similar increase of caspase-3 expression in neocortex (A), hippocampus (B) and Thalamus (C) of neonatal mice when compared to room air (control)

S-194.**EFFECTS OF PROPOFOL ANESTHESIA ON FUNCTIONAL RESPONSE IN SOMATOSENSORY BRAIN REGIONS OF A NEW-WORLD MONKEY (MARMOSET)****AUTHORS:** J. V. Liu, A. C. Silva;**AFFILIATION:** Cmu/lfmi/ninds, National Institutes of Health, Bethesda, MD.

INTRODUCTION Anesthesia effects on cerebral metabolism and blood flow differ across brain regions, especially between thalamus and cortex. A prevailing hypothesis attributes these regional variances to cellular differences in expressing the GABAergic receptors of the anesthetic agent. On the other hand, little is known about the anesthesia effects on neural responses to sensory stimuli, although discrepancy between conscious human and anesthetized rat was reported for the response to peripheral nerve stimulation. Here we study anesthesia effects and their relationships with stimulus properties in the somatosensory neural system, using functional magnetic resonance imaging (fMRI) of a non-human primate (common marmoset). Unanesthetized (awake) and anesthetized states are compared directly.

METHODS Two marmosets were ready for unanesthetized MRI after 3 weeks of acclimation to scanner environment. Six other marmosets were anesthetized using constant infusion of propofol via the lateral tail vein (rate: 0.4-1.0 mg/kg/min). A 7-Tesla scanner was used to acquire images across the brain (resolutions: 0.5*0.5*0.75 mm, 2 s). Unilateral electrical stimulation of the median nerve was delivered to one arm. Each stimulus comprised electrical pulses repeated for 4 s at a single variable frequency (1 of 10 values in 1-128 Hz), or repeated at 40 Hz for a variable duration (2-32 s).

RESULTS In unanesthetized animals, the stimulation-evoked fMRI response was strongest in contralateral SI, bilateral SII and thalamus, and was significant in ipsilateral SI and basal ganglia (caudate and putamen). In anesthetized animals, response in all these regions was reduced, though contralateral SI had the least reduction and the strongest response compared to other regions.

In unanesthetized animals with 4 s stimulation, fMRI response in SI was prompt (time-to-peak: 4 s) and its amplitude increased monotonically with frequency (1-128 Hz). Two types of anesthesia effects on the frequency dependence of response were identified. In type 1, response was unchanged in time course but its amplitude did not increase with frequency until at high frequencies (> 16 Hz). In type 2, response was sluggish (time-to-peak: 6 s) and its amplitude was largely constant across frequencies. In both types, anesthesia reduced SI response more significantly at higher frequencies. Furthermore, SI response elongated linearly with increasing duration in unanesthetized animals, but became much more transient (diminished quickly after 10 s regardless of duration) in anesthetized animals.

DISCUSSION Functional response to sensory stimuli is reduced by anesthesia in a non-uniform way; the reduction is more significant for stimulus with higher temporal frequency or longer duration. Such stimulus parameters may be optimal for future studies that gauge the depth of anesthesia by the stimulus-evoked neural responses. Following the hypothesis of GABAergic receptor expression, the stimulus dependence of anesthesia effects might suggest that GABAergic modulation is related to the aspect of sensory information encoded by neurons.

S-195.**NIMODIPINE REVERSES THE HYPOXIC ELEVATION OF TRYPTOPHAN AND SEROTONIN IN THE STRIATUM OF ADULT RATS****AUTHORS:** M. Haile¹, P. A. Broderick², Y. Li², S. Annabi², A. Y. Bekker²;**AFFILIATION:** ¹Department of Anesthesiology, New York University, New York, NY, ²New York University, New York, NY.

INTRODUCTION: Dysregulation of the neurotransmitters (NT) tryptophan (L-TP) and serotonin (5-HT) has been implicated in postoperative delirium (1). Hypoxia disrupts calcium homeostasis which can activate tryptophan hydroxylase (TH), the rate limiting step in 5-HT synthesis from L-TP. A previous study indicated that the calcium channel blocker Nimodipine (NIMO) administered immediately after acute hypoxia preserves short term memory (2). The hypothesis that these observations may be related to a NIMO dependent attenuation of hypoxic changes in L-TP & 5-HT regulation is investigated.

METHODS: Following IACUC approval, (name of sensor omitted) neuromolecular imaging sensors with a microvoltammetry circuit (3) were implanted in the dorsal striatum of NaPentobarbital anesthetized adult Sprague-Dawley rats. Extracellular NT levels were recorded for fifteen minutes during the establishment of baseline values in room air (N=6). Three sequential thirty minute periods under hypoxia (10% O₂) followed: first under hypoxia alone; second after i.p. injection of NIMO (0.1mg/kg); and third following i.p. injection of NIMO (1.0mg/kg). Measurements were analyzed with ANOVA with post hoc Tukeys test. P-values less than 0.05 were considered significant.

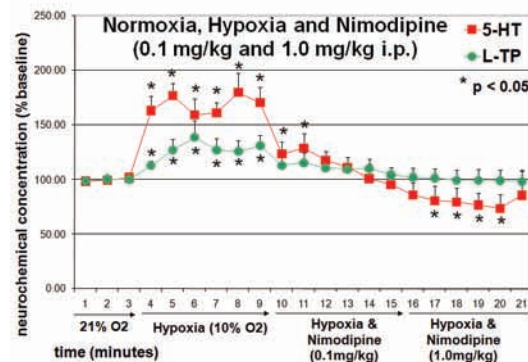
RESULTS: NT levels are expressed as percentages of baseline values (100%). Treatment values were averaged over each sequential thirty minute period following each intervention. Moderate hypoxia resulted in the increase of LTP to 27% (SEM=3.5) and 5-HT to 68% (SEM=4) above baseline. Under continuing hypoxia, NIMO (0.1mg/kg) caused LTP levels to fall to 10% (SEM=1.5) and 5-HT to 13% (SEM=5) above baseline. NIMO (1.0mg/kg) caused LTP levels to fall to baseline (SEM=0.5) and 5-HT to 20% (SEM=2) below baseline.

DISCUSSION: Acute moderate hypoxia increased levels of L-TP and 5-HT in the striatum of adult rats. NIMO administration during ongoing hypoxia caused the levels of both NT to fall to baseline. 5-HT levels were more sensitive to hypoxia and NIMO than L-TP levels possibly because of the role of calcium homeostasis in regulating TH. The results may have implications for understanding cognitive decline in the immediate postoperative period.

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(2) Reference omitted.

(3) Reference omitted.



S-196.

REPEATED HYPERBARIC OXYGEN CAN INDUCE NEUROPROTECTION AGAINST FOREBRAIN ISCHEMIA IN RATS VIA SUPPRESSION OF P38 MITOGEN ACTIVATED PROTEIN KINASE

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INTRODUCTION: Accumulated data show that exposure to hyperbaric oxygen (HBO) prior to ischemia induces tolerance against ischemic damage in the CNS. Production of HSP 72 and antiapoptotic protein or activation of oxygen radical scavenging system has been postulated as the mechanism. We have recently demonstrated in rats that HBO exposure (3.5 absolute atmosphere (ATA), 1 hour/day for 5 days) prior to ischemia induced protein expression of neurotrophin receptor (p75^{NTR}), C/EBP δ and CD74 and significantly reduced neuronal damage in hippocampal CA1 following transient forebrain ischemia¹. Most recent report suggested that HBO provoked neuroprotection by increasing brain derived neurotrophic factor and its downstream effect involving a suppression of p38 activation². In the present study we investigated whether neuroprotection is modified pharmacologically by anisomycin and SB203580, the former is a protein synthesis inhibitor as well as a potent activator of p38 mitogen activated protein kinase (MAPK) and the latter is p38 MAPK inhibitor.

METHODS: Wistar rats were used. Firstly, we performed the study to determine optimal dose of HBO, comparing the effect of five-sessions of oxygen exposure at various pressures (1-, 2- or 3.5-ATA of 100% O₂; 21% O₂, 1-ATA for untreated group) on hippocampal CA1 neuronal damage 7 days after 8-min forebrain ischemia. Secondly, we evaluated neuroprotective effect of 3.5 ATA-HBO (most effective dose) when anisomycin (10 mg/kg) and/or SB203580 (200 μ g/kg) intervened prior to every HBO exposure. Neuroprotective effect was evaluated as a percentage of normal neurons as referenced to those in normal rats. Thirdly, p38 MAPK activity in the hippocampal CA1 was measured at 10 min reperfusion in rats treated either with 3.5 ATA-HBO or sham treatment.

RESULTS: 3.5 ATA-HBO most prominently protected neurons (survived neurons: 68 \pm 6.2% vs. untreated: 2.7 \pm 5.7%, 100% O₂: 13.5 \pm 5.9%, 2 ATA-HBO: 44 \pm 6.2%). Anisomycin (10mg/kg) given prior to every HBO exposure diminished neuroprotective effect of HBO (survived neurons: 2.1 \pm 2.3%), but the protein expression of p75^{NTR}, C/EBP δ , and CD74 were not influenced. When SB (200 μ g/kg) was given between administration of anisomycin and HBO exposure neuroprotective effect of HBO resumed (survived neuron: 58 \pm 17%). When SB was given prior to HBO exposure neuronal survival (69 \pm 13%) was similar to that treated with HBO alone. P38 activity at 10 min reperfusion was significantly reduced in the HBO group as compared to untreated group (33% vs. 96% of sham).

DISCUSSION: The results show that HBO exposure prior to ischemia produces dose dependent neuroprotection. Almost complete attenuation of protective effect by anisomycin without influencing on protein expression of p75^{NTR}, C/EBP δ and CD74 and restoration of protective effect by SB indicate that the suppression of p38 MAPK plays an key role in neuroprotection of HBO.

REFERENCES: 1) Brain Res 1130, 214-222, 2007; 2) Neurobiol Dis 29, 1-13, 2008

S-197.

EFFECT OF DESFLURANE MAC ON INTRAOPERATIVE SOMATOSENSORY EVOKED POTENTIALS

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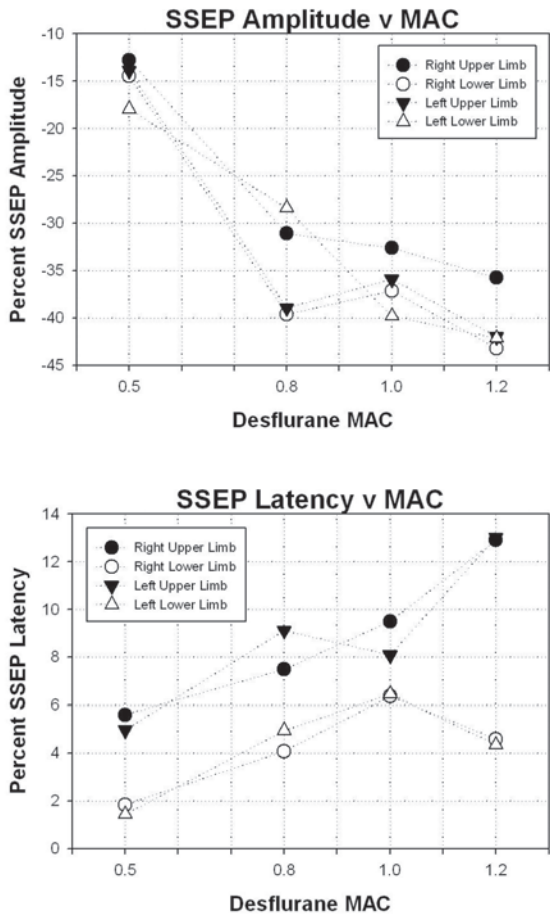
INTRODUCTION: Somatosensory evoked potentials (SSEP's) are used for intraoperative monitoring during surgeries when the somatosensory pathways are at risk. Degradation in SSEP amplitude and latency can indicate surgical trauma, decrease in body temperature, cold irrigation, hypoxemia or changes in PaCO₂. A >50% degradation in SSEP amplitude and/or a >10% increase in latency in the early cortical waveform renders the SSEP ineffective as a monitor and requires clinical intervention. It is well known that anesthetic agents can also cause this 50%/10% degradation in SSEP (reference). In this controlled study we analyzed the relationship between SSEP amplitude/latency and desflurane MAC before surgical instrumentation and in the absence of other known confounding factors.

METHODS: With Institutional approval and written informed consent 22 adult patients, ASA I-III, 18 to 85 years of age, scheduled for spinal surgery entered the study. After standard induction of anesthesia and endotracheal intubation, each patient was maintained with desflurane, dexmedetomidine 0.3 mcg/kg/hr and remifentanyl 0.05 mcg/kg/min. The concentration of desflurane was set in random order at end-tidal 0.5, 0.8, 1.0 and 1.2 MAC. Once steady-state was reached at each MAC, the SSEP was recorded. After the SSEP readings at the four doses of desflurane were obtained, the scheduled surgery resumed. We performed a parameter sensitivity analysis to quantify the effect of MAC on SSEP.

RESULTS: SSEP amplitude decreased and latency increased with increasing MAC (see figures). At a MAC of 1.2 the amplitude and latency remained within the 50%/10% window. Using linear extrapolation our data showed that the 50%/10% window would be exceeded at a desflurane MAC of 1.39 \pm 0.12 (amplitude) or 1.52 \pm 0.61 (latency).

DISCUSSION: Intravenous anesthetics are often used for spinal surgeries because they have fewer detrimental effects on SSEP recordings than inhaled anesthetics. Their use however, comes at the price of decreased patient comfort and increased patient recall. When used, inhaled anesthetics concentrations are kept to a minimum because high levels are believed to adversely influence SSEP amplitude and latency. When desflurane is used for spinal surgeries, for example, the standard of care is 0.5 MAC. While this relatively low concentration ensures that the SSEP recordings remain within the aforementioned window, it may pose an obstacle when more anesthesia is required to maintain proper sedation. Our controlled study suggests that the desflurane concentration can be increased up to 1.2 MAC without compromising the efficacy of SSEP recording as a tool to monitor the intraoperative integrity of somatosensory pathways.

REFERENCES: Anesthesiology 2003;99:716-737.



S-198.

EPILEPTOGENIC EFFECTS OF SEVOFLURANE IN NEONATAL RATS

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INTRODUCTION: This study tests the novel concept that in rats during the early neonatal period when intracellular neuronal [Cl]_i is relatively high, sevoflurane, by stimulating γ -aminobutyric acid type A (GABA_A) and strychnine-sensitive glycine receptors, may depolarize the neuronal membrane potential sufficiently to trigger epileptic seizures. The Na⁺-K⁺-2Cl⁻ co-transporter 1 (NKCC1) inhibitor, bumetanide, should diminish these effects and increase the anesthetic efficacy and safety.

METHODS: Continuous EEG recordings from bilateral occipital and right frontal regions were performed using an EEG/EMG system (Pinnacle Tech., Lawrence, KS) in SD rat pups ranging from postnatal day 4 to day 18 (P4-P18). EEG seizures were defined as EEG patterns of high-amplitude rhythmic activity with evolution in frequency or amplitude that were at least three times higher than baseline activities and lasted for at least 3-10 s.

RESULTS: The EEG activity in younger rats was characterized by episodes of less than 10 s high amplitude high frequency oscillations. Sevoflurane (2.1 %) increased amplitude and frequency of the baseline EEG in younger animals and caused burst suppression-like activity in older rat pups. During anesthesia maintenance for 30 min with 2.1% sevoflurane, 38.9% of P4-P7 animals (7 of 18) had distinctive bilateral EEG seizures that lasted from 10 s in one animal (P6) to 20.75 min in another (P5). In contrast, rats in the P8-P18 group, had only one animal (P8) (1 of 19) with a single 18 s seizure. The effect of bumetanide on sevoflurane (2.1%)-induced seizures was studied utilizing two experimental protocols. First, six animals (P4-P7) received bumetanide (0.3 μ M/kg, I.P.) at the 30-th minute of sevoflurane anesthesia while EEG recording continued for another 60 min. Bumetanide depressed both intensity and duration of EEG seizures. Total duration of EEG seizures was decreased from 1406 s to 223 s. In another set of experiments two groups of animals (P4-P7) received either bumetanide (5 μ M/kg, I.P.) or saline 15 min prior to a 60 minute anesthetic with 2.1% sevoflurane. Bumetanide significantly decreased the number of animals that had seizures during anesthesia. In some older rat pups (>P10) the emergence from 3 hours of anesthesia with 2.1% sevoflurane resulted in more intensive seizures, which were accompanied by clonic/tonic muscle movements. These seizures lasted 486 \pm 133 s (n=6). Arterial blood gas samples drawn at sevoflurane concentration of 2.1% showed no evidence of either hypoxia or hypoventilation (pO₂: 429.0 \pm 7.9; pCO₂: 46.0 \pm 4.2; glucose: 117.8 \pm 8.1).

DISCUSSION: Our results support the possibility that excitatory output of sevoflurane-potentiated GABA_A and glycine systems and their interaction with other neurotransmitter systems may contribute to the epileptogenic effects of sevoflurane.

S-199.

THE EFFECT OF UNILATERAL SCALP BLOCK ON ANALGESIA AFTER SUPRATENTORIAL CRANIOTOMY - A RETROSPECTIVE AUDIT

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INTRODUCTION: Pain following supratentorial craniotomy is common¹⁻². Use of narcotics is frowned upon because of concerns that sedation blunts neurological assessment. We recently introduced scalp blocks³ as one method of controlling post-operative pain and wished to determine the effectiveness and morphine-sparing effect of these blocks in our patients.

METHODS: Following institutional and ethics committee approval a retrospective audit of all supratentorial craniotomies performed by one surgeon (RB) over the preceding 12 months was conducted. Patients who were ventilated post-operatively were excluded. All patients cared for by one anesthesiologist (HG) received a unilateral scalp block, performed using the technique described by Pinosky et al³ with 15mls 0.5% bupivacaine + 1:200,000 epinephrine, prior to surgery starting (Group S). Patients cared for by other anesthesiologists did not receive a block (Group M). All patients received peri-operative acetaminophen and direct bupivacaine wound incision infiltration. Increments of morphine were administered intravenously (iv) in the post-anaesthesia care unit (PACU) and subsequently intramuscularly (im) in the neurosurgical high-dependency unit (NHDU). Case notes were reviewed for morphine consumption in the PACU and in the first 24 hours on the NHDU. Numbers of patients requiring morphine were compared using Fisher's exact test and doses of morphine compared with a Mann-Whitney test.

RESULTS: 47 cases of supratentorial craniotomy performed under GA were identified. 44 sets of case notes were reviewed (3 patient's notes were unavailable). There were 13 patients in Group S and 31 in Group M. In the PACU 2 (15%) patients in Group S required iv morphine increments vs 19 (61%) in Group M [p=0.008] with a mean iv morphine dose of 0.84mg [95%CI: -0.54 - 2.2mg] in Group S vs 3.77mg [95%CI: 1.99 - 5.55mg] in Group M [p=0.017]. In the NHDU 5 (38%) patients in Group S required im morphine vs 23 (74%) in Group M [p=0.037]. The mean total morphine dose in the NHDU was 5.77mg [95%CI: 1.42 - 10.11mg] in Group S v 20.89mg [95%CI: 12.5 - 29.27mg] in Group M [p=0.015].

DISCUSSION: Scalp blocks have been shown to be effective for the management of haemodynamic response to head pinning³ and as a means of providing post-operative analgesia⁴⁻⁵. Our study is a retrospective audit with intra-operative anaesthetic technique determined by the attending anaesthesiologist, rather than by random assignment. The results suggest unilateral bupivacaine scalp blocks are an effective and feasible means of providing post-operative analgesia and reduce overall morphine consumption. Further studies are planned.

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S-200.

NITROGLYCERIN INDUCED HYPOTENSION INTERFERES WITH LONG-TERM MEMORY FORMATION IN ADULT MICE

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INTRODUCTION: Hypotension and a resultant decrease in cerebral blood flow have been implicated in cognitive dysfunction (CD) [1]. Previous studies in mice have shown that nitroglycerin induced hypotension(NTG-IH) caused a transient derangement of short-term memory [2]. We tested the hypothesis that NTG-IH immediately after learning in a passive avoidance (PA) retention paradigm would interfere with the consolidation and retrieval of long-term associative memory in mice at two days.

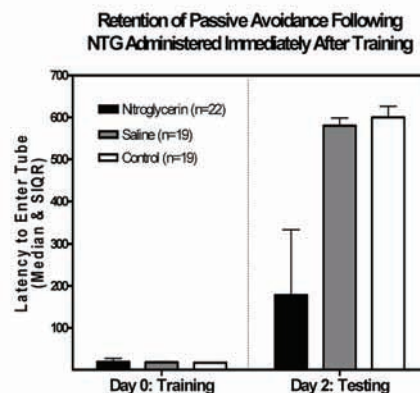
METHODS: Following IACUC approval, 60 Swiss-Webster, 30-35 g mice (6-8 weeks) were randomized into three groups: 1) intraperitoneal injection of NTG (60 mg/kg) in saline immediately after PA training; 2) injection of saline; 3) no injection. For PA training latencies (seconds) was recorded for entry from a suspended platform into a Plexiglas tube where a shock (0.3mA; 2 sec duration) was automatically delivered. 48h later latencies were recorded for a testing trial. Latencies greater than 600 sec were assigned this value. Increased testing latency is indicative of an impairment of long-term associative memory.

RESULTS: All groups exhibited similar training latencies. A Kruskal Wallis one way ANOVA for test latencies indicated significant difference among three treatment groups (H = 37.76; df= 3; p = <0.001) Post hoc comparisons using the Mann-Whitney U test showed saline treated and non-injected controls had significantly longer test latencies(i.e. better retention of the avoidance response) than the NTG group (p= 0.002 for both groups). In a separate group (data not shown) same dose NTG caused mean arterial pressure (MAP) to fall from 81 mm Hg (SEM=5.6) to 35.2 mm Hg (SEM=3.9) over thirty minutes followed by five hours of profound somnolence at MAP of 33 mm Hg (SEM=1.9) [2].

CONCLUSION: Nitroglycerin injected immediately after training in a PA retention paradigm produced a significant impairment of long-term associative memory in mice at 48 hrs. Hypotensive mice showed a significant decrease in latency time compared to saline and non-injection control groups. Profound nitroglycerin induced hypotension may cause long-term cognitive dysfunction in mice. These results may have implications for understanding that phenomenon.

REFERENCES:[1] M. Siepmann and W. Kirch, "Effects of nitroglycerine on cerebral blood flow velocity, quantitative electroencephalogram and cognitive performance," European Journal of Clinical Investigation, vol. 30(9), pp. 832-837, September 2000.

[2] Reference omitted.



S-201.**DEXMEDETOMIDINE SUPPRESSES THE ALERTING ATTENTION NETWORK IN HUMANS****AUTHORS:** S. J. Madison¹, M. T. Alkire²;**AFFILIATION:** ¹Anesthesiology and Perioperative Care, University of California, Irvine, CA, ²University of California, Irvine, CA.

INTRODUCTION. The neural networks that mediate attention and arousal are of great interest. Multiple networks have been defined with distinct anatomic and functional characteristics. These include the alerting, orienting, and executive attentional networks, which are thought to operate somewhat independently, according to the framework of Posner.[1] The alerting system originates in the locus coeruleus (LC) and projects primarily to the frontal and parietal regions. It is thought to use norepinephrine (NE) as its neurotransmitter and causes generalized arousal. Neuroimaging places the orienting system in the superior parietal lobe with signal traffic passing through the temporal-parietal junction. It is thought to be mediated primarily by Acetylcholine (ACh) and functions to direct attention toward a target. The executive system deals with information processing and is thought to arise from the ventral tegmental system, with dopaminergic projections to the anterior cingulate and lateral prefrontal cortex. The Attention Network Test (ANT) of Fan and Posner[2] individually evaluates these three networks in a simple, 30-min reaction-time testing session. Here we determine whether a low dose of the specific alpha-2 agonist dexmedetomidine will functionally affect primarily the noradrenergic system and suppress the alerting component of attention.

METHODS. We recruited 19 healthy volunteers aged 18-35 and administered the ANT once before and once during a computer-controlled infusion of either placebo or low-dose (plasma target 0.3 ng/mL) dexmedetomidine. Reaction times (RT) for correct trials were averaged for each individual (24 responses for each of 12 task types) and the alerting, orienting, and executive effects for each group were calculated as shown (Table). Six subjects were excluded from data analysis for 1) inability to complete the task, or 2) failure to show a "cue advantage" at baseline (RTs were faster with no cue than with a double cue).

<i>Alerting</i>	=	RT no cue/neutral flanker	-	RT double cue/neutral flanker
Placebo		459.3 (30.2)		414.8 (38.2)
Dex		531.6 (64.8)		442.1 (26.8)
<i>Orienting</i>	=	RT center cue/neutral flanker	-	RT orienting cue/neutral flanker
Placebo		425.9 (39.7)		383.4 (15.6)
Dex		467.3 (37.2)		429.5 (34.2)
<i>Conflict</i>	=	RT center cue/congruent flanker	-	RT center cue/incongruent flanker
Placebo		424.1 (33.9)		535.2 (27.8)
Dex		483.3 (78.8)		598.6 (58.7)

Table. Mean (SD) RT for calculation of the Alerting, Orienting, and Executive Attention effects.

RESULTS. All RTs were comparable between groups at baseline. A significant difference only in the mean alerting effect was observed during infusion between the dexmedetomidine group and the placebo group ($p < 0.05$). No significant difference was observed between the two groups in the orienting and executive effects (Figure).

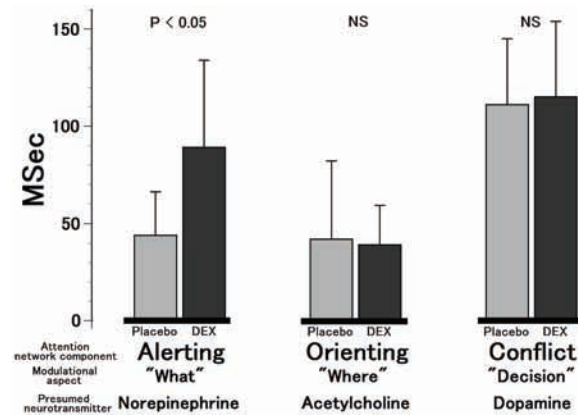


Figure. Reaction time effects on the 3 attention networks during dexmedetomidine infusion, shown as Mean (SD).

DISCUSSION. Dexmedetomidine suppresses the alerting attentional network. This is consistent with the idea that attentional networks are dissociable and mediated by different neurotransmitter systems. As the alerting network appears to be mediated largely by NE, our findings suggest dexmedetomidine may have further utility for detailed cognitive studies of attention by acting as a fairly specific blocker of NE activity in the human brain.

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2. *J Cog Neurosci*, 2002 14(3): 340-7.

S-202.

THE EMOTIONAL MEMORY BLOCKING EFFECTS OF DEXMEDETOMIDINE

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INTRODUCTION. The amygdala plays a role in the mnemonic boost associated with emotional arousal. Norepinephrine (NE) levels in the amygdala during and shortly after learning correlate with subsequent memory performance. Anesthetics have differential effects on emotional memory processing that seem to parallel each agent's ability to interfere with amygdala functioning. Those that suppress it, like sevoflurane and nitrous oxide, block long-term memory for emotional material. Those that do not interfere with it, like desflurane, fail to selectively block emotional memory. As the emotional arousal effect is thought to be due to changes in amygdala NE levels, we wondered whether specific inhibition of NE functioning in humans with the alpha-2 agonist, dexmedetomidine (DEX) might specifically block emotional memory. We determined this in volunteers using a low-dose infusion of DEX.

METHODS. We recruited 19 healthy volunteers aged 18-35 and asked them to view a series of slides from the International Affective Picture System (IAPS) while receiving a computer-controlled infusion of placebo (n=9) or low-dose DEX (0.3 ng/mL target plasma level, n=8). Subjects viewed a total of 60 slides varying in emotional content over a period of 30 minutes and gave their emotional rating to each slide ranging from 1 (neutral, non-arousing) to 4 (highly emotionally arousing). Two days later the subjects returned for recall, recognition, and familiarity memory testing. Total memory was calculated for both confident and non-confident responses, each corrected for false alarms. Two placebo subjects were excluded from analysis due to data capture failure. Significance was assessed using Student's t-test.

RESULTS. The DEX and placebo groups were comparable in the distribution of emotional responses. As expected, the placebo group demonstrated an emotional memory boost in confident recollection memory. Consistent with a reduction of amygdala NE levels, the emotional memory boost was absent in the DEX group (Figure). Interestingly, memory for neutral items was also suppressed, such that the DEX group had a significant reduction in total memory performance (Placebo=58.5±13.8% versus DEX=32.2±13.8%, p<0.01).

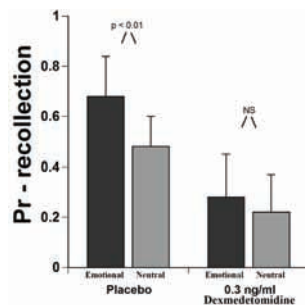


Figure. Recollection memory for both neutral and emotional items is suppressed by DEX.

DISCUSSION. Consistent with a noradrenergic mechanism, the mnemonic advantage of emotional material is significantly reduced in humans given a low dose of DEX during memory encoding. This effect is similar to that previously found with sevoflurane and nitrous oxide. However, DEX also tends to suppress memory for non-emotional items. This supports the idea that more than one mechanism of amnesia may exist for DEX. Given that DEX decreases hippocampal serotonin turnover, we posit a relationship between neutral memory formation and the level of serotonergic functioning in the hippocampus. Studies with lower doses of DEX are underway to examine whether emotional memory can be blocked more specifically while preserving neutral memory.

S-203.

REGULATION BY UPSTREAM PROTEIN KINASES OF PROTEIN PHOSPHATASE-1_α, AN INTRACELLULAR SIGNAL ACTIVATED IN GLOBAL CEREBRAL ISCHEMIA

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INTRODUCTION: Protein phosphatase (PP)-1 is a major serine/threonine phosphatase that interacts with and dephosphorylates critical regulators of energy metabolism, ionic balance, and apoptosis. PP-1_α, a major regulated form of PP-1 that contains the catalytic subunit (PP-1_{cat}) and the regulatory subunit inhibitor-2 (I-2), is activated in brain *in vivo* following cardiac arrest and resuscitation in a clinically relevant pig model of transient global cerebral ischemia and reperfusion.¹ PP-1_α requires preincubation with Mg²⁺/ATP for activation and co-purifies with a number of associated proteins including an inhibitory modulator (14-3-3) and two protein kinases (C-TAK1, PFTAIRE kinase).¹ This study addressed the control of PP-1_α activity by phosphorylation mechanisms.

METHODS: Activation of native purified pig brain PP-1_α, prepared as described,¹ was analyzed using specific kinase inhibitors. Regulation of reconstituted recombinant PP-1_α activity by phosphorylation was analyzed using purified exogenous kinases. PP-1_α was assayed by its ability to dephosphorylate ³²P-labeled phosphorylase *a* or [³²P]phospho-Bad following activation by preincubation with Mg²⁺/ATP without (for native enzyme) or with (reconstituted enzyme) GSK-3.

RESULTS: PP-1_α activation was not inhibited by roscovitine or bromo-3'-oxime indirubin, inhibitors of cdk-5, ERK1 and GSK-3, kinases that can activate reconstituted PP-1_α *in vitro*. Purified C-TAK1 phosphorylated I-2 in reconstituted PP-1_α (PP-1_α:I-2), which resulted in partial inhibition of phosphatase activity. Phosphorylation of I-2 by C-TAK1 at S71 (identified by mass spectrometry) inhibited subsequent phosphorylation of T72 and activation of phosphatase activity by GSK-3. The effects of protein kinase Cδ (PKCδ) and Ca²⁺/calmodulin-dependent protein kinase II (CaMKII), kinases known to phosphorylate 14-3-3, were tested as activators of the trimeric complex of PP-1_α, 14-3-3γ and I-2.

DISCUSSION: Brain PP-1_α is activated by an endogenous protein kinase other than C-TAK1, cdk-5, ERK1 or GSK-3. The possible role of PFTAIRE kinase, an associated kinase that has yet to be isolated in an active form, in PP-1_α activation remains to be determined. Reconstituted PP-1_α is negatively regulated by C-TAK1 via I-2 phosphorylation at a serine adjacent to the activating phosphorylation site. 14-3-3γ is a negative modulator of PP-1_α that can be phosphorylated by PKCδ and CaMKII, kinases that are activated in ischemia and might mediate activation of brain PP-1_α in cerebral ischemia following increases in cytosolic Ca²⁺.

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S-204.

ISOFLURANE ALONE DOES NOT PRODUCE PROGRAMMED CELL DEATH IN HIPPOCAMPUS TISSUE CULTURES OF SEVEN DAY OLD MICE

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INTRODUCTION: There is increasing evidence that exposure to inhaled anesthetics like isoflurane (iso) during the growth spurt of the brain (synaptogenesis) may lead to programmed cell death (PCD) in neurons. Synaptogenesis in mice lasts from birth to about 14 days postnatal with a peak on day 7. The most sensitive time point for induction of PCD in hippocampus cultures is on culture day 7. (1) Most studies during synaptogenesis in the past showing cell death after iso were either live animal experiments, where it is not possible to isolate the effect of the inhaled anesthetic alone (2) or studies in tissue cultures using a combination of iso with nitrous oxide and/or intravenous medications. We undertook an experiment on cultured hippocampus tissue from mice pups to confirm the finding of PCD during synaptogenesis after an exposure of organotypic tissue to iso alone.

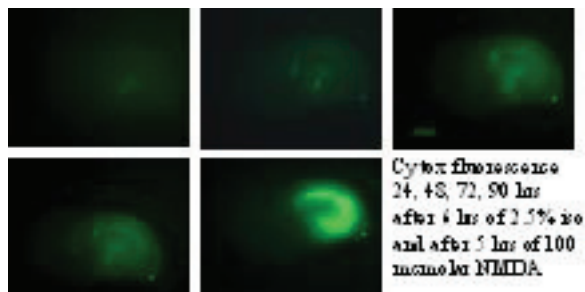
METHODS: We used pups from time dated pregnant C57Bl/6J mice. The hippocampus was extracted on postnatal day 7 and cultured at 37°C. On culture day 7, half the tissue was exposed to 2.5Vol% of iso for 6 hours, measured by infrared gas chromatography while the other half was exposed to air only. The tissue of both groups was also exposed to 5% CO₂ during the experiment and during culture before and after the experiment as necessary for culture of the tissue. 0.075mcmolar Sytox[®] was added as cell death marker 18 hours after the iso exposure and the tissue checked for fluorescence 24, 48, 72 and 90 hours after iso. After 90 hours, the tissue was exposed to 5 hours of 100mcmolar NMDA and again checked for fluorescence.

RESULTS: Some increasing background fluorescence but no cell death was noted in treatment or control group until 90 hours after an exposure to iso. In both the control and the treatment group NMDA lead to immediate and strong fluorescence indicating cell death. (Picture)

DISCUSSION: We were unable to confirm the findings of others who found PCD in cultured hippocampus tissue from mice during synaptogenesis after exposure to iso alone. The immediate fluorescence after NMDA shows the validity of Sytox[®] as our cell death marker. The findings of others of PCD in neural tissue during synaptogenesis after an iso exposure might rather be based on a combination effect than the sole effect of an inhaled anesthetic on neural tissue.

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S-205.

UPREGULATION OF DELTAFOSB REVEALS PROPOFOL IS AN ADDICTIVE DRUG

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INTRODUCTION: There is considerable evidence that all drugs of abuse converge on a common circuitry and induce addiction by modulating gene expression such as DeltaFosB in the nucleus accumbens (NAc) (1, 2). Although propofol, the most widely used drug in anesthesia, is traditionally considered as a safe and non-addictive drug, recent clinical evidences suggest that it might have abuse potential (1). The current study is to provide direct addictive evidence via determining the effect of propofol on DeltaFosB expression.

METHODS: To determine whether propofol is addictive, we examined the effect of propofol on the expression of DeltaFosB. Two well-known addictive agents, **alcohol (ethanol)** and **nicotine** were used as positive controls. Experiments were conducted on thirty-six male Sprague-Dawley rats (150-200 g). These animals were divided into four treatment groups: vehicle (saline), propofol (10 mg/kg), ethanol (1 g/kg), and **nicotine** (0.5 mg/kg). All drugs were administered by intraperitoneal injection twice per day for seven days. The animals were then sacrificed and their NAc were isolated for protein measurements using western blot analysis.

RESULTS: As expected, both ethanol and **nicotine** significantly increased DeltaFosB expression. Intriguingly, propofol elicited a robust increase in DeltaFosB expression similar to that of ethanol and nicotine.

DISCUSSION: The results indicate that DeltaFosB in NAc is sensitive to propofol.

Although the study is in its initial stage, the final confirmation that propofol is an addictive drug will have a huge impact on the entire biomedicine and social community. First, propofol is widely used in and out of the operating rooms. Moreover, the air in the operating rooms contains propofol that may be harmful to the health care staff. New administrative regulations and methods to monitor and control the use of propofol will be warranted as new addictive evidences are accumulated.

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S-206.

POST-ISCHEMIC TREATMENT WITH SSAO INHIBITOR, LJP-1207, REDUCES INFARCT VOLUMES AND IMPROVES NEUROLOGICAL OUTCOMES IN A RAT REVERSIBLE MIDDLE CEREBRAL ARTERY OCCLUSION(MCAO) MODEL THROUGH LATER ARRIVING LEUKOCYTES SUBSETS BLOCKAGE

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INTRODUCTION: Vascular adhesion protein-1(VAP-1), also called semicarbazide-sensitive amine oxidase(SSAO), is reported to play an important role in the adhesion and endothelial transmigration of multiple leukocyte subsets(1). Report showed the different time course of different leukocyte subsets infiltration after temporary MACO, neutrophils peak at 12 hr, monocytes peak at 24 hr and T-cell lymphocytes peak at 48 hr(2).Our laboratory previously reported that treatment with the novel and selective VAP-1/SSAO blocker, LJP-1207, at 6 hr reperfusion followed with repeated dose every 24 hr thereafter for 48 hrs, significantly reduce brain infarction and improved neurological outcome compared to the treatment group at 6 hr after reperfusion only and vehicle-treatment controls. Our aim for this study is to determine the mechanism of protection by the VAP-1/SSAO blocker interaction with the different leukocyte subset.

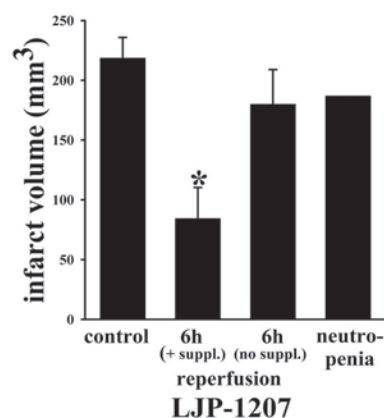
METHODS: In male Spague-Dawley rats were treated with an anti-neutrophil antibody or clodronate liposome (monocyte depletion agent) 24 hr prior to subject to 60 min of MCAO followed by 72 h of reperfusion compare with vehicle treated control and LJP1207 treated at 6 hr with supplemental dose (24hr and 48 hr) and 6 hr alone.

RESULTS: After temporary MCAO, there is no significant protection in neutropenia group nor in LJP treated at 6 hr alone compared to vehicle treated group. Our preliminary data of the infarct volume in the clodronate liposome treated group is significantly less compared to vehicle control group.

DISCUSSION: Cerebral protection post ischemic VAP-1/SSAO inhibitor in rats subjected to transient middle cerebral artery occlusion may target non-neutrophil but the later arriving leukocyte (monocytes and lymphocytes?) population.

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S-207.**DOES ASYMMETRY OF L AND R EYE PUPIL CONSTRICTION VELOCITY PERSIST DURING GENERAL ANESTHESIA AND IN THE STEEP TRENDLENBERG POSITION?**

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AFFILIATION: ¹Anesthesiology, St. Luke's Roosevelt Hospitals, New York, NY, ²St. Luke's Roosevelt Hospitals, New York, NY.

INTRODUCTION: Post operative visual loss due to ischemic optic neuropathy (ION) is a devastating morbidity and may occur following surgeries performed in the Trendelenburg position (1). Pupilometry has been demonstrated to be feasible and reliable during TIVA with remifentanyl infusion in prone spine patients (2).

ION is diagnosed clinically by a "sluggish pupil" response to light flash. Light flash evoked pupilometry allows assessment of "constriction velocity" following light flash. We examined [Issue a] if L/R asymmetries of constriction velocities (CV) of each pupil would maintain throughout anesthesia with desflurane, and [Issue b] in steep Trendelenburg surgeries, with matched case controls, would constriction velocities change over the course of surgery?

METHODS: 64 patients consented to have serial pupilometry recordings every 15 minutes during anesthesia. Complete data were available from (Issue [a]), 47 patients two of whom were in steep Trendelenburg, allowing matched case controls for (Issue [b]). Parameters of interest included CV following light flash. Recordings were made using the NeurOptics handheld pupilometer.

Prior to induction patients received midazolam + fentanyl. Induction with propofol followed by muscle relaxant facilitated endotracheal intubation. Anesthesia was maintained with desflurane (no nitrous oxide) and fentanyl with supplemental muscle relaxation. All vital sign and anesthetic data were captured automatically by CompuRecord for later integration into the database.

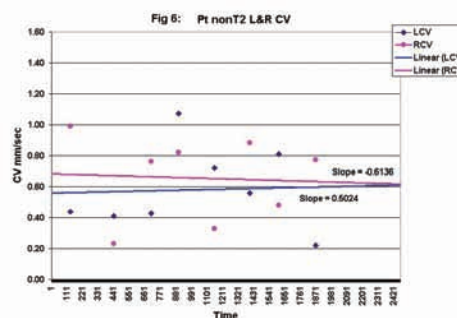
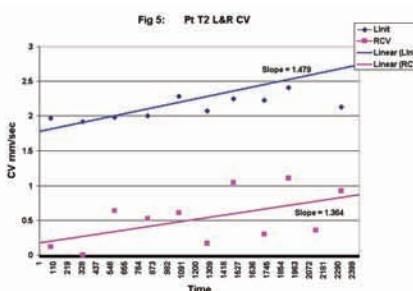
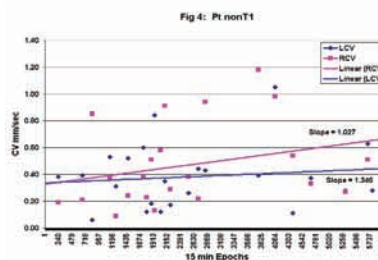
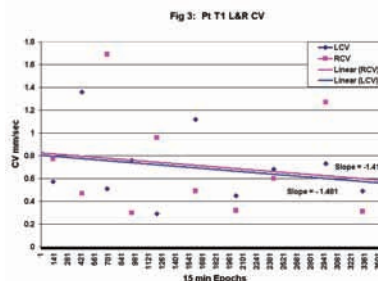
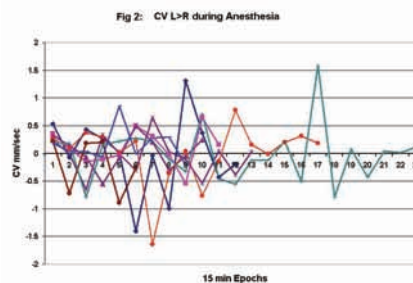
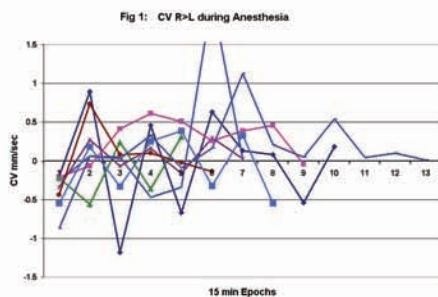
RESULTS: Separate measures were obtained from L and R eyes following induction of anesthesia prior to incision and every 15 minutes throughout anesthesia. Issue [a]: Fig 1 and 2 show tracking of L minus R CV during anesthesia out to 345 min for the 16 patients with the greatest L/R asymmetry (L>R and R>L) at initial recordings. Left-right asymmetry at initial readings post-induction are not maintained and vary during anesthesia.

Issue [b]: two steep Trendelenburg patients had serial pupilometry recordings and were compared to two matched case controls. Pt T1 (Fig 3) showed CV slowing over 7 hrs of anesthesia compared to matched control Pt nonT1 (Fig 4). Pt T2 (Fig 5) did not show CV slowing compared to match control Pt nonT2 (Fig 6).

DISCUSSION: The variability in constriction velocity following light flash presents a challenge as a reliable signal for monitoring optic nerve function. Anesthetic techniques which may improve stability of pupil constriction velocity following light flash may allow for assessment of a signal of optic nerve function during surgeries at risk for post operative visual loss.

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S-208.

STABILITY AND INSTABILITY OF PUPILLOMETRY DURING GENERAL ANESTHESIA

AUTHORS: S. Lee¹, R. Weiser², A. Bangalore², K. Khan², A. Kundra², H. L. Bennett²;

AFFILIATION: ¹Anesthesiology, St. Luke's Roosevelt Hospitals, New York, NY, ²St. Luke's Roosevelt Hospitals, New York, NY.

INTRODUCTION: Pupillometry (PUP) is an easily acquired signal in supine anesthetized patients which may provide unique information on important parameters relevant to anesthesiologists. Resting pupil size dilation may indicate inadequate analgesia (1). Following light flash, slowing of pupil constriction velocity may indicate ischemic optic neuropathy (ION) (2). Prior work has demonstrated feasibility and reliability of PUP during 6+ hrs. of prone spine surgery using TIVA. The present effort examined reliability over time of PUP parameters during supine lower abdominal surgeries using general anesthesia with desflurane and fentanyl.

METHODS:

64 patients consented to have serial pupillometry recordings every 15 minutes during anesthesia. Complete data were available from 47 patients. Parameters of interest included "initial pupil size" (INIT), "latency" (LAT) following light flash to initial constriction and "constriction velocity" (CV) of pupil size changes following light flash. Pupillometry readings were done using the NeuroOptics handheld device.

Prior to induction patients received midazolam + fentanyl. Induction with propofol followed by muscle relaxant facilitated endotracheal intubation. Anesthesia was maintained with desflurane (no nitrous oxide) and fentanyl with supplemental muscle relaxation. All vital sign and anesthetic data were captured automatically by CompuRecord for later integration into the database.

RESULTS: Separate measures were obtained from both L and R eyes at each time period.

Initial pupil diameter (INIT): Resting pupil diameters prior to light flash varied between 1.2 and 5.0 mm (Fig 1). One patient who received glycopyrrolate for bradycardia was an outlier (pupils dilated). Overall, L&R eyes showed a high level of agreement ($r = .781$, $p < .001$).

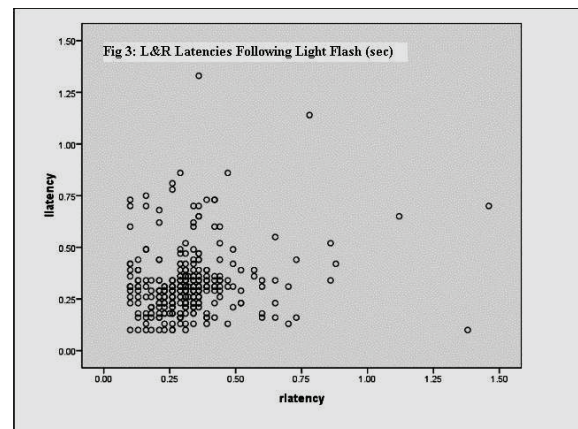
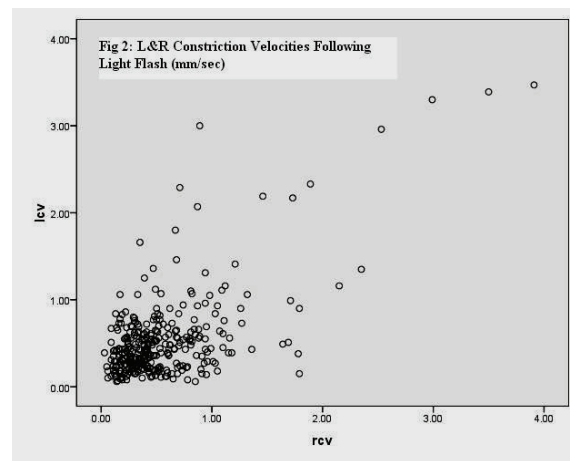
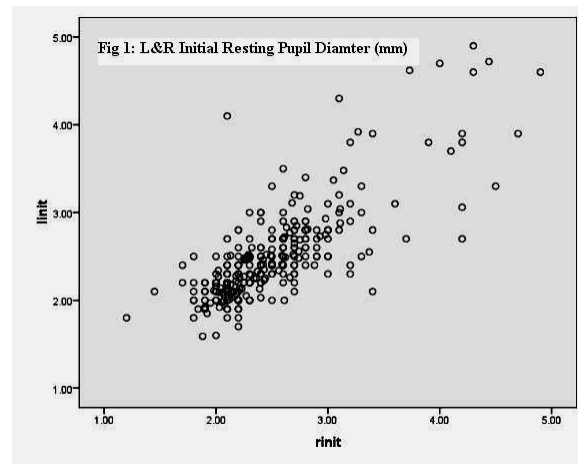
Constriction velocity (CV): Fig 2 shows L&R CV scatter plot over time periods indicating that pupil constriction velocities are reliable between L and R eyes ($r = .643$, $p < .001$).

Latency (LAT): Fig 3 shows moderate agreement between L&R latencies (matched pairs) ($r = .161$, $p = .003$).

DISCUSSION: INIT can be influenced by nociception and anticholinergics. LAT can be influenced by end-tidal anesthetic gas. CV can be influenced by both optic nerve ischemia and severe myosis (few data points during minimal constriction preventing accurate slope calculation) from opioids. General anesthesia does not prevent accurate assessment of pupil measures. Attention must be paid to anesthetic variables affecting these three independent parameters of brainstem and optic nerve function.

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S-209.**TIME TO INR REVERSAL WITH RFVIIA IN PATIENTS ON WARFARIN PRESENTING WITH A SECONDARY INTRACEREBRAL HEMORRHAGE: A RETROSPECTIVE CASE STUDY**

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AFFILIATION: ¹Anesthesiology, The Ohio State University College of Medicine, Columbus, OH, ²The Ohio State University, Columbus, OH.

INTRODUCTION: In patients on oral anticoagulant therapy (OAT), the incidence of spontaneous intracerebral hemorrhage increases up to ten-fold¹. For patients with an acute ICH and an INR greater than 1.5, it is necessary to quickly and safely reduce the INR if procedures, such as emergency neurosurgery, are to proceed. The goal of this retrospective study is to determine if recombinant factor VIIa (rfVIIa) decreased the time to achieve INR reversal (defined as INR<1.5) in patients presenting with an acute ICH with an INR greater than 1.5 while on OAT.

METHODS: IRB approval was obtained. Retrospective review was performed on thirty patients. All had anticoagulation by warfarin, a documented ICH by CT, and an elevated INR on admission. Five patients were excluded due to missing data points. Ten out of twenty-five patients went to emergency neurosurgery. Data consisted of initial and follow-up INR, time to INR<1.5, initial and secondary head CT, and medications used for INR reversal. A Cox regression model was used to study the effect of vitamin K and FFP on the time to reach INR<1.5 with and without rfVIIa. The proportional hazard assumption was checked by looking at the interaction with time. The log-rank test was used to compare the two groups.

RESULTS: Twenty-five patients were included in the study. We divided the population into two groups, nine patients in group A (rfVIIa, vitamin K and/or FFP) and sixteen patients in group B (vitamin K and/or FFP). Median time to INR<1.5 in group A was 4 hours; group B was 16.5 hours. Statistical analysis using a t-test of the data implied that group B had a longer time to achieve an INR<1.5 than group A. The relative risk of having INR>1.5 status in group B is higher (p-value=0.0006).

DISCUSSION: Our data shows that a patient who received rfVIIa reduced his INR to below 1.5 more quickly than without rfVIIa. It also demonstrates the variability in INR reversal using FFP and vitamin K without rfVIIa and shows the heterogeneity of management when it is left to the individual physician. Thus our hospital created an anticoagulant-associated intracerebral hemorrhage clinical algorithm including vitamin K, FFP, prothrombin-complex concentrate (PCC) and rfVIIa to achieve INR<1.5. For patients facing emergency neurosurgery, we believe rfVIIa can reduce the waiting time to achieve INR<1.5.

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S-210.**MILD COGNITIVE IMPAIRMENT IS A RISK FACTOR IN DEVELOPMENT OF POSTOPERATIVE COGNITIVE DYSFUNCTION**

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INTRODUCTION: Increasingly, Postoperative Cognitive Dysfunction (POCD) is recognized as a complication after surgery in the elderly(1). To date, the etiology of POCD remains unclear. Recent research identified an intermediate state between normal aging and dementia known as mild cognitive impairment (MCI). MCI is defined as impairment in one or more cognitive domains (typically various forms of memory) that are greater than would be expected for a person's age, but that is insufficient to interfere with the activities of daily living. Individuals with MCI are known to have an increased risk of progressing to dementia compared to elderly persons with normal levels of cognitive functioning. We sought to determine whether patients with a preexisting MCI will have an accelerated progression of dementia postoperatively when compared to the matched control group without MCI.

METHODS: The Center for Brain Health in our institution maintains records of volunteers who undergo neurological assessment through batteries of psychometric tests. We reviewed records of 670 patients who received at least 3 psychometric evaluations and who's surgery occurred prior to the second evaluation. We identified 169 individuals who met these criteria. Subjects were divided into four groups: 1). "Normal" elderly without surgery (N=71); 2) Patients with MCI without surgery (N=34); 3) "Normal" elderly who had a surgery between evaluations (N=50); and 4). Patients with MCI who had surgery (N=14). Longitudinal differences were examined in working memory, immediate verbal memory, delayed verbal memory, and attention domains.

RESULTS: Normal individuals either with or without surgery did not show longitudinal differences in any domain. Individuals with MCI showed an effect of surgery in the working memory domain. MCI with surgery had a significantly greater decline in performance on the digit span forward test (DSFT) compared to MCI without surgery on their second evaluation (F=1.46, 8.1, p < .05). (Table 1). Interestingly, digit span forward performance has approximated normal decline at the third time point. We did not find acceleration in decline in other cognitive domains after surgery in individuals with or without MCI

DISCUSSION: These preliminary findings suggest that surgery negatively impacts working memory (as measured by the DSFT) in patients with MCI but not in normal individuals. Although postoperative changes in mental function are well documented, this is the first study which identified a specific subgroup of patients who are predisposed to this complication.

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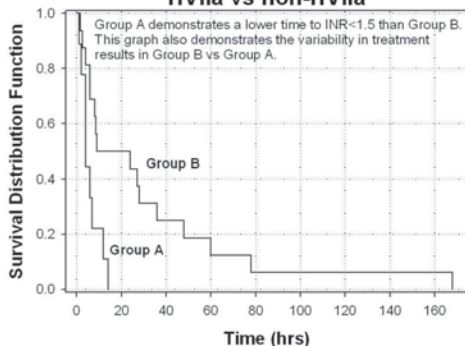
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Longitudinal DSFT performance (mean scores)

	No Surgery			Surgery		
Time Points	1	2	3	1	2	3
Normals	7.2+/-1.3	7.1+/-1.1	7.2+/-1.1	7.1+/-1.1	7.0+/-1.2	6.7+/-1.2
MCI	6.8+/-1.3	7.0+/-2.2	6.4+/-1.5	7.1+/-1.1	6.0+/-1.2*	6.7+/-0.9

*P<0.05

Figure 1. Time to INR<1.5: rfVIIa vs non-rfVIIa



S-211.

INCIDENCE OF CEREBRAL LACTATE PRODUCTION WITH MILD HYPERVENTILATION

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INTRODUCTION: The effect that hyperventilation has on the cerebral vasculature with the subsequent decrease in cerebral blood volume is commonly utilized in neuroanesthesia.¹ By causing cerebral vasoconstriction, the hypocapnia induced by hyperventilation can aid in reduction of intracranial pressure as well as improve surgical exposure.² Profound hypocapnia theoretically could reduce cerebral blood flow enough to induce anaerobic metabolism in the brain. This concept has led to recommendations to avoid hyperventilation in those patients with acute traumatic brain injury.³ However, there are little data to characterize the direct effect that hyperventilation has on the aerobic and anaerobic metabolism of those presenting for intracranial surgery without trauma.

METHODS: After IRB approval, we prospectively recorded data for patients undergoing neurological surgery for which arterial, central and jugular catheters would be placed. During a normocapnic steady-state of general anesthesia under hemodynamically stable conditions, blood samples from arterial, central and retrograde jugular catheters were taken for blood gas analysis. Prior to opening the dura, after a steady-state of mild hyperventilation was established under similar anesthetic depth, a second set of blood gases was analyzed. Parametric data were compared with a t-test and the Fisher exact test was used to compare categorical data.

RESULTS: Twenty-two subjects, ages 42.5 ± 14.7 years were studied. During normocapnia, 3 patients had an arterial-jugular difference of lactate (AJDLac) that was negative (indicating cerebral lactate production). Although the overall increase in lactate production is small (Table 1) the proportion of patients having a negative AJDLac (lactate producers) after establishment of hyperventilation increased to 11 of the 22 patients studied ($P = 0.01$).

There were no differences in the pCO_2 levels nor the normocapnic and hypocapnic jugular bulb oxygen saturations between the lactate producers and those that did not produce lactate.

DISCUSSION: Hypocapnia can induce large reductions in cerebral blood flow, which may lead to anaerobic metabolism and subsequent ischemia. Our data support this hypothesis with half of our study sample showing lactate production with hyperventilation. The average hypocapnic pCO_2 for all patients was 31.3 ± 3.5 mmHg, a level that is routinely used during craniotomy. This would suggest that even a moderate level of hyperventilation might not be ideal in all comers for neurologic surgery. We were unable to predict the presence of lactate production based on changes induced in the jugular bulb saturation. The clinical implications of these findings remain to be established.

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3. Critical Care Medicine, 2002, 30:1950

	Normocapnia	Hypocapnia
pCO ₂ (mmHg)	40.8 ± 3.8	31.4 ± 3.5*
MAP (mmHg)	73 ± 9	76 ± 8*
Temperature (°C)	35.3 ± 0.7	35.2 ± 0.6*
pH	7.40 ± 0.04	7.49 ± 0.05*
AJDLac	3 negative	11 negative*
AJDLac* (mmol/L)	0.04 ± 0.14	-0.04 ± 0.21
JV lactate (mmol/L)	1.18 ± 0.67	1.32 ± 0.62*
AJVD ₂ (ml O ₂ /100 ml)	15.4 ± 1.8	17.8 ± 1.9*
*p < 0.05 compared with normocapnia		

Table 1. Hypocapnia effect on cerebral lactate metabolism.

S-212.

ISOFLURANE DEMONSTRATES ANTIDEPRESSANT-LIKE ACTIVITY IN A MOUSE MODEL OF DEPRESSION

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AFFILIATION: ¹Anesthesiology, University of Utah, Salt Lake City, UT, ²University of Utah, Salt Lake City, UT.

INTRODUCTION: Preliminary clinical research suggests that deep isoflurane anesthesia (achieving an isoelectric EEG) may be equally effective as ECT in treating depression, with significantly less adverse effects (1). Despite these encouraging findings, no large clinical trial has yet been published. Possibly, this is because mechanisms for isoflurane's effects on depression are unknown, which has led to an inability to optimize treatments and dosing strategies. Thus, we performed a pilot study in mice to compare effects of isoflurane vs. conventional antidepressant therapy on behavioral responses in an animal model of depression, the forced swim test (FST). We also quantified the regional brain expression of six genes commonly affected by depression and its treatment.

METHODS: The study protocol was approved by the institutional animal care committee. Using the forced swim test, immobility times (max=360 sec) were recorded for three groups of C57 mice: 1) untreated control, 2) isoflurane-treated, and 3) desipramine-treated. All treatments were administered 24 hours prior to testing. Immediately after behavioral testing, animals were sacrificed and brain tissue was frozen. RNA was extracted and quantified using real-time, quantitative polymerase chain reaction (QPCR). Genes assessed included: brain derived neurotrophic factor (BDNF), glycerol 3-phosphate dehydrogenase (GPD3), glutamic acid decarboxylase (GAD-1), sulfotransferase 1a (sult1a1), serotonin transporter (5HTT), and dopamine beta-hydroxylase (DBH).

RESULTS: Immobility times for isoflurane (119 sec.) and desipramine (117 sec.) were significantly less than that of the control group (201 sec.), $p < 0.05$ for both. Gene expression varied depending on brain region, but is notable for marked increases in both 5HTT and DBH in the hypothalamus.

DISCUSSION: The results of this pilot study indicate that deep isoflurane anesthesia had an antidepressant-like effect. A controlled, blinded comparison with ECT is currently underway. Subsequent investigation will further assess mechanism and alternative treatment regimens in the hope of optimizing efficacy.

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S-213.

THE EFFECTS OF SUFENTANIL AND FENTANYL ON PATIENTS UNDERGOING NEUROSURGICAL SURGERY

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OBJECTIVE

To compare the effects of sufentanil and fentanyl on hemodynamics, recovery profiles from general anesthesia and the stress response in patients undergoing neurosurgery.

METHODS: A total of 40 ASA physical status I or II patients scheduled for intracranial tumor resection were randomized to S(sufentanil) or F(fentanyl) group (20 for each). Induction of anesthesia was begun with midazolam, propofol, 0.4µg/kg sufentanil in S Group or 4µg/kg fentanyl in F Group. Vecuronium 0.1mg/kg was given on Loss of Consciousness(LOS). Tracheal intubation was done three minutes after induction, and mechanical ventilation was performed. Sufentanil or fentanyl was used for patients in S group or F group respectively, in combined with continuous intravenous pumping of propofol(3-4mg/kg/h) and inhalation of sevoflurane for the maintenance of anesthesia. Vecuronium 2mg was injected at intervals of 45-60 min. Sevoflurane was stopped after dural closure and propofol was stopped when the operation was finished. The patient's blood pressure, heart rate and BIS were continuously monitored and recorded at different time points including baseline values(T0), post-anesthesia induction(T1), tracheal intubation(T2), head holder application(T3), skin and dural incisions(T4, T5), dural closure(T6),spontaneous breath recovery(T7) and after tracheal extubation(T8). At time points including T0, 30 minutes after skin incision, 1 minute after tracheal extubation(T8), radial arterial blood sampling were underwent to detect the concentration of blood glucose(BG) and epinephrine(EPI). Time to recovery of spontaneous breath, eye-opening and extubation from the end of operation, postoperative pain and adverse effects were recorded.

RESULTS: MAP, HR in group S were more stable than that in group F in all the time points. The extubation time and the consciousness time were markedly shorter in group S than in group F(P<0.05). The incidence of postoperative restlessness in group S is lower than group F. The incidence of shivering, nausea and vomiting were similar in both groups. VAS grades in group S were significantly lower than group F at 5 minutes after extubation, 2h after operations, group S (P<0.05). The changes of the concentration of blood glucose(BG) and epinephrine(EPI) at each time points was similar at two groups.

CONCLUSIONS: Sufentanil combining with propofol and sevoflurane is superior to fentanyl in general anesthesia for patients undergoing intracranial surgery. Compared to fentanyl, the anesthesia induction and maintenance are more stable, and the quality of consciousness is better by the use of sufentanil. The incidence of nausea and vomiting did not differ. The inhibition of fentanyl or sufentanil on the concentration of blood glucose(BG) and epinephrine(EPI) at each time points is similar.

S-214.

PROFOUND HYPOTENSION FOR THREE MINUTES RESULTS IN HIPPOCAMPAL BUT NOT CORTICAL NEURONAL LOSS IN SPRAGUE DAWLEY RATS

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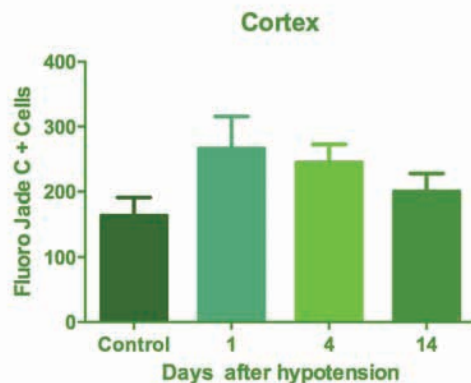
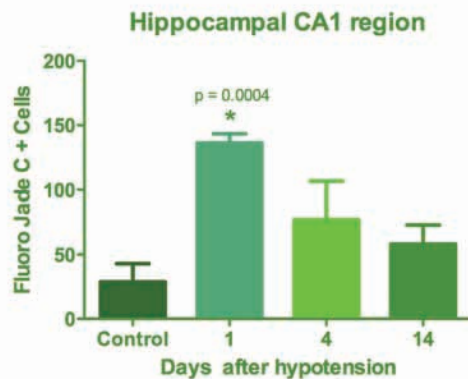
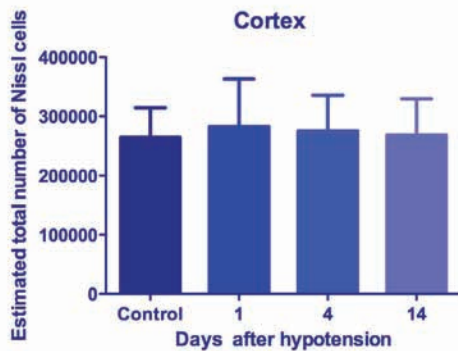
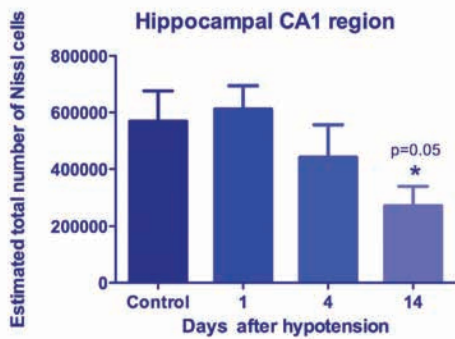
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INTRODUCTION: Cognitive tests have revealed different degrees of dysfunction after surgery, and the underlying cause of this condition seems to be multifactorial. Hypotension per se may not be the culprit but can be responsible for some neuronal loss. We used a rat hemorrhagic shock model to assess functional outcome and to measure the relative neuronal damage at 1, 4 and 14 days post-hypotension.

METHODS: Six month old, 250g to 350g Sprague-Dawley male rats were subjected to severe hypotension induced by withdrawal of arterial blood from the right femoral artery, while under Isoflurane anesthesia. Mean arterial blood pressure was maintained between 20 and 30 mm Hg, accompanied by isoelectric EEG for one minute per hour, for a total of 3 minutes per rat in a two hour period. Shed blood was immediately returned to venous circulation, returning systemic pressure to normal. The rats were separated into four groups as follows; groups 1, 2 and 3 received 3 minutes of hypotension - 1 minute every hour - and were evaluated at 1, 4 and 14 days, respectively. An additional group of rats, control group, received a sham operation. A neurological assessment including motor abilities, sensory system evaluation and retrograde memory was performed at 1, 4 and 14 days post-hypotensive insult. Brains were harvested and stained for fluoro-jade C and Nissl stain. Image analysis of fluorojade-stained brain sections were used to quantitatively detect neuronal damage (necrosis and apoptosis) after the hypotensive insult. We used stereology (Dissector) to quantify fluoro-jade C positive cells in cortex and CA1 hippocampal region. Statistical analysis was performed using Graphpad Prism 5 with the two-tailed unpaired t-test at a 95% confidence interval, after ANOVA.

RESULTS: All behavioral and motor evaluations were normal at all times. However, significant differences in ongoing cell injury were seen between control rats and rats that received 3 minutes of hypotension solely at one day after the insult, represented by numerous fluoro-jade positive hippocampal cells. We demonstrated a similar trend in the cortex; however the differences were not significant. The Nissl stain showed no changes in the cortex but a significant decrease in the number of hippocampal alive cells 14 days after the insult.

DISCUSSION: The present observations that repeated hypotensive episodes lead to hippocampal damage may have clinical implications. Patients with hemodynamic TIAs, cerebral arteriosclerotic disease, or orthostatic hypotension may experience repeated nonfatal circulatory deficiencies. This observation suggests that in this rat hemorrhagic model, brief periods of hypotension result in neuronal damage or distress in the hippocampal CA1 region one day after insult. By day 14, surviving cells are significantly reduced in the hippocampus. We did not find any significant changes in cortical cells.



S-215.

LOW DOSE ADJUVANT DEXMEDETOMIDINE LOWERS THE CONCENTRATION OF INHALED ANESTHETIC REQUIRED FOR ADEQUATE SEDATION

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INTRODUCTION: As an α_2 -adrenergic agonist, dexmedetomidine (DEX) reduces sympathetic outflow by reducing the amount of norepinephrine released in the CNS, especially in the Locus Coeruleus. The suggested maintenance dose of DEX is 0.2-0.7 mcg/kg/hr, but higher maintenance doses may be required for adequate sedation. This retrospective chart review study assessed the effects of low dose DEX (<0.4 mcg/kg/hr), used as an adjuvant to desflurane (DES), isoflurane (ISO) and sevoflurane (SEV), on patients undergoing craniotomies.

METHODS: We reviewed medical records of patients who underwent a craniotomy during the period January 2004 to May 2007. Patients were placed in one of two main groups, DEX or NonDEX, depending on whether or not they received DEX (<0.4 mcg/kg/hr). The patients were also partitioned by the inhaled anesthetic used (DES, ISO or SEV). We collected the intra-operative minimum and maximum concentrations of the inhaled anesthetic for each patient after surgical incision and throughout the procedure. We recorded hemodynamics - systolic blood pressure (SBP), diastolic blood pressure (DBP) and heart rate (HR) - at five minutes before the incision (t=-5), during incision (t=0) and five minutes after incision (t=5). The data was analyzed using a general linear regression model (GLM) for each group and each anesthetic agent.

RESULTS: Our review showed that DEX patients required lower minimum and maximum MAC levels of inhaled agents than NonDEX patients (table). The only exception was for SEV maximum MAC values. Furthermore we saw no hypotension (SBP<60mmHg), hyper tension (SBP>140mmHg), tachycardia (HR>100bpm) or bradycardia (HR<60bpm) in either group. However, at discharge the DEX patients had a lower BP than the NonDEX patients (SBP 130.7±1.6 v 139.9±1.6 p<0.001 and DBP 69.7±0.98 vs 73.15±0.99 p=0.005).

Agent	DEX Minimum MAC (%)			NonDEX Minimum MAC (%)			p
	Mean	SD	N	Mean	SD	N	
DES	3.698	0.111	134	4.326	0.092	134	<0.001
ISO	0.619	0.055	34	0.854	0.053	29	0.004
SEV	0.985	0.112	22	1.472	0.086	25	<0.001

Agent	DEX Maximum MAC (%)			NonDEX Maximum MAC (%)			p
	Mean	SD	N	Mean	SD	N	
DES	5.375	0.125	134	6.042	0.103	134	<0.001
ISO	1.081	0.074	34	1.279	0.080	29	0.074
SEV	1.734	0.160	22	2.264	0.124	25	0.013

DISCUSSION: It is well known the α_2 agonists reduce MAC. However, there is a lack of quantitative data in this area. In a previous study we have shown that DEX in combination with remifentanyl decreases MAC requirements compared to published MAC levels¹. In our current study we confirm our previous observations². Therefore, we conclude that with DEX, at lower doses in combination with remifentanyl, we not only reduce MAC but also achieve hemodynamic stability without experiencing hypotension or bradycardia. Finally, patient's systolic blood pressures on discharge in the DEX group were significantly lower than in the Non DEX group, achieving a more physiologic range.

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S-216.**VARIABILITY OF AUDITORY MIDDLE LATENCY TRANSITIONS IN PATIENTS DURING EMERGENCE FROM GENERAL ANESTHESIA**

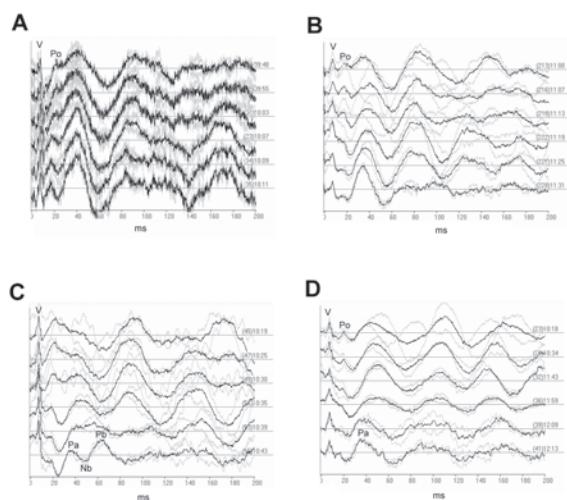
AUTHORS: R. R. McNeer¹, J. Bohorquez², A. Castro-Llanos², O. Ozdamar²;

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INTRODUCTION: Auditory middle latency responses (AMLR) are altered by general anesthetics. Reports describing changes in AMLR component latencies and amplitudes with anesthetic concentration,¹ predominantly used recording conditions that consisted of 10-Hz stimulation and 100 ms (or less) recording windows. In this study we used 5-Hz stimulation and 200 ms recording windows to investigate AMLR changes (transitions) during emergence in human subjects.

METHODS: After IRB approval and informed consent, AMLRs were recorded in surgical patients with stimulation at 5 Hz and traditional sweep averaging techniques. The recordings were obtained minutes before emergence (from either N₂O and sevoflurane or just sevoflurane) up to return to consciousness.

RESULTS: AMLRs were obtained from 15 subjects. At the start of recording (i.e. at end of maintenance), oscillations near 20 Hz were observed that were also present during the maintenance phase. However, within minutes, a number of components appear to change in amplitude and latency as the AMLR reverts back to a normal (awake) appearing recording (e.g., with P_a and P_b components). In general, the oscillations (present at the start) get attenuated (Figs. 1).



There appears to be significant variability in the dynamic changes of individual components between patients during the recording period. For example, leading up to emergence, P_o begins to appear in one patient (Fig. 1A) while it disappears in another (Fig. 1B). Additionally, in another patient, a peak appearing to be P_a at the onset of emergence resolves into two components that ultimately can be identified as P_a and P_b in the awake state (Fig. 1C). Interestingly, in one subject, P_b appears while the second oscillatory component becomes attenuated (Fig. 1D).

DISCUSSION: Anesthetic effects on component amplitudes and latencies of AMLRs suggest that a metric based on AMLR recording might aid assessment of depth of anesthesia. The results presented here appear to counter this suggestion because of the significant patient variability with regard to AMLR component transitions during emergence. However, all patients have oscillations in the beta 1 range that attenuate upon wake up. AMLR components

are associated with neurophysiologic generators in the subcortical and cortical parts of the brain.² The generator(s) of the oscillation peaks observed here are as yet unknown. We hypothesize that an explanation for the AMLR variability is the interaction (peak summation) between the AMLR components and oscillation peaks. Techniques that combine evoked potential and encephalographic recording strategies that differentiate the oscillatory and transient (AMLR) evoked responses, may allow assessment of each phenomenon in isolation and perhaps offer new advantages in monitoring of awareness.

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Obstetric Anesthesia

S-217.

CEREBRAL SPINAL FLUID AND SERUM IONIZED MAGNESIUM AND ION LEVELS IN PRE-ECLAMPTIC WOMEN DURING ADMINISTRATION OF MAGNESIUM SULFATE

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INTRODUCTION: Pre-eclampsia is a pregnancy complication characterized by new onset hypertension and proteinuria after 20 weeks gestation. If left untreated, pre-eclampsia can progress to eclampsia and lead to increased morbidity and mortality. Magnesium sulfate has been used to treat pre-eclampsia. This study was designed to compare the levels of serum and CSF magnesium and other ions in pre-eclampsia and normal pregnant women to reveal the homeostasis disturbance occurred during pre-eclamptic state.

METHODS: Data were collected from 16 pre-eclamptic women and 16 healthy pregnant women aged 20-34 years. Patients with history of neurological, renal, vascular diseases, hypertension and pre-term labor were excluded. The pre-eclamptic women were treated with IV magnesium sulfate (MgSO₄) 6g bolus followed by 2g per hour continuous infusion started at least 4.5 hours before delivery (range 4.5-48 hrs). Blood and CSF samples were collected when spinal anesthesia was induced. Levels of magnesium (total and ionized), calcium, sodium and potassium were measured. Data were analyzed with ANOVA, student test and linear regression model.

RESULTS: MgSO₄ infusion elevated the serum ionized and total magnesium levels in pre-eclamptic patients, which were significantly higher than those in the control group (ionized Mg: 1.10±0.051 vs. 0.46±0.022 mM/L, p<0.001; total Mg: 2.05±0.11 vs. 0.59±0.038 mM/L, p<0.001). However, there was no significant difference of the CSF magnesium levels between two groups. The serum and CSF magnesium fraction (ratio between ionized and total magnesium) in pre-eclamptic women were significantly lower than those in the control group (serum: 54.29±1.74% vs. 80.31±1.96%, p < 0.001; CSF: 57.18±1.84% vs. 63.81±1.81%, p<0.01). Other ions that exhibited significant difference between the two groups included: higher serum and CSF sodium levels in pre-eclamptic women, lower serum calcium level in pre-eclampsia women. In terms of CSF calcium, and potassium levels, there was no significant difference between two groups. In control group, there were significant correlations between serum magnesium levels (both ionized and total) and total CSF magnesium level as well as serum sodium level, while such correlation lacked in the pre-eclamptic patients.

DISCUSSION: Our findings about lower serum magnesium fraction, lower serum calcium level and higher serum sodium level in pre-eclamptic patients are consistent with previous studies. The results revealed the following new findings: 1) elevated serum Mg levels did not alter the CSF Mg levels up to 48 hours post-treatment with MgSO₄; 2) significantly lower CSF ionized magnesium ratio and higher CSF sodium level was associated with pre-eclamptic women; 3) correlation between serum Mg levels and other ions lacked in pre-eclamptic patients. The ion level imbalance associated with pre-eclampsia in this study could potentially shed light on the pathogenesis of pre-eclampsia.

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S-218.

HOW TO PREVENT POST-DURAL PUNCTURE HEADACHE - A QUANTITATIVE SYSTEMATIC REVIEW

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Postdural puncture headache (PDPH) is a typical complication after accidental dural puncture during epidural anesthesia.⁽¹⁾ Even though the incidence of PDPH is low (~0.8%), the large number of labour epidurals translates to over 20,000 severe cases of PDPH per year in the US.

However, randomized controlled trials are rare because the low incidence of PDPH requires a large number of patients to achieve statistically significant results. Several interventions to prevent PDPH have been suggested and investigated, but no clear consensus exists on which interventions are effective and how to best prevent severe PDPH.

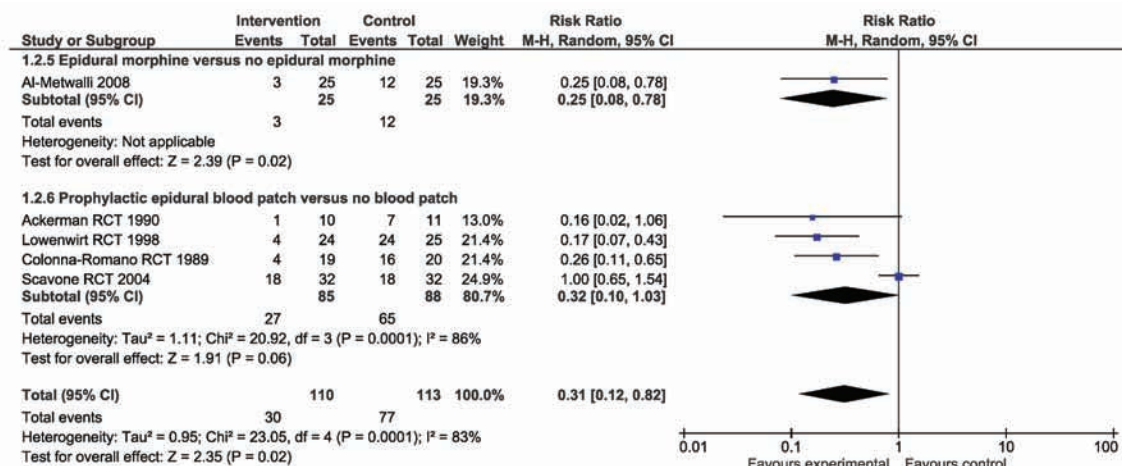
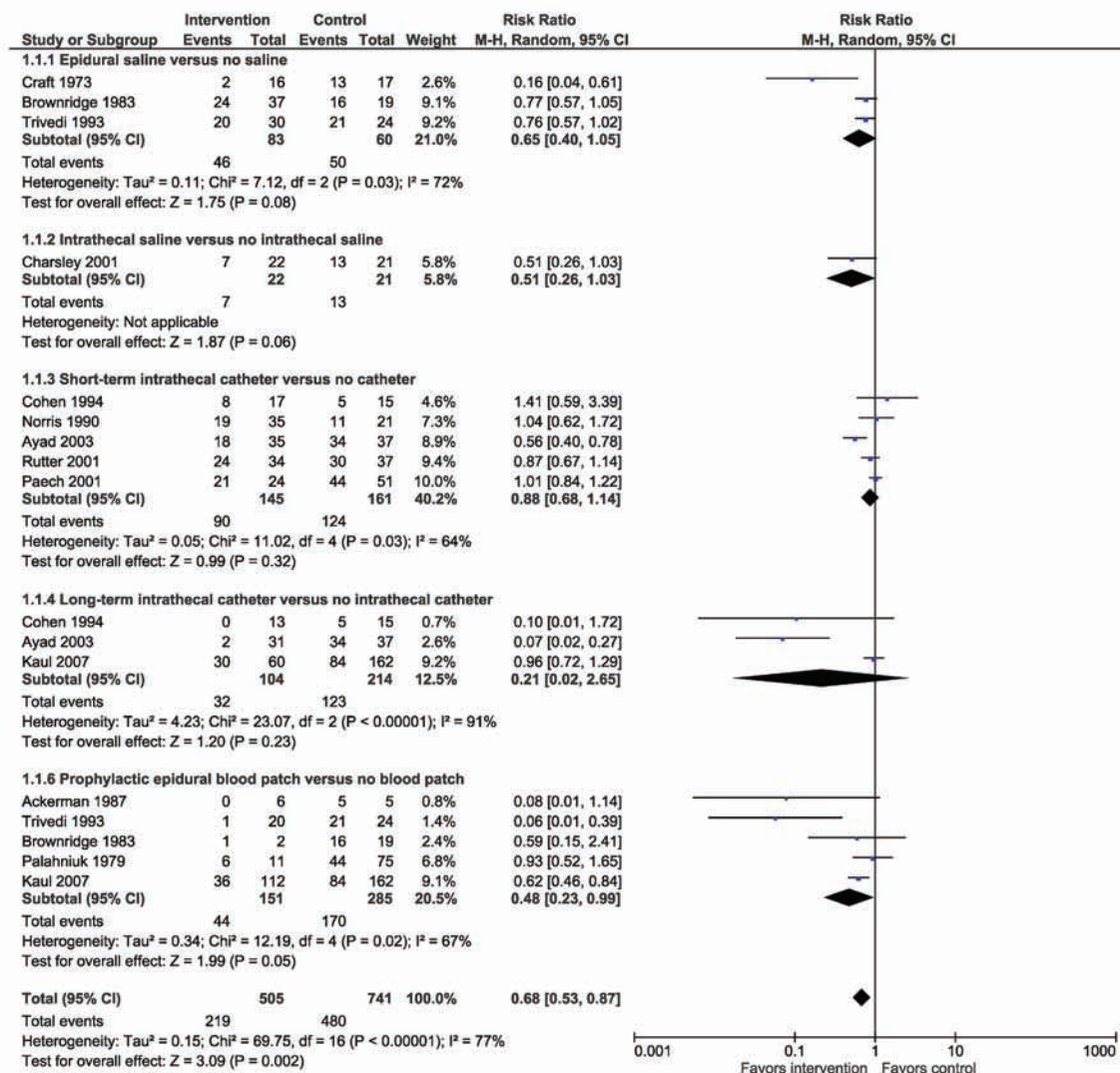
In order to summarize the currently available evidence, we conducted a quantitative systematic review to identify all available evidence for the prevention of PDPH.

Twenty-nine studies met inclusion criteria but 12 had to be excluded for lack of a control group. A total of 1264 patients in 17 studies were included in our review. Studied interventions were prophylactic epidural blood patch, epidural morphine, intrathecal catheters, and epidural or intrathecal saline.

Compared to no intervention, the relative risk for headache after performing a prophylactic epidural blood patch was 0.48 (95% confidence interval: 0.23-0.99) in five nonrandomized controlled trials (fig.1), and 0.32 (0.10-1.03) in four randomized controlled trials (fig 2). The relative risk for PDPH after treatment with epidural morphine (based on a single randomized controlled trial) was 0.25 (0.08-0.78, fig. 2). However, there was no respiratory depression but nausea was numerically more frequent in the morphine group (44% vs. 16%, P=0.06). All other interventions were based on nonrandomized controlled trials and failed to achieve statistical significance (fig. 1). This is also true for long-term intrathecal catheters. Although two smaller initial trials were highly promising, a subsequently larger study was unable to detect a treatment effect so that the relative risk for PDPH is no longer statistically significant (0.21; 0.02-2.65).

In conclusion, long term intrathecal catheters and an epidural blood patch may be options to prevent PDPH after accidental dural puncture. However, heterogeneity between the studies and publication bias limit the available evidence. To investigate the efficacy of the interventions to prevent PDPH, a large, multicenter randomized controlled trial of factorial design is needed.

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S-219.**MIDLINE LUMBAR TATTOOS AND NEURAXIAL BLOCKADE: EXPERIENCE FROM THREE LARGE UK OBSTETRIC UNITS****AUTHORS:** S. K. Kanniah¹, T. N. Sudarshana²;**AFFILIATION:** ¹Department of Anaesthesia, Altnagelvin Area Hospital, Londonderry, United Kingdom, ²Basildon Hospital, Basildon, United Kingdom.

INTRODUCTION: Tattoos have experienced a resurgence in popularity in many parts of the world, particularly in Europe, North America and Japan. In the western world, there are at least 80 million people with tattoos and this number will continue to rise⁽¹⁾. Approximately 50% of these are women. Conflicting opinion exists with regards to ideal anaesthetic management of parturients with midline lumbar tattoos^(2,3). We report the largest case series to date of anaesthetic and analgesic management of these parturients.

METHODS: Cases reported are those encountered by the authors from three large UK obstetric units over a period of one year from September 2007 until September 2008. Only parturients with significant midline tattoos covering lumbar or lumbo-sacral area and who may require a neuraxial blockade were included. Data collected: Patient demographics, type of labour analgesia, obstetric intervention, neuraxial technique, needle contact of the tattoo and complications if any.

RESULTS: Among the total 37 cases, 34 received neuraxial blockade. Type of neuraxial technique: epidural (22), combined spinal epidural (7), spinal (5). Three refused epidural labour analgesia when informed consent was obtained explaining the potential risk of inserting the needle through the tattoo. Labour analgesia was managed with remifentanyl PCA. Epidural needle had to be inserted through the tattoo in 3 parturients for labour analgesia. In 4 patients the needle insertion was close to the pigmented area (< 0.5cm). One developed redness and itching over the tattoo which resolved completely in 48 hours. She had persistent numbness over the L4 dermatome on the left. Reflexes and power were normal. The numbness remained for 4 weeks after which it resolved spontaneously. Among those who received spinal anaesthesia, 1 parturient was a tattoo related hepatitis B carrier. In two cases subarachnoid block was done at L2/3 interspace to avoid the tattoo covering L3/4 and L4/5.

DISCUSSION: The immediate or late complications following neuraxial blockade with the needle insertion either through or close to a tattoo is unknown. In obstetric anaesthesia practice, an informed patient consent has to be made explaining the risk, benefits of various techniques used and alternative options available to the parturient. This series shows patients may refuse regional technique if potential tattoo related risk is explained to them. The perception that substances in the tattoo ink are biologically inert and the amount of pigment that is used in tattoo process is quite miniscule is challenged by a recent study⁽⁴⁾. Modern tattoo colourants frequently consist of azo pigments that not only contain multiple impurities but also are originally produced for car paint and the dyeing of consumer goods. Pigment related neuronal injury can possibly explain the persistent numbness in one parturient. More studies are needed to investigate tattoo related neurological complications following neuraxial blockade.

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S-220.**ULTRASOUND GUIDED TRANSVERSUS ABDOMINIS PLANE BLOCKS FOR POSTOPERATIVE ANALGESIA FOLLOWING CESAREAN DELIVERY****AUTHORS:** M. Vallejo¹, G. M. Moreno², J. E. Chelly²;**AFFILIATION:** ¹Anesthesiology, UPMC Magee Hospital, Pittsburgh, PA, ²Division of Acute Interventional Perioperative Pain, UPMC Magee Hospital, Pittsburgh, PA.

INTRODUCTION: The use of single transversus abdominis plane (TAP) blocks performed for postoperative analgesia has been shown to be an interesting alternative to PCA morphine in patients undergoing either major abdominal surgery^{1,2} or elective cesarean delivery.³ The purpose of this case series is to confirm the safety and efficacy of single TAP blocks for postoperative analgesia following elective cesarean delivery.

METHODS: All patients received spinal anesthesia for cesarean section through a 25 gauge spinal needle with hyperbaric bupivacaine (12mg) and preservative free morphine (0.1-0.2 mg). After the cesarean delivery while under the spinal anesthetic, an ultrasound guided single bilateral TAP blocks were performed in the supine position. A 15-10 MHZ, 38mm probe connected to a S-Nerve ultrasound machine (Sonosite Inc, Bothell, WA) was oriented parallel over a virtual line drawn between the umbilicus and the anterior superior iliac spine. Using an in-plane approach and a 22 gauge needle 15 ml of bupivacaine 0.5% was injected per side between the internal oblique muscle and the transversus abdominis muscle. In addition each patient received NSAIDs as a part of the standardized multimodal pain management. Pain scores using a verbal analogue scale (VAS; 0=no pain, 10=worst pain) and morphine PO consumption were collected over a period of 3 days. Data is presented in mean \pm SD or median (range).

RESULTS: Over a 2 month period, single TAP blocks were performed in 14 patients (age 30.6 ± 5.6 yrs, height 162 ± 12.2 cm and weight 81 ± 15.1 kg). Median VAS and mean morphine consumption is provided in the Table 1. No patient required intravenous opioids. No patient experienced block related side effects or complications.

DISCUSSION: Our data confirm those previously reported by Mc Donnell et al.³ Single TAP blocks were easy to perform and demonstrated to be a safe, and effective analgesic technique following cesarean section. Since, the requirement for morphine was twice on POD#2 vs POD#1, it seems that the block lasted no more than 24 hrs. Recently Guciev et al suggested that continuous TAP blocks may represent a better alternative than single TAP blocks.⁴ Further studies are needed to determine the relative indications of continuous vs single TAP block for postoperative analgesia following cesarean delivery and to determine if the use of such a technique may reduce the requirement for intrathecal morphine and associated side effects (nausea and pruritus).

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Analgesic and Side Effects Data

	POD-0	POD-1	POD-2
Median Pain VAS	0 (0-7)	2 (0-5)	5 (0-8)
Morphine po (mg)	24.6 \pm 25.5	50.5 \pm 26.0	43.3 \pm 29.1
Pruritus Incidence (%)	35	0	7
Nausea Incidence (%)	7	0	7

S-221.

SAFE EPIDURAL ANESTHESIA IN FIFTY-EIGHT PARTURIENTS WITH PLATELET COUNTS BETWEEN 51000 AND 99000 MM³

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Regional anesthesia is a popular form of pain relief for the management of labor and delivery. Thrombocytopenia is considered a relative contraindication to the use of regional anesthesia. Some authorities have recommended that an epidural anesthetic be withheld if the platelet count is <100,000 mm(-3). We reported fifty-eight parturients who received regional anesthesia with platelet counts between 51000 and 99000.

For the period of January 2005 through December 2007, we reviewed the charts of all parturients who received cesarean section and had a platelet count <100,000 mm(-3). Fifty-eight women met this criterion immediately before operation. Patients whose platelet count was >100000 before operation but fell to a platelet count <100000 during cesarean section were not included. Of these 58, 56 had an epidural anesthetic placed (range 51,000-99,000 mm(-3)), and 2 received general anesthesia.

Twenty-four of the fifty-eight had predisposing causes for thrombocytopenia, including twin (fourteen), PIH (four), immune thrombocytopenia purpura (three), placenta accreta (one), abruption (two) and rupture of the uterine (one). Thirty-four had asymptomatic thrombocytopenia of unknown origin.

There were no other associated coagulation abnormalities. No neurological complications were documented in any patients reviewed.

We found no documentation of any neurologic complications in the medical records. We conclude that regional anesthesia should not necessarily be withheld when the platelet count is between 51000 and 100,000 mm(-3).

Fifty-six of the fifty-eight thrombocytopenic patients received regional anesthesia, and none had permanent sequelae. Based upon this retrospective review, periparturient thrombocytopenia (51,000-99,000/mmicroL) did not increase the risk of neurologic complications after a regional anesthetic. There have been no reports in the literature of spinal or epidural hematomas in parturients after regional anesthesia.

In our study anesthesia was safely administered to parturients with platelet counts was between 51000 and 100,000•μL⁻¹. Neurologic complications were rare events so it is difficult to assess in clinical practice. Therefore, it is prudent to evaluate the risk-benefit ratio on a case-by-case basis before administering regional anesthesia to parturients.

S-222.

ANESTHETIC MANAGEMENT FOR ELECTIVE CESAREAN SECTION IN A PATIENT WITH RECENT STROKE

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Stroke is the second leading cause of death of women in the US ¹. There is a higher incidence of stroke in young women than in men between the ages of 15 and 35 years ². Stroke that occurs in pregnancy is associated with significant mortality and morbidity. We report here the anesthetic management of a 38 year old woman with a term pregnancy who underwent elective Cesarean section because of breech presentation. The patient had suffered a thrombotic stroke 12 days prior to her Cesarean section with stable residual left sided hemiparesis. The coagulation laboratory studies were normal and there was no evidence of increased intracranial pressure. The patient was given a subarachnoid block with hyperbaric bupivacaine and morphine. The anesthetic and surgery were uneventful and the patient was discharged after a few days without complications. Subarachnoid anesthesia is an option for Cesarean section in a patient with recent stroke who has normal coagulation studies and does not have raised intracranial pressure.

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S-223.

ESSENTIALS OF ANAESTHESIA

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1 APPLICATION OF THE NEW SCORING SYSTEM (HDA) A PREDICTOR FOR ANESTHESIA RISK FOR PARTURIENTS: PRELIMINARY OBSERVATION

There is no good and accurate system for evaluation of parturient for anesthesia risk. ASA classification is too broad and it is not specific enough for obstetrical anesthesia management. In this study we present our preliminary results of application of the new HDA Scoring System used on women in labor in the OB/GYN department, as a predictor for anesthesia risk in parturient and correlates our results to the maternal and infant morbidity and mortality.

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Classification and definitions

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Economic restraints imposed on clinical practice by recent changes in health care management and scrutiny regarding

METHODS

The HDA classification system includes the following parameters (table 1):

Physical condition:

Mild disease: Severe disease

II-Weight: height and weight, initial and at term, (2).

III-Substance abuse:

Chronic alcohol use is .

IV-Eclampsia:

Placenta: Normal implantation

P. Previa: implantation of the placenta in the lower uterine segment, below the fetal presenting part.

Abruption placenta: premature separation of the normally implanted placenta from the uterine wall

Placenta accreta: is placental adhesion to the uterine wall without the usual intervening deciduas basalis (8).

VI-Age:

VII-Parity:

VIII-Hydramnios:

Oligohydramnios: AFI less than the fifth percentile for GA; or the AFI < 5 cm at term.

Polyhydramnios: IX-

Number of C-sections:

RESULTS: The maximal score in HDA system is 40. The score 0-10 is consider to be low risk, 10-20 mild risk, 20-30 moderate risk, and above 30 severe risk. The main predictors of risk are the urgency of giving anesthesia, physical condition, morbid obesity, age, and multiparity. The HDA assessment scoring system was applied from September 1 to March 15, 2002 on 70 parturients. We found that 68.6 % of the parturients have low risk, 31.4 % mild, and none of them had moderate or severe risk (table 1 & figure 1). During this period, the Maternal Mortality Rate (MMR) was 0 and no infant mortality. The total number of C-sections was 18(25.6%). Table 2 shows that most of the parturients received epidural anesthesia (57.1%), two spinal, ten general, and 18 parturients needed no anesthesia (Figure 2).

CONCLUSION: Our preliminary data indicates that this new HAD Scoring System not only upgrades the safety and risk management of women during labor, facilitates quality assurance of anesthesia delivery, and improves the maternal and fetal outcome, but also may serve as a new national standard of anesthesia care for parturients.

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EFFECT OF VAGINAL CAPSAICIN ON LABOR PAIN BEHAVIOR IN RATS

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INTRODUCTION: Labor is intensely painful and therefore many women request analgesia. Although neuraxial analgesia is highly efficacious, it is associated with some risks and not suitable for all women. Uterine cervical distension in non-pregnant rats produces certain pain behaviors which appear similar to pregnant rats during labor. Nociception from distension of the uterine cervix is a result of increased firing of afferents from hypogastric nerve. Majority of sensory afferents in the uterine cervix express the TRPV1 receptor for capsaicin. This study was to evaluate the hypothesis that desensitization of the TRPV1 receptor with application of capsaicin would reduce pain behavior during labor in term pregnant rats.

MATERIALS AND METHODS: After approval by the ACUC, twelve dated Sprague-Dawley pregnant rats were studied. On day 21, the gel form of either 2% lidocaine (Lido) or lidocaine plus 0.1% capsaicin (Cap) were administered vaginally in a random manner. The pregnant rat was placed into a plastic chamber in an isolated room for a 72 hr for continuous behavior recording. Animals had free access to food and water, and a normal light/dark cycle throughout the filming period. Noldus Observation 5.0 Pro was used for the offline behavioral analysis. Behaviors were analyzed for 2hrs before the birth of first pup, entire delivery period, and 30 min after the last pup. Data are expressed as mean \pm SEM, analyzed by student t-test and $p < 0.05$ was considered significant.

RESULTS: Vaginal capsaicin significantly decrease the appearance of pain behaviors compared to lidocaine control group (lateral contraction incidence: 32.6 ± 18.4 vs. 70.3 ± 46.6 ; duration 74.7 ± 46.4 vs. 191.5 ± 114.5 ; $p < 0.05$ respectively). General activity (eating, drinking, rearing, and grooming) and maternal attentions (licking pups and eating placenta) were not different between the groups. The number of newborn live pups were 12.8 ± 3.4 (Cap) and 10.8 ± 1.6 (Lido), as well as the labor duration were 83.8 ± 27.8 min vs. 74.3 ± 25.6 (Cap vs. Lido in min). All animals received Cap treatment gave birth on Day 22 while most Lido treated rats gave birth at day 23 (4 in 6).

CONCLUSION: This study confirmed our previous observation that the appearance of squashing and lateral contraction behaviors are likely related to pain, and that these behaviors can be attenuated vaginal application of capsaicin prior to the onset of labor. Furthermore, this treatment neither affected general behavior and attention to the newborn pups, nor the duration of the labor process.

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S-225.

EPIDURAL ANESTHESIA FOR THE PERCUTANEOUS LASER TREATMENT OF TWIN-TWIN TRANSFUSION SYNDROME

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INTRODUCTION: Twin-twin transfusion syndrome (TTTS) occurs in 5-10% of monochorionic multiple pregnancies and is associated with a high level of perinatal morbidity and mortality if left untreated. It is thought that blood flow imbalance between twins through placental vascular anastomosis may be the cause of TTTS. TTTS can be eliminated by selective laser photocoagulation of communicating vessels (SLPCV). Although SLPCV requires only a small skin incision, the optimal anesthetic technique has not been defined. In 2008 Rossi et al. described SLPCV using general, TIVA and local anesthesia/conscious sedation. They concluded that local anesthesia is the safest anesthetic technique for SLPCV in TTTS patients. However, Rossi et al. did not review epidural anesthesia. We have been using epidural anesthesia for SLPCV without incident since 2006 and have been successful in reducing maternal hypotension or peripartum complications. The purpose of this study was to compare our epidural anesthetic technique in SLPCV to treat TTTS with local anesthesia/conscious sedation reviewed by Rossi et al. in 2008.

METHODS: A total of 58 consecutive eligible patients who underwent only epidural anesthesia (EA) in SLPCV were compared with 139 patients on local anesthesia/conscious sedation (LocA) of Rossi et al. in 2008. Maternal age, gestational age, maternal hemodynamic fluctuations and peripartum complications were compared between the groups. Maternal hemodynamic fluctuations were defined as systolic blood pressure under 100mmHg or a decrease of more than 20% in base values.

RESULTS: Median maternal age was 30 years (16 y to 39 y) and median gestational age was 20 weeks (16 wks to 25 wks) which were not significantly different from LocA group. Although mean lowest intraoperative maternal blood pressure was significantly lower in EA (98/53 mmHg) than LocA (105/51 mmHg), there were no significant differences in the ratio of intraoperative maternal hypotension between the two groups. Frequency of intraamniotic bleeding and pulmonary edema was not significantly different between EA and LocA.

DISCUSSION: Maternal blood pressure was stable in both epidural anesthesia and local anesthesia/conscious sedation. In our study, epidural anesthesia was as safe as local anesthesia/conscious sedation for SLPCV in TTTS patients.

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S-226.

GENERAL ANESTHESIA FOR CAESAREAN DELIVERY: A STUDY OF TRAINEE EXPERIENCE IN THE UNITED KINGDOM

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INTRODUCTION: Central neuraxial blockade (CNB) has largely replaced general anesthesia (GA) for caesarean delivery (CD) over the past twenty years with 91% of elective and 77% of emergency CS being performed under CNB. GA for CD is increasingly scarce which has training and safety implications [1]. It may be necessary to administer GA for CD when CNB is contraindicated, insufficient or when time constraints do not permit CNB. Anatomical changes in pregnancy, cricoid pressure and inexperience of administering general anesthesia for caesarean delivery may contribute to failed intubation at rate of 1/250 [2]. We conducted a study of trainee experience with GA for CD in four hospitals of the Oxford deanery.

METHODS: Data including the number of GA for category 1-3 CD, total number of emergency CD and the number of GA administered by each trainee between February 2007 and January 2008 were obtained from the database at the John Radcliffe (JR), Royal Berkshire (RB), Milton Keynes (MK), and Wexham Park (WP) hospitals. The audit standard was the Royal College of Anaesthetists (RCoA) guideline of GA for emergency CD which states that > 85% of emergency CD should be performed under regional anesthesia [3]. Median number of GA administered by trainees in each hospital was ascertained to indicate experience.

RESULTS: see table 1

Number of emergency CS, % of CS performed under GA and number of GA per trainee

	JR	RB	WP	MK
Emergency CD	653	1022	730	588
Emergency CD under GA	73	116	86	81
Emergency CD under GA (%)	11.1	11.3	11.8	13.8
Median GA per trainee	2	3	2	2

DISCUSSION: The rate of GA for emergency CD in each hospital is below 15% which meets the audit standard set by the RCoA. Although the tertiary hospital (JR) has a higher proportion of high risk deliveries it had the lowest rate of GA for CD amongst the hospitals of Oxford deanery. The median number of GA administered by individual trainees per year was three or less in all hospitals. With greater than 90% of elective CS being performed under CNB, trainee experience with GA for CD is scarce. GA for emergency CD may have to be performed by trainees without the presence of a senior anesthetist for support or direction. In countries where the frequency of GA for CD is higher and where consultant grade anesthesiologists are resident on call the adverse event of failed intubation is less frequent [4]. The trend away from GA for CD may impact upon anesthesia training and hence safe delivery of anesthesia in emergency situations such as category 1 CD. Other training modalities such as simulated clinical scenarios may need to be incorporated into training programmes as a source of supervised, training experience.

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S-227.

A WOMAN WITH DERMATOMYOSITIS NEEDS EMERGENCY CESAREAN SECTION: ANESTHETIC CONSIDERATIONS

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INTRODUCTION: Dermatomyositis, an inflammatory myopathy, usually presents in childhood or in middle age. It is uncommon in the childbearing years.¹ This report describes a young adult with dermatomyositis needing emergency Cesarean section, and addresses some relevant anesthetic concerns.

METHODS: A 24-year-old woman developed skin rash, myalgias, and proximal muscle weakness after the Cesarean birth of her first child at age 20. Appropriate workup, including skin and muscle biopsies, led to the diagnosis of dermatomyositis.² She responded well to methotrexate, but discontinued it before this pregnancy, during which symptoms were controlled with prednisone.

At 33 weeks' gestation, a contraction stress test produced repeated late decelerations. With a closed cervix, high fetal station, and prior hysterotomy, immediate Cesarean delivery was recommended.

Except for an elevated CPK (427 U/L) laboratory values were normal. Recent pulmonary function studies and echocardiogram were normal. No recent muscle weakness or sensory changes were reported, and physical examination was normal except for obesity (155 centimeters, 90 kilograms) and the expected skin changes over her knuckles.

RESULTS: Subarachnoid injection of hyperbaric bupivacaine (12 mg) and fentanyl (20 mcg) produced a T4 pinprick level within 12 minutes. A vigorous male infant, Apgars 7 and 9, was delivered after reducing three loops of nuchal cord. Blood loss was average and hemodynamics were stable. The woman received 100 mg of intravenous hydrocortisone at the obstetrician's request.

Sensory and motor function returned uneventfully. On the first postpartum day, the patient experienced unexplained tachycardia, with palpitations and shortness of breath. CPK and troponin levels did not rise, and EKG showed no acute changes. Her symptoms resolved spontaneously, and she went home on the third day.

DISCUSSION: A multisystemic disease, dermatomyositis can produce dysphonia, dysphagia, respiratory muscle weakness, and interstitial lung disease, in addition to skin changes and proximal limb weakness.³ Cardiac involvement can include cardiomyopathy and conduction abnormalities.⁴ Sensory neuropathy is also described.⁵

Avoiding general anesthesia in such patients is obviously appealing, especially since little is known about the interactions of contemporary muscle relaxants or halogenated anesthetics with the cardiac, pulmonary, and skeletal muscle abnormalities in these patients. No publications address the effects of anesthesia on newborn infants of affected women.

We observed normal onset, spread, and recovery from spinal anesthesia, without intraoperative dyspnea, dysphagia, or dysphonia. The infant appeared normal and vigorous.

Although historically associated with poor reproductive outcomes, the response of dermatomyositis to new therapies such as intravenous immunoglobulin^{1,6} suggests that more affected women may need obstetric anesthesia care in future. Additional reports of experience in this population will be valuable.

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S-228.

WITNESSED ASYSTOLE AFTER SPINAL ANESTHESIA FOR CESAREAN SECTION: REVERSAL WITH STARTLING

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INTRODUCTION: Particularly young and healthy patients with low resting pulse are at risk for cardiac arrest under spinal anesthesia (SPA) [1].

CASE REPORT: A 24 yo female (70 kg, 65") at term with no known medical problems or medications was scheduled for an elective Cesarean section. Fetal heart rate (HR) showed no distress. The patient's HR was 62 bpm, BP 126/70. After administration of 1000 ml Ringer's lactate, SPA was performed with 12 mg hyperbaric bupivacaine, resulting in a bilateral T4 sensory block. The patient only spoke Spanish, but a bilingual nurse served as a translator. No sedatives were given. Three minutes later, HR decreased to 30 bpm, followed by asystole. This was immediately noticed and 1 mg atropine iv was administered. The anesthesiologist's loud voice shouting for help appeared to startle the patient, who, after 15 sec asystole, turned toward him. Now, 3 beats at 40 bpm were noted, followed by asystole. One mcg/kg epinephrine iv was given, the anesthesiologist repeated the call, and got ready for CPR. During these 30 sec, the patient remained asystolic. Before CPR began, the patient was startled when her chest was touched, and a spontaneous heart beat reappeared on the monitor. Another beat followed within 2 sec, and HR rapidly accelerated to 160 bpm. The patient was rapidly prepped, and within 5 min, the fetus was delivered surgically with Apgar scores of 8 and 9. Afterwards, the events were discussed with her through an interpreter. She had been unaware of the arrest, and denied having been unconscious. Because there was no active communication at this time, it was impossible to ascertain her level of consciousness during the arrest. However, she had a calm demeanor, and, even before the anesthetic, would typically lie still with eyes closed.

DISCUSSION: Most unusually, our patient remained responsive during asystole. Supine position and volume loading probably contributed to venous pooling within the cerebral vasculature, so even if blood was not flowing, this situation differs from a "standing faint" where venous blood drains away coincident with arterial hypoperfusion. During supine cardiac arrest venous blood may still be present and delay cerebral hypoxia. This means that in case of a cardiac arrest during SPA in the supine position, unconsciousness may occur considerably after the onset of asystole which may dramatically reduce the time available for treatment and may contribute to its high mortality [2]. There were two startle reactions in both of which inspiration could have decreased her vagal tone [3] and permitted enough spontaneous cardiac activity to circulate the resuscitative drugs without CPR.

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S-229.

PROPOFOL ACTIVATES PKC ϵ IN MOUSE DORSAL ROOT GANGLION NEURONS

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INTRODUCTION: Recent data from this laboratory has demonstrated that propofol increases the sensitivity of the transient receptor potential vanilloid 1 receptor (TRPV1) via the epsilon isoform of protein kinase C (PKC ϵ) in dorsal root ganglia (DRG) neurons. The activation and intracellular localization of PKC ϵ is regulated by phosphorylation of important amino acid residues including the autophosphorylation of serine 729 located in the hydrophobic motif of the enzyme. PKC ϵ autophosphorylation of serine 729 induces a conformational change in the enzyme, rendering it catalytically active. Our objectives were to determine if the intravenous anesthetic agent, propofol, increases autophosphorylation and membrane translocation of PKC ϵ in mouse DRG neurons.

METHODS: Lumbar DRG neurons (L1-L6) from adult C57BL/6 wild-type mice were isolated by enzymatic dissociation and grown for 24 to 48 h. DRG neurons were treated with propofol alone (1 μ M) or following combined pre-treatment with the PKC ϵ inhibitor peptide (ϵ V1-2; 0.5 μ M; 10 min). Incubation with the PKC ϵ activator peptide (ψ RACK; 0.5 μ M) and the intralipid vehicle (IL; 10 μ M) was also performed. Western blot analysis was performed on whole DRG neuronal cell lysates with an antibody targeted at the auto-phosphorylation site (Ser 729) of PKC ϵ (PKC ϵ S⁷²⁹). Western blot analysis for total PKC ϵ was also performed on cytosolic and membrane fractions to assess protein translocation. Immunocytochemistry for total PKC ϵ was performed to assess intracellular localization.

RESULTS: Propofol alone, ψ RACK alone and IL alone all stimulated the presence of immuno-detectable PKC ϵ S⁷²⁹. Pre-treatment with the PKC ϵ inhibitor peptide (ϵ V1-2) reduced the propofol-induced increase in PKC ϵ S⁷²⁹. Under baseline conditions, PKC ϵ was associated mainly in the cytosolic fraction while propofol alone and ψ RACK alone caused translocation of PKC ϵ from the cytosolic to membrane fraction. Pre-treatment with the PKC ϵ inhibitor peptide (ϵ V1-2) reduced the propofol-induced translocation of PKC ϵ . IL alone had no effect on the cytosolic/membrane composition of PKC ϵ . In the absence of propofol, immunocytochemical localization of PKC ϵ revealed predominant cytosolic localization. Propofol alone and ψ RACK alone both stimulated translocation of PKC ϵ primarily to the perimeter of the neuron, indicating plasma membrane association. Pre-treatment with the PKC ϵ inhibitor peptide (ϵ V1-2) reduced the propofol-induced translocation. IL alone did not induce a change in intracellular localization of PKC ϵ .

DISCUSSION: These data indicate that propofol stimulated autophosphorylation of PKC ϵ in DRG neurons. Furthermore, these results demonstrate that propofol caused the subcellular translocation of PKC ϵ from cytosolic to membrane fraction. Moreover, translocation appears to result in association with the plasma membrane, perhaps an association with TRPV1 ion channels. Taken together, these data indicate a propofol-induced activation of PKC ϵ in DRG neurons.

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PROPOFOL INCREASES INTRACELLULAR FREE CA²⁺ CONCENTRATION IN DORSAL ROOT GANGLION SENSORY NEURONS VIA ACTIVATION OF TRPV1 RECEPTORS

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INTRODUCTION: Propofol is well known for its association with pain on injection. Capsaicin-sensitive, vanilloid receptor subtype-1 (TRPV1) receptors in dorsal root ganglion (DRG) sensory neurons are known to act as a molecular sensor of noxious stimuli. Moreover, activation of protein kinase C (PKC) in capsaicin-sensitive neurons is believed to activate TRPV1 receptors and PKC has been shown to be a molecular target for activation by propofol in several cell types. Our objectives were to identify the extent to which propofol activates TRPV1 receptors in mouse DRG neurons and whether PKC activation is involved.

METHODS: Lumbar DRG neurons (L1-L6) from adult C57BL/6 mice were isolated by enzymatic dissociation and grown for 24 to 48 h. Intracellular Ca²⁺ concentration ([Ca²⁺]_i) was measured in individual DRG neurons using Fura-2 and an inverted fluorescence microscope. DRG neurons were treated with propofol (1-100 μ M) or capsaicin (10-500 nM) in the presence or absence of extracellular Ca²⁺. The effects of TRPV1 receptor blockade (capsazepine, 10 μ M) and PKC inhibition with bisindolylmaleimide (Bis; 1 μ M) or the selective PKC ϵ inhibitor ϵ V1-2 (0.5 μ M) were also assessed.

RESULTS: Both propofol and capsaicin stimulated dose-dependent transient increases in [Ca²⁺]_i in isolated DRG neurons. In the absence of extracellular Ca²⁺, neither propofol nor capsaicin were capable of eliciting increases in [Ca²⁺]_i. Repetitive stimulation with propofol (30 μ M) resulted in a progressive decrease in the transient increase in [Ca²⁺]_i. Similar effects were observed with capsaicin (100 nM). Pre-treatment with capsazepine completely blocked the capsaicin-induced transient increase in [Ca²⁺]_i and reduced the propofol-induced transient increase in [Ca²⁺]_i by more than 70%. Pre-treatment with Bis or ϵ V1-2 had no effect on the capsaicin-induced transient increase in [Ca²⁺]_i. In contrast, Bis and ϵ V1-2 both attenuated the propofol-induced transient increase in [Ca²⁺]_i by more than 50%.

DISCUSSION: These results indicate that propofol and capsaicin transiently increase [Ca²⁺]_i in DRG sensory neurons in a dose-dependent manner that is entirely dependent on influx of Ca²⁺ from the extracellular space. Moreover, repetitive stimulation with propofol or capsaicin progressively decreases the transient increase in [Ca²⁺]_i, suggesting desensitization of the response. TRPV1 receptor inhibition completely blocked the capsaicin-induced transient increases in [Ca²⁺]_i, but did not entirely block the propofol-induced transient increase in [Ca²⁺]_i, suggesting a potential role for direct activation of TRPV1 by propofol. Activation of PKC has no apparent role in mediating the capsaicin-induced transient increase in [Ca²⁺]_i, but plays a prominent role in mediating the propofol-induced transient increase in [Ca²⁺]_i. We conclude that pain on injection with propofol may be mediated, in part, by direct activation of TRPV1 receptors and by indirect activation via a PKC-dependent pathway in DRG neurons.

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PROPOFOL INCREASES SENSITIVITY OF TRPV1 RECEPTORS VIA ACTIVATION OF PKC EPSILON IN MOUSE DORSAL ROOT GANGLION NEURONS

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BACKGROUND: Ca²⁺ selective ion channels of vanilloid receptor subtype-1 (TRPV1) in capsaicin-sensitive dorsal root ganglion (DRG) neurons are known to be desensitized upon successive applications of capsaicin. The epsilon isoform of protein kinase C (PKCε) has been shown to phosphorylate TRPV1, increasing the sensitivity of the channel. Our laboratory has previously demonstrated that the intravenous anesthetic, propofol, can activate PKCε in cardiomyocytes. The objective of this study was to determine the extent to which propofol modulates capsaicin-induced desensitization of TRPV1 and the role that PKCε may play in this process.

METHODS: Lumbar DRG neurons (L1-L6) from adult C57BL/6 wild-type and PKCε knock-out mice were isolated by enzymatic dissociation and grown for 24 to 48 h. Intracellular Ca²⁺ concentration ([Ca²⁺]_i) was measured in individual DRG neurons using Fura-2 and an inverted fluorescence microscope. DRG neurons were treated with successive applications of capsaicin (100 nM, 20 s) followed by treatment with the experimental interventions and subsequent reapplication of capsaicin. The experimental interventions consisted of propofol alone (10 μM), intralipid alone (10 μM), bisindolylmaleimide alone (Bis; 1 μM), phorbol myristic acid alone (PMA; 1 μM), the PKCε activator peptide (ψεRACK; 1 μM; 10 min) or the PKCε inhibitor peptide (εV1-2; 1 μM; 10 min) prior to propofol.

RESULTS: Brief addition of capsaicin (10 s) to DRG neurons stimulated a dose-dependent (10nM - 500nM) transient rise in [Ca²⁺]_i that returned to baseline. However, successive applications of capsaicin (100 nM) resulted in a progressive decrease in the transient rise in [Ca²⁺]_i. Pretreatment of DRG neurons with propofol, PMA or the PKCε activator peptide prior to the reapplication of capsaicin rescued the capsaicin-induced transient increase in [Ca²⁺]_i. Pretreatment with broad range PKC inhibitor, Bis or the PKCε inhibitor peptide prior to the reapplication of capsaicin blocked the propofol-induced rescue of the capsaicin-induced transient increase in [Ca²⁺]_i. In DRG neurons isolated from PKCε knock-out mice, neither propofol nor PMA were capable of rescuing the capsaicin-induced desensitization of TRPV1.

CONCLUSIONS: These data demonstrate that clinically relevant concentrations of propofol rescue the capsaicin-induced desensitization of TRPV1 ion channels in DRG neurons. Moreover, the PKCε activator peptide mimics, whereas the PKCε inhibitor peptide blocks, the rescuing effects of propofol on the capsaicin-induced desensitization of TRPV1. These data suggest a propofol-induced, PKCε-dependent resensitization of TRPV1 receptors in DRG neurons.

S-232.

CO-APPLICATION OF LIDOCAINE AND THE IMPERMEANT SODIUM CHANNEL BLOCKER QX-314 PRODUCES LONG-LASTING REGIONAL ANALGESIA

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BACKGROUND: Voltage-gated sodium channel blockers produce non-selective local anesthesia. Selective local analgesia can be produced by entry of the permanently charged lidocaine-derivative QX-314 into nociceptors through TRPV1 channels, when co-administered with capsaicin. However, transient pain evoked by capsaicin before development of QX-314 mediated block might limit clinical utility. It was recently reported that TRPV1 channels can be activated by lidocaine (but not QX-314). We examined whether activation of TRPV1 by lidocaine is sufficient to introduce QX-314 into nociceptors and thereby produce regional analgesia.

METHODS: We injected lidocaine alone, QX-314 alone and a combination of the two subcutaneously and adjacent to the sciatic nerve in rats. Mechanical (von Frey threshold, pinch) and thermal (radiant heat) responsiveness were measured as well as motor block.

RESULTS: Co-application of QX-314 with lidocaine greatly prolonged the sensory block compared to lidocaine alone. This effect was attenuated in TRPV1 KO mice. QX-314 alone had no effect when injected subcutaneously (intraplantar) or perineurally, and produced only a small, short inhibition of the cutaneous trunci muscle reflex. Peri-sciatic nerve injection of lidocaine together with QX-314 produced a long lasting nociceptive block that exceeded the more transient motor block by many hours.

CONCLUSIONS: Co-application of lidocaine and its charged derivative QX-314 produces a long-lasting, predominantly nociceptor-selective block, most likely partially mediated by entry of QX-314 through TRPV1 into nociceptor neurons. Using lidocaine instead of capsaicin to deliver QX-314 into nociceptors might be useful clinically to produce sustained regional analgesia, since it is not accompanied by an initial irritant response.

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**NEONATAL HINDPAW INCISION INCREASES THE
RESPONSE TO SURGICAL INJURY IN ADULTHOOD:
SPINAL MICROGLIAL ACTIVATION AND MODULATION
BY MINOCYCLINE**

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INTRODUCTION: Tissue injury in a critical neonatal period can produce longterm alterations in sensory processing and enhance pain sensitivity to repeat injury in later life. Using plantar incision in the rat pup, we have evaluated the response to repeat incision in adulthood to determine if prior neonatal surgical injury alters the degree of postoperative hyperalgesia and is associated with changes in microglial activation in the dorsal horn.

METHODS: Midline plantar hindpaw incision was performed in anaesthetised postnatal day (P)3 rats. Littermate controls received anaesthesia only. Three groups of adult animals were subsequently compared: repeat (P3 + adult) incision; single incision in littermate and age-matched naïve adults; and non-incised controls. Hyperalgesia was quantified 24 hours following incision by recording flexion reflex EMG responses to hindpaw mechanical stimuli under light anaesthesia. To assess microglial activation, Iba1 immunoreactivity in the dorsal horn was mapped and quantified 24 hours and 3 days after incision in adult animals with or without prior P3 incision, and compared to non-incised controls. Effects of systemic and spinal administration of minocycline were compared in single (adult only) and repeat (P3+adult) incision groups. Minocycline (100mg/kg intraperitoneal or 0.35mg/kg intrathecal) or saline was administered one hour prior to plantar incision and one hour prior to EMG recordings the following day.

RESULTS: Prior incision at P3 enhanced the hyperalgesic response to subsequent injury, as reflex sensitivity was significantly greater in the repeat versus single incision groups. The response to adult incision did not differ between littermate and naïve controls. In comparison with non-incised controls, Iba1 immunoreactivity in the dorsal horn was increased 3 days following adult single incision. In the repeat incision group, microglial activation was apparent earlier (at 24 hours) and was more marked at 3 days. Pre-treatment with intrathecal minocycline blocked hyperalgesia in the repeat incision group, as the reflex response did not differ significantly from non-incised controls. Whereas intrathecal minocycline had no effect 24 hours following single incision, a time when there is no clear microglial activation in the cord in this group, intraperitoneal administration reduced hyperalgesia in both the single and repeat incision group.

DISCUSSION: Neonatal hindpaw incision is associated with an enhanced response to subsequent injury that persists until adulthood. Alterations in both the time course and degree of microglial activation in the spinal cord are likely to contribute to the longterm enhancement of responses to repeat surgery. Effects of intrathecal minocycline in the repeat incision group suggest centrally-mediated inhibition of microglial activation, whereas systemic minocycline may have additional peripheral anti-inflammatory effects. These studies have implications for perioperative pain management and outcomes in children and adults with prior neonatal surgery.

S-234.

WITHDRAWN

S-235.

INTRATHECAL MORPHINE IN THE NEONATAL RAT: ANALGESIC EFFICACY AND PRECLINICAL EVALUATION OF SAFETY

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INTRODUCTION: Due to the plasticity of the developing nervous system, the efficacy and toxicity of analgesics and anesthetics may differ in early life. Significant alterations in analgesic actions and dose-requirements, and an increased susceptibility to developmental neuroapoptosis following general anesthetics have been demonstrated in the neonatal rat. Increased utilization of neuraxial techniques may reduce these potential risks, but intrathecal (IT) agents have not been systematically assessed for their safety in early life. We aimed to evaluate analgesic efficacy of intrathecal morphine and validate a model for assessment of toxicity of IT drugs in neonatal rats.

METHODS: To evaluate analgesic efficacy, Holzman rats at postnatal day (P)3, 10 and 21 were anesthetized with isoflurane in O₂/air for percutaneous IT injection of 0.5ml/g saline or morphine (1-30 mcg/kg). Using von Frey hairs, mechanical withdrawal thresholds were calculated from the midpoint of a stimulus-response curve. Effects following systemic administration of the maximum dose, and of naloxone following intrathecal morphine were also evaluated. Higher doses of IT morphine were administered at P3 or P21 to investigate potential for spinal toxicity. One or 7 days later animals were terminally anesthetized, transcardially perfused, and the spinal cord dissected. Spinal cord H&E sections were examined for histopathological changes by a neuropathologist. Additional sections were stained with immunohistochemical markers: cleaved caspase-3 to detect neuronal apoptosis; Iba-1 and GFAP to evaluate glial activity. Comparison was made with saline injection and naïve controls, and intraspinal injection of NMDA as a positive control.

RESULTS: Intrathecal morphine produces dose-dependent antinociceptive effects in rat pups, and dose requirements are lower at P3 than P21. Analgesic effects are naloxone-reversible and spinally mediated, as the same dose systemically has minimal effect on withdrawal threshold. High doses of morphine produced significant side-effects (respiratory depression and loss of righting reflex) but did not produce major histopathological signs in H&E at P3 or P21 animals. Immunohistochemical analysis is ongoing.

DISCUSSION: There are no systematic reports on the preclinical safety of neuraxial drugs in neonates. IT morphine produced a robust spinally mediated antinociceptive action in rat pups, and no obvious pathology was observed with H&E. This model is now being used to further evaluate neuronal and glial changes in the spinal cord, and for safety studies of other spinal drugs. The ability to demonstrate both an analgesic effect and evaluate spinal cord histology will permit us to define the therapeutic ratio e.g. the minimal toxic dose as a ratio of a significant analgesic dose. This will provide important comparative data for both the efficacy and safety of spinal analgesics in early life.

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Pain - Clinical - Acute

S-236.

A RANDOMIZED TRIAL OF LOCAL INFILTRATION ANALGESIA VS. EPIDURAL INFUSION FOR TOTAL KNEE ARTHROPLASTY. AN INTERMEDIATE-ANALYSIS OF 40 PATIENTS

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INTRODUCTION: Epidural and femoral nerve block analgesia has been shown to reduce opioid consumption compared to IV PCA but even though both modalities reduce the occurrence of the well known side effects of opioid drugs, they involve extra equipment and the potential risk of neurological sequelae. Therefore it would be of value to find alternative ways of analgesia. Only a few studies have described peroperative wound infiltration and postoperative intraarticular infusion or bolus injections with multimodal analgesia for knee arthroplasty (1-2). In this study we compared the efficacy of epidural infusion (EPI) to wound infiltration in combination with intraarticular regional analgesia (ART).

METHODS: Forty patients undergoing elective, unilateral, primary total knee arthroplasty due to osteoarthritis were enrolled in this randomized controlled trial. The study was conducted in accordance with GCP-ICH guidelines. Main exclusion criteria were age<18, contraindications to spinal anesthesia, hypersensitivity to study drugs, regular opioid use, general anesthesia, medicamentally treated diabetes, rheumatoid arthritis, pregnancy or severe obesity (BMI>40). In group EPI, an infusion pump was connected to an epidural catheter with a flowrate of 4 ml/h ropivacaine 2mg/ml for 48 hours postoperatively. Intravenous ketorolac, 15 mg was given perioperatively and again 3, 20, 28, 34 and 42 hours postoperatively. In group ART - at the end of surgery - the surgeon infiltrated the knee joint region with a mixture of 300 mg ropivacaine, 30 mg ketorolac and 0.5 mg epinephrine (total volume 151.5 ml). A multi-holed epidural catheter was placed in the joint and connected to an infusion pump with the same mixture (ropivacaine and ketorolac) for 48 hours with a flow-rate of 4ml/h. In both groups rescue analgesia were provided with IV patient-controlled morphine.

RESULTS: Baseline data were similar in the two groups. Cumulative IV PCA morphine consumption over the first 24 hrs was significantly reduced by 65 % in group ART compared to group EPI. Median (p10-p90) was 7.5 mg [0-35] vs. 17.5 mg [2.5-55] (p-value < 0.02). Cumulative morphine consumption 24-48 hrs postoperatively was 5 mg [0-13.75] vs. 13.75 mg [0-27.5] (p-value < 0.02), and was reduced by 75 %. There was no significant difference between groups regarding duration of surgery and occurrence of side-effects. In group ART a reduction in the length of hospital stay was observed compared to group EPI. Median (p10-p90) was 3 (3-5) and 4 (3-7) days, respectively (p-value < 0.01).

DISCUSSION: Wound infiltration combined with intra-articular infusion of ropivacaine and ketorolac is a simple and effective method for postoperative pain management which can be recommended for patients undergoing total knee arthroplasty

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S-237.

ANALGESIC EFFICACY OF PREEMPTIVE USE OF ETORICOXIB FOR THE POST OPERATIVE PAIN RELIEF AFTER LUMBER DISCECTOMY

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INTRODUCTION: Etoricoxib, a cox-2 selective inhibitor, has been demonstrated to be safe and effective in the management of acute pain in patients with dysmenorrhoea¹, dental surgery pain², and for short term use after orthopedic surgery³. Etoricoxib with a rapid onset time and a long duration of action has been found to be effective for providing preemptive analgesia in ambulatory surgeries and laparoscopic cholecystectomy^{4,5}. However the existing literature is replete with regards to its use in major surgeries as a preemptive analgesic. We therefore studied the effect of preemptive use of etoricoxib on post operative pain after lumbar disk surgery.

METHODS: After institute ethics approval for this randomized, double blind, placebo controlled study we included 40 patients ASA 1 & 2, age more than 18 years. After informed consent patients were randomized to received either etoricoxib 120 mg (group A) or placebo tablet (group B) 60 minutes before surgery. All patients received tablet lorazepam 0.04mg/kg in the night and morning of surgery. After the surgery all the patients in postoperative care unit received patient controlled analgesia with fentanyl boluses of 20µg on demand with lockout period of 10 minutes (total 2µg/kg/hour). A blinded observer recorded the pain score at time points of 0, 6, 12, 18, 24 hours on visual analogue scale (0-100 mm) at rest and movement. Total fentanyl consumption during study period was noted.

RESULTS: both the groups were comparable with respect to age, body weight, sex and duration of surgery. Postoperative pain (static and dynamic) and postoperative patient controlled fentanyl consumption were reduced significantly in the etoricoxib group as compared to placebo (P<0.05) (Table 1)

DISCUSSION: our study indicates that the preemptive oral use of etoricoxib significantly reduced the pain severity until 24 hours postoperatively and reduced the total fentanyl requirement in lumbar discectomy patients leading to their early mobility and discharge. This finding of good pain relief with reduced opioid requirement makes etoricoxib a desirable drug in the treatment of postoperative pain in lumbar disk surgery.

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Table 1: Postoperative pain and fentanyl consumption; pain is expressed as median VAS scores (inter-quartile range) whereas, postoperative PCA fentanyl consumption is presented in µg. * denotes P<0.05.

Groups Variables	Placebo (n=20)	Etoricoxib (n=20)	Placebo vs Etoricoxib P value
0 hr			
Static	52 (20)	28 (22)*	<0.001
Dynamic	74 (23)	32 (18)*	<0.001
6 hr			
Static	45 (25)	31 (8)*	0.012
Dynamic	53 (23)	38 (18)*	0.023
12 hr			
Static	44 (16)	35 (11)*	0.028
Dynamic	56 (34)	25 (23)*	0.030
18 hr			
Static	34 (16)	20 (18)*	0.018
Dynamic	46 (16)	30 (20)*	0.002
24 hr			
Static	32 (26)	20 (20)*	<0.001
Dynamic	35 (23)	20 (10)*	<0.001
Total post-operative fentanyl consumption (µg)	915.0 ± 141.5	479.0 ± 261.4*	<0.001

S-238.**COMPARISON OF DURATION OF POSTOPERATIVE ANALGESIA FOLLOWING CAUDAL MIDAZOLAM VERSUS KETAMINE AS ADJUVANTS TO 0.25% BUPIVACAINE IN CHILDREN UNDERGOING HERNIOTOMY****AUTHORS:** D. Mangla¹, S. Ahuja², A. K. Saxena², M. S. Green³;**AFFILIATION:** ¹Department Of Anesthesiology, Drexel University College of Medicine/ Hahnemann University Hospital, Philadelphia, PA, ²University College of Medical Sciences, New Delhi, India, ³Drexel University College of Medicine/ Hahnemann University Hospital, Philadelphia, PA.**INTRODUCTION:** The aim of this study was to evaluate caudal midazolam versus ketamine as adjuvants to 0.25% bupivacaine on duration of postoperative analgesia in children undergoing herniorrhaphy.**METHODS:** After ethics committee approval and written informed parental consent, 45 children, ASA I-II, aged 1-10 years were randomly divided into three groups: Group 1 received Midazolam (50 µg/kg) with 1 ml/kg of 0.25% bupivacaine; Group 2 received Ketamine (0.5 mg/kg) with 1 ml/kg of 0.25% bupivacaine and Group 3 received 1 ml/kg of 0.25% bupivacaine with normal saline. All received general anesthesia with caudal block. Inhalational induction with halothane and 60% nitrous oxide in oxygen was done. Airway was secured using LMA with spontaneously ventilation and maintained with isoflurane. Caudal anesthesia was performed in the lateral position with 22 G needle. Rescue opioid was given if HR/RR increased by more than 15%. Postoperative analgesia was evaluated every 30 minutes by AIIMS score¹ (in children <5 years) and VAS score² (in children >5 years). Rectal paracetamol (10 mg/kg) was given when VAS >4. Continuous data were compared using one way analysis of variance, followed by Tukey test. The end of point for analysis was the time of administration of analgesia either during surgery or in postoperative period, p<0.05 was regarded as statistical significant.**RESULTS:** Mean age, weight, duration of surgery, duration of anesthesia and time to removal of LMA was similar in three groups**Table 1: Demographic profile**

	Group 1	Group 2	Group 3
Age (yrs)	5.36±2.54	4.53±2.00	4.95±1.82
Weight (kg)	22±1.60	20±1.50	21±1.50
Duration of surgery (min)	44±1.92	43±1.90	46±1.91
Time to removal of LMA (min)	45±2.23	47±2.21	46±2.01
HR before induction	103.4±8.56	91.07±10.58	103.47±9.84
RR before induction	28.80±5.25	21.07±3.98	22.33±4.03

Table 2: Time for rescue analgesia

Group 1	Group 2	Group 3
6.7±0.04	8.83±0.62	4.00±0.33

Time from reversal of general anesthesia to first postoperative analgesic administered is taken as duration of analgesia. Mean duration of analgesia in group 1 was 6.7±0.4 as compared to 8.83±0.62 in group 2 and 4.00±0.33 in group 3. The difference between group 1 and group 2 was significant (P <0.05).

DISCUSSION: We conclude that caudal bupivacaine ketamine combination provides a longer duration of postoperative analgesia as compared to bupivacaine midazolam combination. In this study however follow up was only for 24 hours. This could have led to observation of no side effects in ketamine group. Doses selected for adjuncts were derived from literature without performing dose-response curve^{3,4}. These dosages may not be equipotent. Further studies are required to compare the equipotent dosage of each drug.**REFERENCES:**

1. Lancet 1974; 2: 1127-3
2. Indian J Anaesth 1996; 44(1): 46-51
- 3 Br J Anaesth 2004; 94: 198-204.
- 4 Anaesthesia 1996; 1170-2.

S-239.**ULTRASOUND GUIDED APPROACH FOR A CONTINUOUS INTERCOSTAL APPROACH TO THE PARAVERTEBRAL SPACE****AUTHORS:** A. Y. Ben-Ari¹, G. M. Moreno², P. E. Bigeleisen³, J. E. Chelly²;**AFFILIATION:** ¹UPMC Dept of Anesthesiology, Acute Postoperative Pain Service (AIPPS), UPMC, Pittsburgh, PA, ²UPMC Dept of Anesthesiology, Acute Postoperative Pain Service (AIPPS), Pittsburgh, PA, ³Department of Anesthesiology, University of Rochester Medical School., Pittsburgh, PA.**INTRODUCTION:** Continuous paravertebral block (CPVB) is an established technique for postoperative analgesia following thoracic and abdominal surgery. It provides similar analgesia than epidural yet carries fewer side effects and complications. ¹ Performing CPVB relies on anatomical landmarks. ² We investigated the feasibility of approaching the paravertebral space through the intercostal space which we identified sonographically.**METHODS:** Twelve patients scheduled for elective abdominal surgery were included in this report. Using standard monitors, patients were positioned in the prone position. cPVB were placed at the level of T₈-T₁₀. The corresponding intercostal spaces were scanned in the short axis 8cm lateral to the midline of the spine using a linear 13 Mhz ultrasound transducer to identify rib and pleura connected to a S-Nerve ultrasound (Sonosite Inc, Bothell, WA). Next, the probe was aligned over the long axis of the rib. "Toggling" the probe allowed imaging of the intercostal muscles and pleura. Following skin anesthesia, a 17 gauge Tuohy needle was introduced in-plane at the lateral end of the probe aiming medially. The needle was advanced in the space between the innermost and inner intercostal muscles. Normal saline was injected to expand the plane between the muscles and the pleura was displaced anteriorly. This was followed by injection of 10 ml of ropivacaine 0.5% and the placement of an epidural catheter 7 cm beyond the tip of the needle. The procedure was repeated on the contra-lateral side.

Following surgery, CPVB were bolused with 10 ml of lidocaine 1.5%. Sensory blockade was determined by pinprick using a 25gauge needle twenty minutes later. To assess the relationship between the local anesthetic spray and the extend of the sensory block, 5 patients were injected with contrast dye in 5 patients. This was followed by an antero-posterior chest X-ray. The PVB catheters were connected to pumps for continuous infusion of ropivacaine 0.2%. All patients were also has free access to a hydromorphone PCA . The first 24h of hydromorphone consumption and VAS score were recorded. Data are presented mean ± SD and median interquartile range.

RESULTS: a total of 24 blocks were performed. The mean age was 56 ± 16, weight was 81 ±24 kg . Clinical measurements are listed in table 1. Dermatome sensory blockade was demonstrated in 23/24 of CPVB. In the contrast dye study both spindle and cloud spread patterns on chest x-ray were observed. No incidence of pneumothorax.

	Median	Interquartile range
Number of dermatomes blocked	5	4-6
Hydromorphone consumption 24h (mg)	1.9	0.7-5.05
VAS POD 1	5.5	3.5-6

Table1. Result of clinical measures.**DISCUSSION:** Our data support the concept that ultrasound guided intercostal approach to the paravertebral represent an alternative approach to the paravertebral space.

1. Br J Anaesth 2006;96:418-26.

2. Anaesthesia 1979; 34: 638-42.

S-240.

EFFECT OF INFUSION TIME ON REMIFENTANIL FOR PROPOFOL INJECTION PAIN

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INTRODUCTION: Propofol is one of the popular induction drugs for general anesthesia. Therefore, there were many reports on propofol injection pain. In this study, we use remifentanyl as analgesics for attenuating propofol injection pain, and examined the effect of remifentanyl among three different infusion times.

METHODS: Seventy-five patients, ASA1-2, scheduled to undergo general anesthesia were assigned to one of the following groups: the control group (n=25), the 1-min group (n=25) and the 2-min group (n=25). In the control group, 1mg/kg of propofol was injected intravenously as a bolus without continuous infusion of remifentanyl. In the 1-min group, 1mg/kg of propofol was injected intravenously as a bolus 1 minute after continuous infusion of remifentanyl at the rate of 0.5µg/kg/min. In the 2-min group, 1mg/kg of propofol was injected intravenously as a bolus 2 minutes after continuous infusion of remifentanyl at the rate of 0.5µg/kg/min. Carrier fluid infusion speed was at 500ml/h. Pain severity was assessed on an 11-grade verbal analogue scale. Heart rate and blood pressure were examined after propofol administration in the three groups. Differences in age, height, weight, mean blood pressure and heart rate were evaluated by ANOVA. Difference in sex was analyzed by chi-square test, and differences in the verbal analogue scale score were evaluated by the Kruskal-Wallis test. $P < 0.05$ was considered statistically significant.

RESULTS: There were no significant differences among the three groups on age, height, weight and sex distribution. Mean arterial pressure was lower in the remifentanyl group than in the control group. Heart rate variability did not differ significantly among the groups. In the VAS score, the control group differed significantly from both the 1-min and 2-min groups, however, when the 1-min and 2-min groups were compared with each other, the difference was not statistically significant.

DISCUSSION: Remifentanyl has been used for the induction and maintenance of general anesthesia. This study evaluated the effect of remifentanyl for attenuating propofol injection pain in the three different time intervals. Effect site concentration of remifentanyl elevates much more quickly with bolus administration than that of fentanyl on the simulation. Remifentanyl infusion at the rate of 0.5µg/kg/min for 1 minute followed by propofol injection was found to effectively attenuate propofol injection pain. Infusion of remifentanyl at the same rate for two minutes was found to be somewhat more effective than one minute; however this difference was not statistically significant.

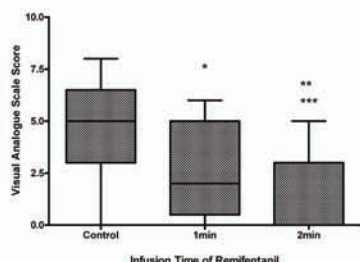


Figure 1. Verbal analogue scale score after propofol administration among three groups. Median (horizontal line), 25th and 75th percentile (box), and range (whiskers).
* $p < 0.05$ compared with control
** $p < 0.05$ compared with 1 min
*** $p < 0.001$ compared with control

S-241.

IMPROVED PAIN MANAGEMENT WITH AN ELECTRONIC ORDERING SYSTEM

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INTRODUCTION: To maximize the efficacy of postoperative pain management, PCA should be initiated as soon as possible after surgery, before the level of pain experienced by the patient becomes difficult to control. In addition, the preemptive analgesic benefits of regional anesthesia may be eliminated if postoperative pain modalities are not instituted until after the patient experiences pain. This hospital recently implemented an electronic ordering system (SMM; Eclipsys). Soon after "go live" it appeared that patients were having less pain in the PACU and using less narcotics. We hypothesized that differences in work-flow and turn around time allowed patients to receive their PCA mixtures in a more timely fashion after go-live. We studied the following metrics before and after go live: time to initiation of the PCA, the pain experienced during the first day, and amount of pain medication used.

METHODS: With IRB approval we retrospectively compared patients undergoing THA performed during the month of May 2007 - prior to go live, with patients from May 2008, after go-live. All patients received an epidural/CSE anesthetic with mepivacaine/lidocaine and a postoperative epidural infusion of 0.06% bupivacaine and 10 mcg/ml hydromorphone, with a an initial 4cc infusion and patient boluses of 4cc. Volume of epidural PCA infused was recorded from the pump and VAS pain scores recorded at the initiation of the PCA and hourly. Data was entered in SPSS; analyzed using independent-samples T-test.

RESULTS: We analyzed 106 patients from 2007 and 99 patients from 2008. Using the electronic ordering system patients received their postoperative pain medications earlier and had less pain than patients from the previous year (Table). In addition these patients also required less total pain medication. One third of the patients from 2007 had a VAS in the PACU ≥ 6 , while only one fifth of those from 2008 reached those levels. Time spent in the PACU was similar for both groups.

DISCUSSION: We have shown that using an electronic system, patient's receive their PCA sooner, have less post op pain, and use less narcotics compared to pre go live. We believe that treating post op pain at its inception, prevents the pain levels from escalating and reduces the amount of analgesic required. Because it did not affect PACU discharge time, factors other than pain must be responsible for preventing their discharge.

	Conventional	Electronic
Patients (n)	106	99
Time to PCA infusion† (min)	51±26	25±28*
Initial Pain (VAS)	1.5±3	1.0±2*
Mean VAS in PACU	4.2±3	2.9±3*
Patients VAS ≥ 6	36	20
VAS at 4h postop	1.6±2	0.8±2*
Volume PCA used at 4h (cc)	35±20	27±20
PACU Duration (h)	4.7±1.1	4.4±1.2

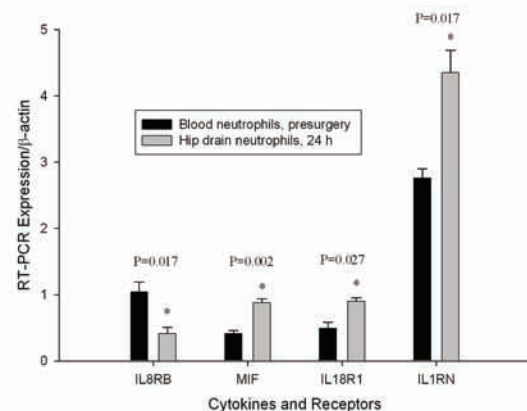
* $p \leq 0.05$

S-242.**ANALGESIA FOLLOWING A SINGLE ADMINISTRATION OF DEPOBUPIVACAINE INTRAOPERATIVELY IN PATIENTS UNDERGOING INGUINAL HERNIORRHAPHY: PRELIMINARY DOSE-RANGING STUDIES****AUTHORS:** P. F. White¹, G. Schooley², M. Ardeleanu³;**AFFILIATION:** ¹Department of Anesthesiology & Pain Management, University of Texas Southwestern Medical Center, Dallas, TX, ²Pacira Pharmaceuticals, Inc., San Diego, CA, ³Pacira Pharmaceuticals, Inc., Dallas, TX.**INTRODUCTION:** DepoBupivacaine (DB), a controlled-release formulation of bupivacaine contained within multivesicular liposomal DepoFoam[®], was designed to provide prolonged (72h) local analgesia after a single wound infiltration. The objective of these studies was to evaluate efficacy and safety of single administration DB compared with bupivacaine (Bup) in patients undergoing open inguinal herniorrhaphy.**METHODS:** In the initial study, 4 doses of DB were compared with commercial Bup (Table) in a randomized, double-blind, sequential-cohort, dose-ranging study. During surgery, 40 mL of DB or Bup were infiltrated into tissue surrounding the wound. Postoperative rescue medication consisted of parenteral and oral opioid analgesics. Pain at rest and with activity (cough) was assessed at specific time intervals after surgery. Time to first opioid rescue and total dosages of opioid rescue medications were recorded. In the second study, DB 105, 180, and 345mg were compared with Bup 100mg at incision site. Pain with activity was assessed during unassisted movement from supine to sitting position.**RESULTS:** In the initial study, DB significantly reduced pain with activity 8-24h after administration of all doses studied compared with Bup.

Time Points	Mean (SD) Pain Intensity VAS Scores				
	DB				Bup 100mg n=26
	175mg n=12	225mg n=12	300mg n=12	350mg n=14	
4h	24.8±20.1*	30.8±23.3	30.5±17.9	36.2±21.7	45.7±19.3
8h	21.6±18.6*	25.5±12.7*	26.3±21.2*	31.4±25.3*	49.9±22.3
12h	26.4±21.2*	21.4±19.2*	22.0±17.0*	24.6±19.0*	48.0±18.0
24h	27.2±23.5*	29.8±18.6*	20.8±18.6*	29.9±24.2*	48.7±20.1
48h	33.4±30.2	31.6±27.5	28.5±24.6	27.5±24.9	39.4±20.8
72h	23.8±20.2	24.1±23.6	16.8±14.8	21.7±23.1	35.7±22.5
96h	15.5±15.5	14.4±16.3	16.1±18.5	15.1±20.0	24.0±20.1

*Statistically significant compared with Bup group, using ANOVA.

DB produced trends toward fewer patients requiring opioids, increased time to first opioid rescue, and decreased total opioid consumption compared with Bup. No serious adverse events were attributable to DB. Wound healing was assessed as normal. In the second study, DB 180 and 345mg showed trends of decreased pain at rest and with activity, and decreased opioid rescue compared with Bup. Integrated pain and opioid use scores were lower in DB 345mg compared with all other groups. Nausea or vomiting was experienced by 4 and 2 subjects in the DB 180- and 345-mg groups compared with 11 in the Bup group along with increased time from end of surgery to first report of nausea or vomiting ($P<0.05$).

DISCUSSION: A single administration of DB resulted in significantly lower pain scores with activity compared with Bup in the first 8-24h following surgery. Although these dose-finding studies were not powered to detect differences in all pain-related outcome variables ≤ 72 h, there was a trend to lower opioid rescue in all DB groups compared with Bup. Further studies are needed in patients undergoing operations associated with longer duration of moderate-to-severe pain.**S-243.****CYTOKINE GENE EXPRESSION AFTER TOTAL HIP ARTHROPLASTY: SURGICAL SITE VERSUS CIRCULATING NEUTROPHIL RESPONSE****AUTHORS:** A. Buvanendran¹, K. Mitchell², J. S. Kroin³, M. J. Iadarola²;**AFFILIATION:** ¹Anesthesiology, Rush Medical College, Chicago, IL, ²NIH, Bethesda, MD, ³Rush Medical College, Chicago, IL.**INTRODUCTION:** Following surgery, cytokines and chemokines are released at the surgical wound site, which can contribute to postoperative pain, local inflammation and tissue repair. Multiple cell types are present that can release cytokines/chemokines at the wound site and, thus, the exact cellular source of these molecules is unclear (Am J Pathol 1998;153:1849; J Leukoc Biol 2001;69:513; Am J Surg 2004;187:11S). The aim of this study was to better understand the contribution of neutrophils to cytokine/chemokine gene expression at the surgical wound site during the initial postsurgery phase of total hip arthroplasty (THA).**METHODS:** Hip drain fluid was collected at 24 h postsurgery from 6 patients undergoing standardized THA. In addition, venous blood was collected presurgery and 24 h postsurgery. Neutrophils were isolated, total RNA extracted, and a biotinylated cRNA probe generated. The probes were hybridized with a cDNA microarray containing ~ 100 oligonucleotide sequences representing various human cytokines/chemokines or receptor genes. Only hip drain neutrophil-derived transcripts demonstrating both a 2-fold change and $P<0.05$ compared to neutrophils in blood are considered altered in the gene microarray. Changes in gene expression seen in the microarray were verified by reverse transcription polymerase chain reaction (RT-PCR).**RESULTS:** In the microarray analysis of hip drain neutrophils, interleukin-1 receptor antagonist (IL1RN), interleukin-18 receptor 1 (IL18R1), and macrophage migration inhibitory factor (MIF) were upregulated, while interleukin 8 receptor beta (IL8RB) was consistently downregulated compared to presurgery blood neutrophils. All of these changes were confirmed by RT-PCR (Fig. 1).**DISCUSSION:** There is a distinct cytokine gene expression profile in neutrophils at the TKA surgical wound site at 24 h postsurgery as compared to that found in presurgery circulating neutrophils. Understanding these changes may allow us to manipulate neutrophil activity in a knowledgeable fashion to reduce postoperative pain and inflammation without impairing wound healing.

S-244.

HIGH-DOSE INTRATHECAL MORPHINE FOR POSTOPERATIVE ANALGESIA AFTER RADICAL PROSTATECTOMY

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INTRODUCTION: Intrathecal (IT) opioids are commonly used to control postoperative pain.¹ Opioid dosing is limited, however, by opioid-related side effects, most importantly respiratory depression. To overcome these limitations, we combined high-dose IT morphine with a continuous intravenous naloxone infusion to limit opioid-related side effects. The purpose of this study is to document the efficiency and safety of high-dose IT morphine combined with postoperative naloxone infusion to provide postoperative analgesia after major surgery.

METHODS: After IRB approval, a retrospective chart analysis was performed on 38 patients undergoing radical prostatectomy. All patients received a single injection of IT opioids (ITO) prior to general anesthesia, followed by an IV naloxone infusion at 5mcg/kg/min started 1hr post-ITO and continued for 22 hrs postoperatively. The following data was collected: patient age, height, weight, anesthesia technique/time and dose of intrathecal opioids given. Postoperative pain relief was assessed for 48 hrs using the visual analog scale (VAS) for pain (0=no pain;10=worst pain), perioperative opioid use and ability of patient to ambulate postop. Safety of treatment was assessed with opioid-related side effects and vital signs.

RESULTS: Data are reported as mean (S.D.). All patients but one were extubated at the end of surgery. One patient needed postoperative ventilation because of muscular weakness. Mean dose of ITOs given were 1.3(0.3)mg morphine combined with fentanyl 55(8)mcg. Patients required very little opioid in the PACU: 75(38) mcg fentanyl and 1.0(0)mg morphine until discharge from the PACU. The mean worst pain VAS in the first 12hrs postoperatively was only 1.1(1.8). The first NSAID dose was given 6.6(3.1)hrs post ITO. The first opioid given on the floor was 22.6(14.5)hrs post ITO. A mean of only 5.4(10.7)mg morphine equivalents were given postoperatively on day 1. On POD 1, 23 patients required no additional opioids. On POD 2 the mean worst pain VAS was 2.8(2.3) with only 8.1(9.0) mg morphine equivalents given for postop analgesia. Overall, 9 of 37 patients did not require any postoperative opioids. Most patients (34) were able to ambulate in the first 12hrs postoperatively. No opioid-induced respiratory depression was observed. Opioid-related side effects (pruritus, nausea) were infrequent (14%) and minor.

CONCLUSIONS:

1. High-dose ITOs combined with postoperative IV naloxone infusion provided superb analgesia for radical prostate surgery.
2. IV naloxone infusion added to high-dose ITOs appeared to control opioid side effects while maintaining excellent analgesia.
3. No serious side effects were noted.
4. Future prospective randomized clinicals are warranted .

Reference: 1. Hamann SR. J Opioid Manage 2008; 4:251-255.

S-245.

INTEGRATION OF PAIN SCORES AND OPIOID RESCUE DOSE IN PERIOPERATIVE ANALGESIC CLINICAL TRIALS

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Aim of Investigation: At present, the primary efficacy measures in many analgesic clinical trials include both pain scores and amounts of rescue opioid consumed by patients. The analysis of either variable alone often fails to show a statistically significant effect because the use of rescue medication decreases the analgesic's effect on pain relative to placebo, while the variation in self-dosing increases the variance in pain and rescue dose analyses. Researchers have suggested that the two be modeled together (Silverman DG et al. Anesth Analg. 1993;77:168-70) but there is no validated method to do this. We evaluate here several alternative statistical strategies of integrating pain and patient-controlled analgesia (PCA) doses to determine whether a dose of analgesic drug is more effective than placebo, using pain scores alone, PCA scores alone, and each method of combined testing. Extensive simulations were performed to compare the performance (e.g., power and type I error) of both multivariate statistics including parametric Hotelling's T2 test, nonparametric bivariate rank sum test, Silverman's test, as well as univariate nonparametric rank sum test and parametric T test.

We then applied those method to analyze a data

derived from 612 patients in three double-blind, placebo-controlled, randomized studies of the efficacy of two different dose levels of a nonopioid analgesic. The drug was given postoperatively in patients with total joint arthroplasty (two trials) and abdominal hysterectomy (one trial). Pain intensity was assessed on a 4-item category scale immediately postoperatively and at 2, 4, 6, 9, 12, 18, 24, 36, and 48 hours after surgery. Patients self-administered IV morphine as needed. Pain scores and morphine usage were assessed for the individual time points and days 1 and 2.

RESULTS: Each study showed an overall pattern suggesting that both doses of the analgesic were effective, but for many time points, changes in pain or reduction of PCA doses compared to placebo alone missed statistical significance. Results of combined analyses of pain scores and PCA morphine use are pending and will be presented.

S-246.**COMPARISON OF QUALITY OF POSTOPERATIVE ANALGESIA FOLLOWING CAUDAL MIDAZOLAM VERSUS KETAMINE AS ADJUVANTS TO 0.25% BUPIVACAINE IN CHILDREN UNDERGOING HERNIOTOMY****AUTHORS:** D. Mangla¹, S. Ahuja², A. K. Saxena²;**AFFILIATION:** ¹Department Of Anesthesiology, Drexel University College of Medicine/ Hahnemann University Hospital, Philadelphia, New Delhi, PA, ²University College of Medical Sciences, New Delhi, India.**INTRODUCTION:** The aim of this study was to evaluate caudal midazolam versus ketamine as adjuvants to 0.25% bupivacaine on quality of postoperative analgesia in children undergoing herniorrhaphy.**METHODS:** After ethics committee approval and written informed parental consent, 45 children, ASA I-II, aged 1-10 years were randomly divided into three groups: Group 1 received Midazolam (50 µg/kg) with 1 ml/kg of 0.25% bupivacaine; Group 2 received Ketamine (0.5 mg/kg) with 1 ml/kg of 0.25% bupivacaine and Group 3 received 1 ml/kg of 0.25% bupivacaine with normal saline. All received general anesthesia with caudal block. After Inhalational induction with halothane and 60% N₂O in O₂, airway was secured using LMA with spontaneous ventilation. Anesthesia was maintained with isoflurane. Caudal anesthesia was performed in the lateral position. Rescue opioid was given if HR/RR increased by > 15%. Postoperative analgesia was evaluated every 30 minutes by AIIMS score¹ (in children <5 years) and VAS score²(in children >5 years). Rectal paracetamol (10 mg/kg) was given when VAS >4. Continuous data were compared using one way analysis of variance, followed by Tukey test. 45 patients would provide 90% power to detect a difference in VAS/AIIMS score of .5 with 5% type 1 error.

Results:

Demographic profile was similar in three groups

Table 1: Demographic profile

Table 2: VAS / AIIMS Pain Discomfort Score

*p< 0.05 between group 3 & 2

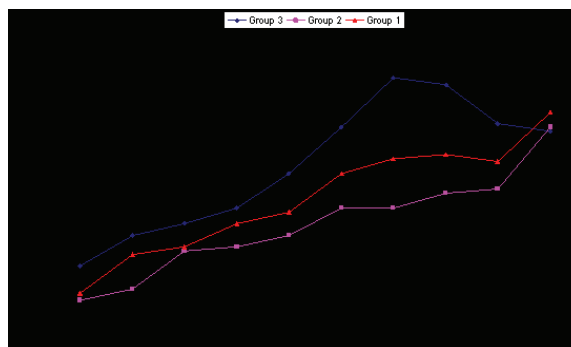
#p< 0.05 between group 3 & 1

VAS/AIIMS score in group 2 was significantly lower at 0.5, 2, 3, 4, 5, 6 hours postoperatively as compared to group 3 and 1. VAS/AIIMS score in group 1 were significantly lower 4, 5, and 6 hours as compared to group 3 at 4, 5 and 6 hours postoperatively. At 24 hours VAS scores in the three groups were comparable.

DISCUSSION: We conclude that caudal ketamine adjuvant with bupivacaine provides a better quality of postoperative analgesia as compared to bupivacaine midazolam combination or bupivacaine alone with no side effects in accordance with previous studies^{3,4}.

References

- 1) Indian J Anaesth 1996; 44(1): 46-51.
- 2) Lancet 1974; 2: 1127-31.
- 3) Anesth Analg 2005; 101: 69-73.
- 4) Internet J Anesth 2007; ISSN: 1092406X.



*implies significance between group 3 & 2

#implies significance between group 3 & 1

Table 1: Demographic profile

	Group 1	Group 2	Group 3
Age (yrs)	5.36±2.54	4.53±2.00	4.95±1.82
Weight (kg)	22±1.60	20±1.54	21±1.50
Duration of surgery (min)	44±1.92	43±1.90	46±1.91
Time to removal of LMA (min)	45±2.23	47±2.21	46±2.01
HR before induction (bpm)	103.4±8.56	91.07±10.58	103.47±9.84
RR before induction	28.80±5.25	21.07±3.98	22.33±4.03

Table 2: VAS / AIIMS Pain Discomfort Score

Postoperative Time (hrs)	Group 1	Group 2	Group 3	p-value
0	0.20±0.41	0.07±0.25	0.67±0.48	NS
0.5	0.87±0.99	0.27±0.59*	1.20±0.41*	p < 0.05
1	1.00±0.84	0.93±0.70	1.40±0.50	p < 0.05
2	1.60±0.50	1.20±0.67*	2.27±0.45*	p < 0.05
3	2.27±0.59	1.67±0.61*	3.07±0.45*	p < 0.05
4	2.53±0.51#	1.67±0.61*	3.93±0.25**	p < 0.05
5	2.60±0.50#	1.93±0.45*	3.80±0.41**	p < 0.05
6	2.47±0.83#	2.00±0.53*	3.13±0.35**	p < 0.05
24	3.33±0.72	3.07±0.25	3.00±0.00	NS

S-247.

THE EFFECTS OF EXTENDED RELEASE EPIDURAL MORPHINE ON LENGTH OF STAY AND PAIN MANAGEMENT FOR PRIMARY TOTAL HIP ARTHROPLASTY PATIENTS

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Abstract

INTRODUCTION: Post-operative pain following Total Hip Arthroplasty (THA) impacts negatively on patient satisfaction, rehabilitation, and hospital length of stay. We hypothesized that an injection of extended release epidural morphine (EREM) would decrease pain, narcotic consumption, and allow patients to transition directly to oral narcotics following hip surgery. One would expect these effects to translate into a shorter hospital stay. In this study, we evaluated the effects of EREM on outcomes in patients undergoing THA.

METHODS: We retrospectively studied 168 THA patients (44 patients who received EREM and 124 patients who received IV narcotics) and compared the effects of the different pain management modalities on total narcotic consumption, visual analog pain scores (VAS), and length of hospital stay. The two groups of patients were matched (3 to 1 ratio) for age, ASA classification, and major comorbidities.

RESULTS: After matching, there were no significant differences in ASA status, age, BMI, presence of comorbidities, or length of surgery. Patients who received EREM experienced significantly less pain when assessed immediately after surgery ($p = 0.025$), and also had significantly less pain 16 hours post-operatively ($p = 0.007$). The EREM group continued to report less pain on average throughout the inpatient stay and took less time to transition to oral analgesics, but these differences were not statistically significant. In addition, the EREM group required almost no supplemental IV narcotics in the first 48 hours compared to the IV group. Likewise, those patients who received EREM experienced a shorter hospital stay of 4.5 days versus 4.8 days, but this was also not statistically significant.

Only one epidural hematoma was observed in the EREM group, but this did not increase length of stay, nor was it clear whether or not the hematoma was related to the administration of EREM. There were significantly more instances of vomiting and nausea reported in the EREM group compared to the IV group, but there were significantly fewer patients with hypotension, dizziness, and respiratory distress in the EREM group (all $p < 0.05$).

DISCUSSION AND CONCLUSIONS: While no statistically significant difference in LOS was observed, our data demonstrates that extended release epidural morphine can provide superior pain control and obviates the need for a PCA, allowing the patient to transition more quickly to oral analgesics. Serious complications were rare, so EREM should be considered for eligible patients undergoing THA. Further prospective study is needed to confirm longer term outcomes.

S-248.

THE POLYMORPHISM IN HUMAN IL-1 RECEPTOR ANTAGONIST (IL-1RA) GENE INTRON 2 IS ASSOCIATED WITH CIRCULATING IL-1RA LEVELS AND PAIN PERCEPTION FOR PATIENTS WITH NEPHRECTOMY

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INTRODUCTION: IL-1 receptor antagonist (IL-1Ra) genotype is the principal determinant of IL-1 β bioactivity within the IL-1 gene cluster, regulating both constitutive and stimulated IL-1Ra and IL-1 β release (1). The present study was designed to understand the relationship between genetic polymorphisms of IL-1Ra and circulating IL-1Ra levels at the times of pre- and 24 hours post-operation and postoperative pain perception.

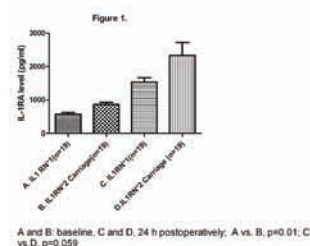
METHODS: Thirty eight patients with nephrectomy were equally distribute into two groups according to IL-1 Ra genotype results, with IL1RN*1 in group one and IL1RN*2 carriage (IL1RN*1/2+2/2) in group two. The IL-1Ra genotypes were determined by polymerase chain reaction amplification of the variable number of tandem repeats (VNTR) of 86 base pair (bp) in intron2 of IL-1Ra gene. Serum IL-1Ra before surgery (baseline) and 24 h postoperatively were measured by ELISA (R&D systems, USA). A visual analogue scale (VAS) for pain was assessed at 2, 6, 12, 24, 30, 36, 48, 60 and 72 hour postoperatively.

RESULTS: There was a nearly three-fold increase in IL-1Ra levels in all subjects 24 hours after their operation (719.1 ± 47.37 pg/ml baseline vs. 1937 ± 212.3 pg/ml 24 h postoperatively, $p < 0.0001$). The IL-1Ra level was significantly higher in IL1RN*2 carriage group than in IL1RN*1 group ($p = 0.01$) before surgery. This difference was also observed at 24 h postoperatively ($p = 0.059$) (Figure 1). There were higher VAS scores in IL1RN*1 group than in IL1RN*2 carriage group (3.632 ± 0.742 vs. 1.368 ± 0.525 , $p = 0.018$) at 24 hour postoperatively. There were no significant differences in age, sex, ethnic, body mass index (BMI), and other clinical characteristics between two groups.

DISCUSSION: Our current study showed that the subjects with IL1RN*2 carriage are associated with higher circulating IL-1Ra level both at baseline and 24 h postoperatively, with decreased pain perception. These results are consistent with a recent study (2), which demonstrated that IL1RN*1 homozygotes release more IL-1 β than carriers of at least one IL1RN*2 allele of the IL-1Ra gene (IL1RN*2). Our previous study demonstrated that there was a significantly higher 24 h morphine consumption in individuals homozygous for allele IL-1RN*1 when compared with individuals with IL-1RN*2 carriage (3). Combined these studies support the concept that IL1RN*1 homozygotes should release more IL-1 β , increasing inflammatory pain hypersensitivity and subsequently require higher doses of morphine postoperatively. In contrast, those patients who are carriers of at least one IL1RN*2 allele are expected to release more IL-1Ra, decreasing inflammatory pain hypersensitivity and require less morphine by comparison.

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2. *J. Immunol.* 2002, 32: 2988-2996.
3. *ASA annual meeting, Orlando, FL, 2008: 351.*



S-249.**WHAT ARE THE PREDICTORS FOR POSTOPERATIVE PAIN? A SYSTEMATIC REVIEW****AUTHORS:** H. V. Ip¹, A. Abrishami², P. W. Peng², J. Wong², F. Chung²;**AFFILIATION:** ¹Anesthesia, Toronto Western Hospital, Toronto, ON, Canada, ²Toronto Western Hospital, Toronto, ON, Canada.**INTRODUCTION:** Pain is a subjective multi-dimensional experience which is often inadequately managed in clinical practice. Effective control of postoperative pain is important after anesthesia and surgery. We conducted a qualitative systematic review to identify the independent predictive factors for developing postoperative pain to enable early intervention.**METHODS:** Systematic search was conducted through MEDLINE (January 1950 to July 2008), EMBASE (January 1980 to July 2008), CINAHL (January 1982 to July 2008), PsycInfo (1806 to 2008) and relevant reference lists for all studies investigating the risk factors for acute postoperative pain in adults using multivariate analyses. All studies meeting the inclusion/exclusion criteria were independently reviewed, critically appraised and data extracted by the authors.**RESULTS:** We identified 48 eligible studies for final analysis. This included a total of 23,037 patients with 6 different surgical groups. (Table 1) Anxiety and type of surgery such as abdominal, orthopedics and thoracic surgery were significant predictors for postoperative pain. Furthermore, existing preoperative pain and low pain threshold were also predictive factors for postoperative pain intensity. Other variables with positive correlations were: pain catastrophizing, extroverted personality, chronic sleeping difficulty, duration of surgery and previous surgery. Another interesting finding was that age and gender were not important predictive factors for postoperative pain as traditionally believed. For breast, orthopedic and thoracic surgery, the number of studies was limited for any meaningful conclusion to be drawn. The coefficient of determination of predictive models (R^2) was less than 54% and only two studies externally validated their regression models.**DISCUSSION:** Qualitative analysis of the studies shows a wide range of predictive factors for postoperative pain. Anxiety, type of surgery and preoperative pain are important predictive factors for postoperative pain intensity. However, it seems a misconception that age and gender predict postoperative pain. More vigorous studies with robust statistics and validated designs are needed to investigate this field of interest.*Table 1. Table showing the number of studies, sample size and predictors for postoperative pain*

Type of surgery	No. of studies	Sample size	Predictors for postoperative pain
Mixed surgery	15	19, 083	Type of surgery Anxiety Preoperative pain
Gastrointestinal surgery	11	2, 028	Anxiety Chronic pain
Obstetrics and gynecology surgery	16	1, 064	Anxiety Low pain threshold
Breast surgery	2	213	N/A due to limited no. of studies
Orthopedic surgery	2	397	N/A due to limited no. of studies
Thoracic surgery	2	252	N/A due to limited no. of studies
TOTAL	48	23, 037	

S-250.**COMPLICATIONS OF REGIONAL ANESTHETIC PROCEDURES AT A RURAL LEVEL ONE TRAUMA CENTER- OUR ACUTE PAIN SERVICE'S FIRST 5000 BLOCKS****AUTHORS:** W. T. Fritz¹, D. R. Meenan², J. M. Garguilo²;**AFFILIATION:** ¹Anesthesia, Conemaugh, Johnstown, PA, ²Conemaugh, Johnstown, PA.**INTRODUCTION:** The Anesthesiologist directed Acute Pain Service was initiated at our institution in July 2005. Prior to that time there were intermittent regional anesthetic block procedures provided at the request of either the trauma service or an attending surgeon.

Our Acute Pain Service was established using an initial core group of 4 anesthesiologists who were provided with advanced training in regional anesthetic anatomy via cadaver and ultrasound training courses supplemented by expert procedural proctoring. Two dedicated monitored and fully equipped procedural sites and supplemental ancillary support staff including physician extenders, nursing and surgical technologists were provided to create the support necessary for a high volume regional anesthetic based acute pain service. An acute pain patient database tracking system was created shortly after the establishment of this institutional service.

METHODS: As part of a Quality Improvement Project the Acute Pain Procedure Log, Acute Pain Database, Anesthesiology Morbidity and Mortality Conference records at our institution were queried from July 2005 to September 2008 for patients whose procedures were associated with Cardiac Arrest, Pneumothorax, Seizures, Wrong Sided Block and Possible Peripheral Neuropathy. These records were confirmed by comparing the entry with the patient's medical record.**RESULTS:** From July 2005 to September 2008 over 5000 regional anesthetic procedures were performed at our institution. 13 significant complications were associated with 12 patients. A possible femoral and sciatic neuropathy may have developed in the same patient.

Event	Block Type	Number	Rate
Cardiac Arrest (Successful Resuscitation) Cardiac Arrest (Unsuccessful Resuscitation)	Lumber Plexus	1	Overall Institutional Rate of 2 per 5000
	Lumber Plexus/ Sciatic (Septic)	1	
Pneumothorax	Paravertebral	2	2 / 213 1 / 129 1 / 868
	Posterior Cervical	1	
	Catheter Interscalene	1	
Seizure	Interscalene	1	Overall Institutional Rate of 3 per 5000
	Axillary (US Guided)	1	
	Sciatic	1	
Wrong Side Block	Paravertebral	1	Overall Institutional Rate of 2 per 5000
	Lumber Plexus/ Sciatic	1	
Possible Neuropathy	Sciatic	1	1 / 1024 1 / 1519
	Femoral	1	

RESULTS: Significant complications related to acute pain regional anesthetic techniques as defined by Cardiac Arrest, Pneumothorax, Seizure, Wrong Sided Block and Possible Peripheral Neuropathy occurred at our institution at an approximate rate of 2.6 per 1000 procedures. This data will be utilized as a part of a quality improvement effort at our institution.

S-251.

WHAT PATIENTS WANT: CLINICALLY RELEVANT OUTCOME MEASURES OF SUCCESSFUL PERI-OPERATIVE ANALGESIA

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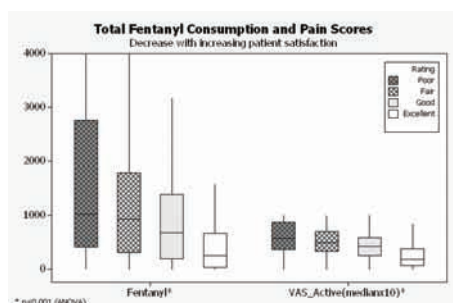
INTRODUCTION: Reassurance that an analgesic regimen reduces pain by 30% on average is cold comfort to a patient who happens not to be average. Statistical significance often fails to translate into clinical relevance. A more global measure of peri-operative experience, like patient satisfaction with pain medication, might be a more useful primary outcome, if only because it can identify treatment failures - dissatisfaction with analgesia. This possibility was explored in an analysis of individual patient data from several high quality randomised trials.

METHODS: Individual patient data from five large, multi-centre, randomised controlled trials of extended release epidural morphine were pooled. Patients underwent abdominal (n=134), pelvic (n=341) or hip surgery (n=361), or Cesarean section (n=73). IVPCA opioid (fentanyl or morphine) or oral opioid were used as appropriate. Data included VAS and categorical ratings at rest and with activity at ten timepoints during the first 48 hours post-operatively, opioid requirements, adverse event incidence and severity, and patient satisfaction ratings. Data from 909 patients were analyzed using Minitab® Statistical Software. Classifying ratings of "poor" and "fair" as negative outcome and "good", "very good" or "excellent" as positive outcome, binary logistic regression analysis was carried out with anesthesia and epidural morphine dose as factors and adverse effects, mean, median and maximum pain ratings, and IVPCA fentanyl equivalent consumption as co-variables. The contribution of each to patient satisfaction was assessed.

RESULTS: IVPCA fentanyl equivalent consumption decreased with increased epidural morphine dose. There was no significant difference in adverse event prevalence (nausea, urinary retention, pruritus) between satisfied and dissatisfied groups. Satisfaction was associated with lower median pain scores at with activity and lower IVPCA fentanyl use. Dissatisfaction was associated with higher median pain scores and higher IVPCA fentanyl consumption.

DISCUSSION: PCA analgesia requires patients to demand analgesia in response to pain. Pre-emptive analgesia, often criticized as a concept, does not require patients to "earn" medication through the pain experience. High PCA demand and dissatisfaction were linked; low PCA demand resulted in satisfied patients. The absence of pain was more influential than the absence of unpleasant side effects on satisfaction. The importance of "getting in first" with adequate post-operative analgesia may be underestimated and greater emphasis might be placed on prevention than treatment. Activity related pain should not be neglected. Using patient satisfaction as the primary outcome measure in clinical trials may be more enlightening than average pain score change.

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S-252.

PROPOFOL MIXED WITH LIDOCAINE VERSUS LIDOCAINE PRETREATMENT WITH TOURNIQUET FOR ALLEVIATION OF PAIN ASSOCIATED WITH PROPOFOL INJECTION

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AFFILIATION: ¹Anesthesiology, Virginia Mason Medical Center, Seattle, WA, ²Childrens Regional Medical Center, Seattle, WA, ³Virginia Mason Medical Center, Seattle, WA.

INTRODUCTION: Propofol injected through a peripheral vein causes pain in over 60% of patients. Lidocaine is thought to attenuate propofol-induced injection pain when administered either as a tourniquet-assisted pretreatment¹ or as a simultaneous admixture with propofol.² The ideal method of lidocaine administration is unknown. We hypothesize that a propofol-lidocaine admixture will be superior to lidocaine pretreatment with a tourniquet for the alleviation of pain on injection of propofol.

METHODS: Our IRB approved this randomized, double-blind, placebo-controlled trial. Following written informed consent, 150 un-premedicated patients were randomized to 1 of 3 groups: Control (saline pretreatment / saline admixture); Group 1 (saline pretreatment / 50mg lidocaine admixture); Group 2 (50mg lidocaine pretreatment / saline admixture). A tourniquet (non-invasive blood pressure cuff) was inflated to 60 mmHg, after which the patient received 1 of 3 pretreatments injected into a distal vein. One minute later, the tourniquet was deflated and a solution containing 50mg propofol plus either admixed saline or lidocaine was injected. Immediately after injection, the patient was asked by a blinded observer to rate their pain on a 0-10 point verbal pain score (VPS). Prior to PACU discharge, the blinded observer asked the subject 1) if he or she recalled any pain on injection of propofol, 2) to rate the pain using a VPS, and 3) whether the subject would choose the same anesthetic in the future. Fifty patients per group was calculated to detect a 20% difference in VPS, alpha=0.05, beta=0.8.

RESULTS: To preserve study integrity, the following preliminary analysis was made of the 3 study groups, which were designated Group A, B, or C by a person uninvolved with the study. The identity of these groups is masked from the study's authors. We anticipate complete study enrollment and data analysis by the time of abstract presentation.

Interim blinded analysis was performed on 79 of the expected 150 subjects. Mean age (~55 yrs) and gender did not differ between groups. Interim VPS (mean±SD) after injection are: Group A: 0±1, Group B: 4±3, Group C: 1±2. PACU VPS data: Group A: 0±1, Group B: 4±4, Group C: 1±1. In Group B, 7 of 25 subjects would elect not to have the same anesthetic again. All subjects in Groups A and C would have the same anesthetic again.

CONCLUSIONS: Based upon interim analysis of approximately half the expected number of subjects, two groups experienced less pain on injection of propofol as compared to the third (presumably control) group. Thus far, pain on injection of propofol is not different between the two groups that demonstrate a clinical effect.

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S-253.**THE EFFECT OF A SINGLE PREOPERATIVE DOSE OF GABAPENTIN ON OPIOID CONSUMPTION AND VAS SCORES IN ADULT LAPAROSCOPIC GASTRIC BYPASS PATIENTS**

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BACKGROUND: Gabapentin is an anticonvulsant that has antinoceptive and antihyperalgesic properties. This prospective, non-randomized pilot study was designed to evaluate the effect of preoperative gabapentin administration on post-operative pain in patients undergoing laparoscopic gastric bypass (LGB).

METHODS: Twenty-five patients scheduled for LGB surgery were enrolled consecutively. Twelve patients were assigned to receive 1200 mg oral gabapentin 1 hour before surgery (Gaba) and 13 patients were assigned to receive no gabapentin (No Gaba). Intraoperative anesthesia and postoperative pain management for both groups was standardized. Patients received midazolam 1-2 mg IV (intravenous) and a dexmedetomidine bolus of 0.5 mcg/kg IV over 10 minutes prior to transport to the operating room. Patients were induced with IV lidocaine 1-1.5 mg/kg, propofol 1.5-2.0 mg/kg, and succinylcholine 0.6 mg/kg or cisatracurium 0.15-0.2 mg/kg. Following intubation, patients were given dexamethasone 10 mg IV and a dexmedetomidine infusion at 0.5 mcg/kg/h IV until the end of the operation. Anesthesia was also maintained with desflurane and fentanyl. Ondansetron 4 mg IV and ketorolac 30 mg IV were administered after abdominal drain placement. Postoperative pain was controlled with IV hydromorphone via boluses and patient controlled analgesia (PCA). Pain scores, measured using a standard Visual Analog Scale (VAS) (0-10), and hydromorphone use was recorded in the post-anesthesia care unit (PACU), as well as at 12, 24, and 48 hours postoperatively. Continuous variables between groups were evaluated using Student's t-test. Categorical data was analyzed using Chi-Squared Test. $p < 0.05$ was considered statistically significant.

RESULTS: There were no differences observed in patient demographics. There was no difference in intraoperative fentanyl use in the Gaba group (127.1 ± 13.6 mcg) compared with No Gaba (128.8 ± 16.0 mcg; $p > 0.05$). The Gaba group reported significantly reduced postoperative pain scores at all recorded time intervals ($p < 0.05$; see figure 1). Postoperative IV hydromorphone use was not significantly different among groups (see figure 2). A trend towards less hydromorphone use in the PACU period was shown in the Gaba group (1.1 ± 0.2 mg) compared with No Gaba (1.9 ± 0.5 mg; $p = 0.064$).

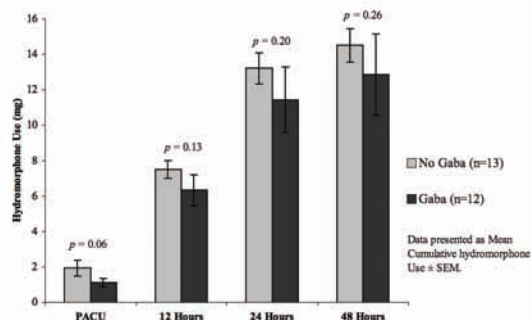
Cumulative Hydromorphone Use Per Time Interval

Figure 2: Cumulative hydromorphone use in PACU and at 12, 24 and 48 hours following laparoscopic gastric bypass surgery. Data displays a trend toward, but does not reach a statistically significant reduction in hydromorphone use in PACU for the Gaba group.

CONCLUSIONS: Single preoperative gabapentin administration decreased pain scores at all postoperative time intervals and showed trending towards decreased early postoperative dilaudid use at PACU. Based on this data a prospective double-blind randomized placebo-controlled trial has been designed and is currently being conducted to further evaluate the effects of a single preoperative gabapentin dose compared to a single preoperative gabapentin dose combined with continued postoperative dosing (6 total postoperative doses-300 mg PO TID for two days).

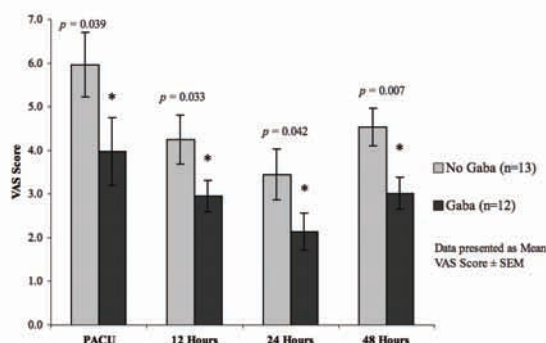
Average VAS Pain Score Per Period

Figure 1: Mean VAS Pain Score at PACU, 12, 24, and 48 hours following laparoscopic gastric bypass surgery. * $p < 0.05$ displays a significant reduction in patient reported pain in the Gaba group for all time periods.

Pain - Clinical - Chronic

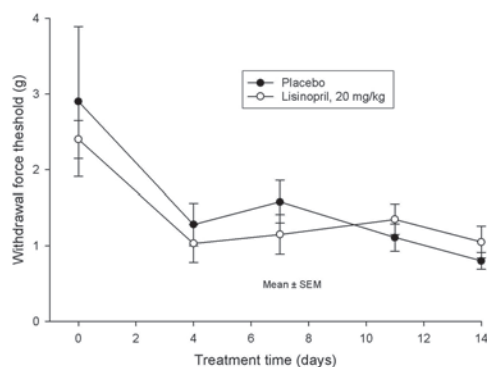
S-254.**DOES ACE INHIBITION ALTER MECHANICAL ALLODYNIA IN DIABETIC RATS****AUTHORS:** J. S. Kroin¹, J. Li², A. Buvanendran², B. Wagenaar², K. Tuman²;**AFFILIATION:** ¹Anesthesiology, Rush Medical College, Chicago, IL, ²Rush Medical College, Chicago, IL.

INTRODUCTION: Rats with diabetes induced by injection of streptozocin develop tactile allodynia and slower conduction times in both sensory and motor nerves (Pain 1996;68:293). Animal studies have shown efficacy of the angiotensin-converting enzyme (ACE) inhibitor lisinopril in restoring sciatic nerve conduction velocity in diabetic rats (Diabetologia 1992;35:12; Eur J Pharm 2001;417:223), potentially by improving endoneurial blood flow. This study directly assesses the therapeutic effect of lisinopril on streptozocin-induced mechanical allodynia in rats.

METHODS: Male Sprague-Dawley rats (200-250g) were injected with 50 mg/kg streptozocin i.v. (n=24). Blood glucose concentration was determined at 2 days post-injection (>250 mg/dL considered diabetic). Diabetic rats were then given a daily oral gavage of lisinopril 20 mg/kg (n=12) or placebo (n=12). Mechanical sensitivity of the plantar hindpaws was measured with calibrated von Frey filaments, and the average of the 2 sides used. Over 14 days of treatment, lisinopril and placebo groups were compared with repeated measures general linear model (SPSS) to determine if lisinopril had reduced mechanical allodynia compared to placebo.

RESULTS: Force withdrawal thresholds prior to streptozocin injection were 12.8 ± 0.7 g (mean \pm SEM) in the group assigned to receive lisinopril and 13.1 ± 0.6 g in the group assigned to receive placebo (P=0.700). Mean blood glucose levels 2 days after streptozocin injection were > 250 mg/dL in all animals. The force withdrawal threshold at this time was 2.9 ± 1.0 g in the group assigned to receive lisinopril and 2.4 ± 0.3 g in the group assigned to receive placebo (no difference; P=0.209). Both groups evidenced mechanical allodynia (decreased force threshold compared to pre-streptozocin force threshold; P< 0.001 in both groups). Over 14 days of treatment there was no difference in mechanical sensitivity between the lisinopril and placebo groups (F=.000, P=0.990) (Fig). Body weight gain was similar in both groups: 76.1 ± 4.3 g in the lisinopril group, 80.8 ± 4.3 g in the placebo group (P=0.788).

DISCUSSION: Lisinopril given at a daily dose that was previously shown to ameliorate deficits in sciatic motor and sensory conduction velocity in streptozocin-diabetic rats in a 2-month treatment protocol (Diabetologia 1992;35:12), did not improve mechanical allodynia in our diabetic animals. Although ACE inhibition can improve some aspects of nerve function in diabetic rats, it does not alter mechanical allodynia responses.

**S-255.****A RANDOMIZED CONTROLLED DOUBLE-BLINDED STUDY TO INVESTIGATE THE EFFECTIVENESS OF AN ADDUCTOR CANAL SAPHENOUS NERVE BLOCK IN PATIENTS WITH CHRONIC KNEE PAIN****AUTHORS:** M. S. Eckmann;**AFFILIATION:** Anesthesiology, University of Texas Health Science Center at San Antonio, San Antonio, TX.

INTRODUCTION: The saphenous nerve may supply some sensation to the knee joint; part of its course is through the adductor (sub-sartorial) canal in a medial thigh fascial envelope containing the nerve to vastus medialis, femoral artery, and femoral vein (1). Blockade of the saphenous nerve here may provide knee analgesia without causing quadriceps weakness as with a femoral nerve block (2,3,4).

METHODS: We investigated the efficacy of the adductor canal saphenous nerve block in patients with chronic knee pain using a randomized, double-blinded, placebo controlled design. Outcome measures were visual analog pain score (VAS, 0-100 mm), active ROM (degrees), quadriceps muscle strength (0-5 scale), presence of appropriate sensory change. Thirty-five adult patients, without recent knee surgery, with ongoing unilateral knee pain (VAS >40mm) for more than three months were selected.

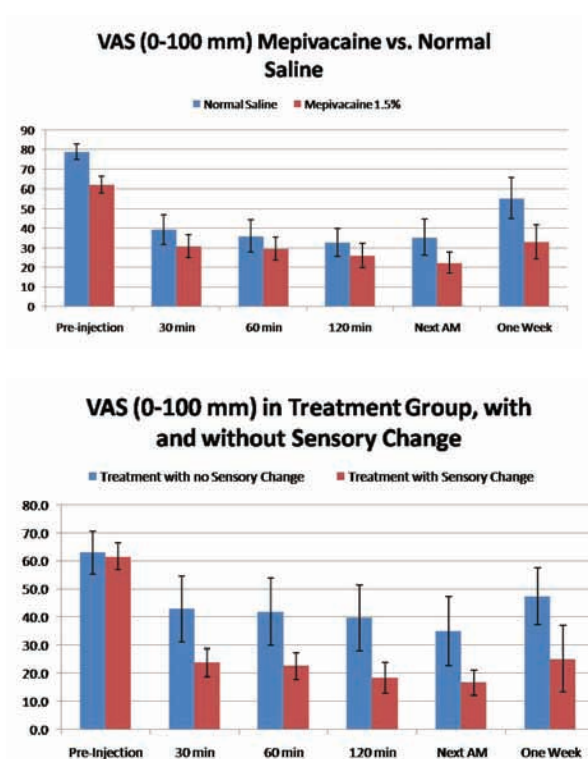
The injection was performed with the patient supine and knee flexed and hip externally located. Successful entry into the fascial envelope between the vastus medialis and the sartorius muscles was confirmed by elicitation of vastus medialis muscle (via nerve to vastus medialis) twitch at <0.5 mA with stimulating needle. Patients were randomized to receive either 20 ml of Mepivacaine 1.5% (treatment) or 20 ml of normal saline (control). Measurements were taken prior to injection and 30, 60, 120 minutes, one day, and one week post procedure.

RESULTS: Of 35 voluntarily recruited patients, 33 were included. In the control group (n=14), 4 patients could not be reached for one week follow-up. In the treatment group (n=19), 4 patients could not be reached for one week follow-up. Pre-injection VAS in the treatment versus the control group was 62.2 ± 4.1 vs 78.9 ± 4 mm (p=0.006). VAS tended to be lower in the treatment versus control group throughout, but did not reach significance [33 ± 33 vs 55 ± 33 mm (p=0.11), at one week]. The treatment group had expected saphenous distribution sensory changes in 12/19 (63%) cases versus 2/14 (14%) in the control group. Patients with sensory changes within the treatment group tended to have lower VAS scores at all times after the injection [18.3 vs 39.7 mm (p=0.08) at 120 min; 16.6 vs 35.0 (p = 0.1) next AM]. There were no significant changes in strength or range of motion, nor significant complications.

DISCUSSION: The adductor canal approach to the saphenous nerve block tended to result in >50% reduction of pain VAS without causing weakness, although significance was not reached possibly because of the 63% success rate of producing sensory changes. The adductor canal saphenous nerve block in the treatment of knee pain warrants further study and perfection of the technique.

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- 2) *Clin Orthop* 1982;168:97-101.
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S-256.

GENDER SPECIFIC GEOGRAPHIC VARIATION IN OPIOID PRESCRIBING IN NOVA SCOTIA

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INTRODUCTION Opioid medications are often prescribed as part of the management of pain, both acute and chronic. (1). The same medications used to treat pain are often implicated in drug abuse (2). Studies of geographic variation in opioid prescribing have focused on misuse and adverse events associated with the use of these medications (3). Gender differences in prescribing of opioids have been described in the Emergency room setting (4).

The Nova Scotia Prescription Monitoring Program (NSPMP) collects information from all prescriptions for controlled substances in Nova Scotia independent of third party drug coverage. This comprehensive data may provide insight into the provision of pain and addiction care in Nova Scotia. The goal of the study was to determine the variation by region and population of gender specific opioid prescribing.

METHODS This is a retrospective review of all prescriptions for opiate prescriptions written in Nova Scotia from 2004-2006, collected by the NSPMP as this was the most recent completed data set. Aggregate data were collected and converted to morphine equivalents (ME). Population data was derived from the 2006 Statistics Canada census. Prescribing data to the level of county was obtained and population density identified. The data was then merged and a map of gender specific prescribing patterns was created. The number of physicians was determined from the data base maintained by the Nova Scotia College of Physicians and Surgeons. Historical numbers of physicians were not available so current numbers were utilized for determination of physician load.

RESULTS We report the regional distribution by gender of all opioid prescriptions written from 2004 to 2006 in Nova Scotia. The total amount of opioid prescribed gradually increased from 190.4 x 10⁶ ME in 2004 to a maximum 210.6 x 10⁶ ME in 2005 and declining slightly in 2006 to 210.3 x 10⁶ ME. The overall number of patients receiving opioid prescriptions remained stable in 2004 and 2005 but increase by 11% in 2006. We report the annual trends of opioid prescribing by gender in Nova Scotia over this time period. An annualized map of opioid prescribing as a function of gender was created highlighting gender specific differences in opioid prescribing over time. Gender specific differences are compared to overall population density to highlight rural-urban gender differences.

CONCLUSIONS Regional distribution of opioid prescribing can provide insight into regional disparity in medical services such as chronic pain management and addiction management. Gender variations in opioid prescribing may reflect gender variations in pain, prescriber biases. This information may be used to guide education and policy development.

- 1) JAMA 2000; 284:428-9.
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- 3) J Pain 2005; 6:662-72.
- 4) Pain Med Nov 2008 epub ahead of print

S-257.

VARIATION IN OPIOID PRESCRIBING AND RELATION TO POPULATION DENSITY-RURAL VS URBAN

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AFFILIATION: ¹Anesthesia, Dalhousie University, Halifax, NS, Canada, ²Dalhousie University, Halifax, NS, Canada, ³Nova Scotia Prescription Monitoring Program, Halifax, NS, Canada.

INTRODUCTION: Opioid medications are often prescribed as part of the management of pain, both acute and chronic. (1). The same medications used to treat pain are often implicated in drug abuse (2). Studies of geographic variation in opioid prescribing have focused on misuse and adverse events associated with the use of these medications (3). Variation in the prescribing of opioid medications has been described in the context of third party insurance (4).

The Nova Scotia Prescription Monitoring Program (NSPMP) collects information from all prescriptions for controlled substances written in Nova Scotia independent of third party drug coverage. The comprehensive nature of the data may provide insight into the provision of pain and addiction care in Nova Scotia. This retrospective database study will describe the effect of population density and especially rural/urban discrepancies on the prescribing of opioid medications.

METHODS: The most recent complete data set, 2004-2006, of all opioid prescriptions in Nova Scotia was reviewed. Aggregate data were collected and converted to morphine equivalents. Population data was derived from the 2006 Statistics Canada census. Prescribing data to the level of county was obtained and population density identified. The data was then merged and a map of prescribing patterns was created. The number of physicians was determined from the data base maintained by the Nova Scotia College of Physicians and Surgeons. Historical numbers of physicians were not available so current numbers were utilized for determination of physician load.

RESULTS: We report the regional distribution by gender of all opioid prescriptions written from 2004 to 2006 in Nova Scotia. The total amount of opioid prescribed gradually increased from 190.4 x 10⁶ ME in 2004 to a maximum 210.6 x 10⁶ ME in 2005 and declining slightly in 2006 to 210.3 x 10⁶ ME. The overall number of patients receiving opioid prescriptions remained stable in 2004 and 2005 but increase by 11% in 2006. Additionally, we report the annual trends of opioid prescribing in Nova Scotia over this time period by county as a reflection of population density. A map of opioid prescribing as a function of population density over time was created comparing rural vs urban prescribing patterns. Opioid prescribing patterns as a function of population density are described.

CONCLUSIONS: Regional distribution of opioid prescribing can provide insight into regional disparity in medical services such as chronic pain management and addiction management. This information can also be used to track regional distribution of inappropriate or inadequate prescribing. Further, trends in this information may be used in development of and as quality assurance measures of public policy or education initiatives.

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- 2) Med Care 2006; 44:1005-10.
- 3) J Pain 2005; 6:662-72.
- 4) J Rural Health 2006; 22: 276

S-258.

ACTIVATION IN DISCRETE BRAIN REGIONS DURING CHRONIC PAIN: A POSITRON EMISSION TOMOGRAPHY (PET) SCAN STUDY

AUTHORS: A. Buvanendran¹, A. Ali², T. R. Stoub², J. S. Kroin², K. J. Tuman²;

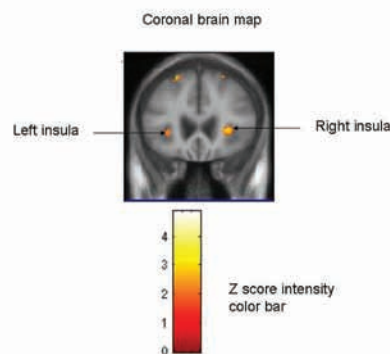
AFFILIATION: ¹Anesthesiology, Rush Medical College, Chicago, IL, ²Rush Medical College, Chicago, IL.

INTRODUCTION: Neuroimaging techniques have made it possible to identify the main cortical and brain stem responses of the human nociceptive system in various pain syndromes (J Anat 2005;207:19). PET is an imaging technique that can quantify increases in nerve cell activity in selective regions of the brain (Brain 1998;121:931). While earlier PET studies have examined the pattern of increased brain activity associated with neuropathic pain (Pain 1995;63:55) or chronic fatigue syndrome (JNNP 2003;74:922), brain activation in diffuse cancer-related pain has not been studied.

METHODS: Twelve patients with a history of Hodgkin's disease, non-Hodgkin's lymphoma, and lung cancer underwent whole body PET imaging for diagnosis and monitoring of disease status. There was no evidence of brain metastases in these patients. Pain scores using the verbal rating scale (VRS), with 0 corresponding to "no pain" and 10 to the "worst imaginable pain" were assessed prior to the PET scan. Inclusion criteria for our study was minimal or no pain (VRS score 0-2) or moderate-to-severe pain (VRS score 4-8) even with analgesic treatment. In a quiet room with low light level, patients were injected IV with the standard PET radionuclide 18F-fluoro-2-deoxyglucose (FDG). After waiting 40 min for the FDG to reach a stable brain intracellular level, the head was positioned in the PET scanner. Anatomic accuracy was achieved by registering the PET images with a standardized stereotactic brain MRI. To compare PET scans among different patients, a linear normalization was applied by dividing regional activity by whole brain activity for each scan (Eur Neuropsychopharm 2002;12:527-44).

RESULTS: The mean pain score in the patients with chronic pain (n=6) was 5.92 ± 1.74 (mean ± SD), versus 1.17 ± 0.75 (P<0.001) in the group with minimal pain (n=6). Chronic pain patients' had increased PET brain activation in the insula (area 13) bilaterally (Z score = 3.33 in right insula, 2.86 in left insula) (Fig. 1), compared to the minimal pain group.

DISCUSSION: The insula, an area of neuromodulation implicated in other chronic pain studies, was the most important region of activation with chronic diffuse cancer-related pain. Since the insula is considered a major center for affective and cognitive pain processing, drugs that address affective pain perception (e.g. reuptake inhibitors, anticonvulsants) may be more effective than conventional analgesics.



S-259.

POSTOPERATIVE ANALGESIA WITH HIGH-DOSE INTRATHECAL MORPHINE VERSUS IV MORPHINE

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AFFILIATION: ¹Anesthesiology, University of Kentucky, Lexington, KY, ²University of Kentucky, Lexington, KY.

INTRODUCTION: The effectiveness of high-dose intrathecal (IT) opioids for postoperative analgesia has been limited by opioid-related side effects, most importantly respiratory depression. To overcome these limitations, we combined high-dose IT morphine with a continuous intravenous (IV) postoperative naloxone infusion to control opioid-related side-effects. The purpose of this study is to compare the efficacy and safety of high-dose IT morphine combined with IV naloxone infusion to traditional IV opioid-based postoperative analgesia after major female pelvic surgery.

METHODS: After IRB approval, a retrospective chart analysis (2004-2006) was performed on 53 female patients requiring pubovaginal sling with vaginal hysterectomy. Forty patients received a single injection of high-dose IT opioids (ITO) prior to general anesthesia followed by IV naloxone infusion at 5mcg/kg/hr started 1hr post-ITO and continued for 22hrs postoperatively. Thirteen patients used IV morphine (IVM) for postoperative analgesia and served as a control group. The following data were collected: patient age, height, weight, anesthesia technique/time and dose of ITOs given. Postoperative pain relief was assessed for 48hrs using the visual analog score (VAS) for pain (0=no pain; 10=worst pain), perioperative opioid use, postop NSAID use, and ability of patients to ambulate. Safety of treatment was assessed with opioid-related side effects and vital signs. All data are reported as mean (S.D.). Statistical significance* level of p<0.05 was used.

RESULTS: The mean dose of ITOs given was morphine 1.04(0.2) mg combined with fentanyl 46(10)mcg. The mean worst pain VAS in the first 12hrs postoperatively was 0.4(1.3)* in ITO versus 4.8(1.6) in IVM. On POD 2 the mean worst pain was only 1.7(2.1)* in ITO versus 4.6(2.8) in IVM. Analgesic requirements are listed in Table 1. Thirty-eight patients (95%) in ITO group were able to ambulate in the first 12hrs postoperatively compared to 6 (46%) in the IVM group. No opioid-induced respiratory depression was observed in either group. Other opioid-related side effects (pruritus, nausea) were infrequent and minor in both groups.

CONCLUSIONS: 1) High-dose ITOs combined with postoperative IV naloxone infusion provided better analgesia for major female pelvic surgery compared to traditional IV morphine. 2) IV naloxone infusion combined with high-dose ITOs appeared to control opioid side effects without affecting analgesia. 3)No serious adverse effects were noted. 4) Future prospective clinical trials are warranted.

Mean (SD) postoperative analgesic data

	ITO (40 patients)	IVM (13 patients)
Time to first postoperative opioid (hrs)	20.6 (3.9)*	1.0 (0.3)
Time to first postoperative NSAID (hrs)	6.2 (11.3)	3.1 (1.8)
Opioid use on POD 1 in morphine equivalents	7.6 (11.6)*	97.6 (33.6)
Opioid use on POD 2 in morphine equivalents	38.6 (26.3)	84.0 (49.2)
Opioid use total 48hrs postoperatively in morphine equivalents	46.2 (33.8)*	181.5 (74.10)
Patients not receiving additional opioids on POD 1	22	0
Patients not receiving additional opioids on POD 2	5	1

S-260.

INJECTION SITE PAIN AFTER FLUOROSCOPICALLY GUIDED EPIDURAL STEROID INJECTION

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AFFILIATION: ¹Anesthesiology, U. of Tennessee Medical Center, Knoxville, TN, ²U. of Tennessee Medical Center, Knoxville, TN.

INTRODUCTION: Back pain has been reported as the most common complication of epidural injection procedures. Studies have reported the incidence of back pain or tenderness as high as thirty percent after epidural anesthesia for obstetric and non-obstetric procedures (1,2,3). Factors such as catheter placement and use of fluoroscopic guidance may influence complication rates (4). No studies have specifically evaluated injection site tenderness after fluoroscopically guided lumbar epidural steroid injection (LESI). Our goal was to determine the incidence of tenderness at the injection site after LESI. We also measured the correlation between injection site tenderness and patient satisfaction.

METHODS: 113 patients were contacted by phone one day post LESI and were asked to rate their tenderness at epidural injection site (1- no discomfort, 2- minor discomfort, 3- major discomfort) and their satisfaction with the procedure (1 -dissatisfied, 2-somewhat satisfied, 3- very satisfied). All LESI's were performed via interlaminar approach with fluoroscopic guidance.

RESULTS: 35 of 113 patients (31%) reported discomfort at injection site one day after LESI. 82% (93 of 113) were very satisfied with the procedure. 11 (14%) of the 78 patients who reported no discomfort at the injection site one day after LESI were less than very satisfied with the procedure. 8 out of the 33 patients (24%) who experienced mild discomfort at injection site were less than very satisfied with the procedure. Only 2 patients of 113 reported major discomfort at the injection site and one (50%) of these patients was less than very satisfied with the procedure.

DISCUSSION: Pain at injection site is common after LESI. In this study the reported incidence of 31% is not significantly different from that reported for other epidural injection procedures performed without the use of fluoroscopic guidance (1,2,3). Experiencing discomfort at the injection site following epidural steroid injection may have an impact on patient satisfaction. Any technique or treatment that can decrease the incidence/severity of injection site tenderness may improve patient satisfaction.

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S-261.**EFFECT OF DIABETIC NEUROPATHY ON DURATION OF NERVE BLOCKS IN RATS**

AUTHORS: J. S. Kroin¹, A. Buvanendran², B. Wagenaar², K. J. Tuman²;

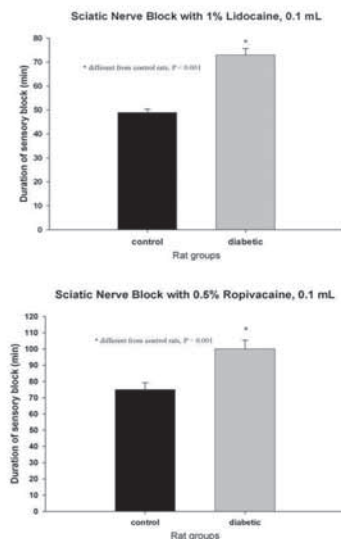
AFFILIATION: ¹Anesthesiology, Rush Medical College, Chicago, IL, ²Rush Medical College, Chicago, IL.

INTRODUCTION: Rats with diabetes induced by the injection of streptozocin develop peripheral neuropathy and slower conduction times in both sensory and motor nerves (by 5 weeks) (Pain 1996;68:293). These changes in the peripheral nerve may affect the onset of a local anesthetic block, and even the susceptibility to nerve toxicity of local anesthetics (Anesthesiology 1992;77:941; Anesthesiology 2008;109:361). Our hypothesis is that for the same dose a local anesthetic block will last longer in diabetic rats.

METHODS: Male Sprague-Dawley rats (200-250 g) were injected with 50 mg/kg streptozocin i.v. (n=24) or saline vehicle (n=24). Glucose concentration was determined at 7 days post-injection from tail blood, with a commercial blood glucose monitoring meter and test strips. Rats with blood glucose levels above 250 mg/dL were considered diabetic. Force withdrawal thresholds of the plantar hindpaws were measured with calibrated von Frey filaments (0.4-15 g) to verify mechanical allodynia. After waiting 35 days, injections (0.1 mL) of local anesthetics were performed at the sciatic notch in both diabetic and vehicle control rats, and the duration of sensory (pin prick) or motor (toe spreading reflex) nerve block in the hind paws was determined (Anesthesiology 2004; 101:488). Duration of nerve block was compared between groups with independent samples t-test.

RESULTS: Prior to streptozocin injection, rats had mean force withdrawal thresholds >12 g, but by day 31 post-streptozocin the threshold had dropped to 1.2 ± 0.8 g in diabetic rats versus 14.4 ± 1.3 in control rats ($P < 0.001$), indicating neuropathy in the diabetic animals. Sciatic nerve block with 1% lidocaine showed a longer duration of sensory block (by 24 min) in diabetic rats versus control rats (Fig. 1Upper). Motor block was also longer in diabetic rats (76.7 ± 3.0 vs. 51.3 ± 1.4 ; $P < 0.001$). Similarly, sciatic nerve block with 0.5% ropivacaine showed a longer sensory block (25 min) in diabetic rats versus control rats (Fig. 1Lower). Motor block was also longer in diabetic rats (102.9 ± 5.7 vs. 78.5 ± 4.2 ; $P = 0.001$).

DISCUSSION: The duration of local anesthetic nerve block is longer in diabetic animals than in normal animals. This may have implications for the dosing of local anesthetic in diabetic patients. Additional studies are needed in this diabetic animal model to assess for altered susceptibility of nerves to local anesthetic toxicity.



Pediatric Anesthesia

S-262.**DEXMETOMIDINE FOR PEDIATRIC PATIENTS UNDERGOING TONSILLECTOMY: EMERGENCE AND RECOVERY CHARACTERISTICS**

AUTHORS: S. R. Pestieau¹, Y. J. Johnson², J. L. Anderson², R. J. McCarter², J. C. Finkel²;

AFFILIATION: ¹Anesthesiology and Pain Medicine, Children's National Medical Center, Washington, DC, ²Children's National Medical Center, Washington, DC.

INTRODUCTION: Children undergoing tonsillectomy tend to be very sensitive to the respiratory depressant effects of opioids¹. Dexmedetomidine (dex) (Precedex; Hospira, Lake Forest, IL) is a selective α_2 adrenoreceptor agonist that has sedative and analgesic effects. Dexmedetomidine provides profound levels of analgesia and sedation without affecting respiratory and cardiovascular stability^{2,3}. In this study, we examined the effect of a single intraoperative dose of dex vs. fentanyl on emergence characteristics and hemodynamic parameters in children undergoing tonsillectomy.

METHODS: One hundred children, 2-12 years old, received general anesthesia with desflurane for tonsillectomy surgery. They were randomly assigned to receive a single intravenous dose of fentanyl 1 $\mu\text{g}/\text{kg}$, fentanyl 2 $\mu\text{g}/\text{kg}$, dex 2 $\mu\text{g}/\text{kg}$ or dex 4 $\mu\text{g}/\text{kg}$, given over 10 minutes immediately after inhalation induction, intubation and prior to surgical stimulation. A blinded observer recorded times to emergence, recovery criteria, and hemodynamic parameters. Statistical analysis was performed with Pearson chi square and log-rank tests.

RESULTS: The results showed no difference between the 4 groups with regard to demographics or the presence of obstructive sleep apnea. There was less emergence agitation including severe emergence agitation (Steward agitation score ≥ 2) as well as less postoperative pain including severe postoperative pain (Objective Pain Discomfort Scale score ≥ 6) in the dex groups. Time to first supplemental dose of morphine in the post-anesthesia care unit was delayed when dex was compared to fentanyl. There was also less postoperative nausea and vomiting with dex although this was not statistically significant. The incidence of tachycardia, hypertension and light anesthesia, defined as an increase in heart rate and blood pressure of 20% above baseline, was significantly decreased with the use of dex. Both drugs exhibited equal hemodynamic responses to noxious stimuli, i.e. mouth gag placement and surgical incision. Finally, times to emergence and overall length of stay were slightly increased with dex. Upon examination of the data it was noted that patients in the dex groups continued to breathe spontaneously throughout surgery. One of the emergence criteria, spontaneous eye opening, was relatively delayed in the dex groups.

DISCUSSION: Dexmedetomidine had a profound impact on emergence agitation and analgesia in children undergoing tonsillectomy surgery. The time delay for additional pain treatment indicates that at the doses used, dex provided superior analgesia into the recovery period. When compared to fentanyl, dex maintained a more stable hemodynamic profile. Although the recovery period was prolonged, the length of stay did not exceed 2 hours and 3 hours with dex 2 $\mu\text{g}/\text{kg}$ and 4 $\mu\text{g}/\text{kg}$ respectively. Further dose-ranging studies are needed to establish the optimal dose while maintaining rapid recovery.

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Table 1. Emergence and Recovery Characteristics

	Fent 1	Fent 2	Dex 2	Dex 4	P value
Time to emergence mean (SD) sec	306±152	397±210	375±223	490±363	0.0389
Incidence of pain in PACU (%)	25	18	7	7	0.000
Pain score ≥ 6 (%)	15	9	4	1	0.000
Incidence of agitation in PACU (%)	25	24	14	12	0.000
Agitation score ≥ 2 (%)	15	14	5	4	0.003
Time to 1st morphine dose mean (SD) min	19±25	44±61	61±89	138±123	0.0004
Nausea in PACU (%)	5	3	2	0	0.147
Retching in PACU (%)	5	3	2	1	0.361
Vomiting in PACU (%)	3	3	0	2	0.420
Morphine in PACU (%)	19	16	13	14	0.555
LOS in PACU mean (SD) min	54.2±13	66.4±27	66.9±23.7	81.6±33	0.0015
Light anesthesia (HR and BP 20% \geq baseline) (%)	9	7	0	1	0.002
Incidence of hypertension (%)	23	18	11	14	0.017
Incidence of hypotension (%)	3	5	9	8	0.100
Incidence of tachycardia (%)	18	17	5	9	0.002
Incidence of bradycardia (%)	3	3	9	12	0.003

S-263.

IMPACT OF DEXMEDETOMIDINE ON VASCULAR RESISTANCE AND CARDIAC FUNCTION

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INTRODUCTION: Dexmedetomidine (dex) is a specific α_2 adrenergic agonist with an $\alpha_2:\alpha_1$ ratio of 1620:1¹. Alpha-2-adrenoreceptors (α_2 AR) are found in a variety of body tissues, and the physiologic response mediated by the α_2 AR is determined by location. High densities of α_{2A} AR have been demonstrated in the vagus nerve. The α_{2B} AR is concentrated in the peripheral vasculature² and produces a dose dependent systemic vascular resistance and a decrease in cardiac output³. By examining patients with denervated transplanted hearts, we were able to examine the impact of dex on peripheral vascular resistances and cardiac function without the influence of reflex cardiac activity.

METHODS: We studied four children greater than one year status post cardiac transplant, ages 6 to 18 years old, undergoing cardiac catheterization for endomyocardial biopsy. Two sets of invasive measurements, including cardiac output and cardiac index were recorded; one at "baseline" under general anesthesia using a volatile anesthetic and one after dex was loaded. Pulmonary and systemic vascular resistances were later calculated. Inhalation induction, placement of a laryngeal mask airway (LMA), and maintenance with sevoflurane was performed. After the first set of invasive measurements, two patients received dex 2 μ g/kg IV over 20 minutes and two patients received 3 μ g/kg/hr over 30 minutes. Sevoflurane was titrated down to maintain a BIS less than 60. This was followed by a 1 μ g/kg/hr infusion of dex.

RESULTS: Neither blood pressure nor heart rate changed by more than 20% from baseline after the dex loading dose. Pulmonary vascular resistance (PVR) increased after dex was loaded relative to pre-dex PVR, with a mean difference of 60. There was no statistical difference by the Wilcoxon signed-rank test ($p=0.07$). The SVR increased in all four patients post-dex with no statistical difference ($p=0.07$). Cardiac output (CO) and cardiac index (CI) both decreased relative to pre-dex values in three of four patients, with no statistical significance in CO ($p=0.18$) or CI ($p=0.09$). (Table 1)

DISCUSSION: In this small sampling, dex at the dose used was shown to non-significantly increase SVR and PVR in parallel with a compensatory decrement in CO/CI. These observations are important factors to consider for the design of future investigations examining the use of dex in patients with congenital cardiac pathophysiology.

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Table 1. Pre and Post Dex Invasive Measurements

Pt	Pre-dex PVR	Post-dex PVR	Pre-dex SVR	Post-dex SVR	Pre-dex CO	Post-dex CO	Pre-dex CI	Post-dex CI
1	104	167	1350	1766	3.9	2.4	4.7	2.9
2	41	64	637	918	5.9	6.3	3.5	3.7
3	113	123	640	1353	6.4	3.3	8.4	4.3
4	107	252	1265	2947	3.7	1.9	5.3	2.7
P value	0.07		0.07		0.17		0.09	

S-264.

DOSE-RANGING EFFECT OF DEXMEDETOMIDINE ON HEART RATE AND BLOOD PRESSURE IN PEDIATRIC HEART TRANSPLANT PATIENTS

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INTRODUCTION: Dexmedetomidine (dex) is a specific α_2 adrenergic agonist with an $\alpha_2:\alpha_1$ ratio of 1620:1 and α_2 :imidazolin 1 (I₁-R) ratio of 30:1¹ that exhibits sympatholytic effects² via central mechanisms. Both α_2 AR and I₁-R are also present in human heart tissue^{3,4} but the direct effect on these cardiac receptors is unclear. The denervated state of the transplanted heart excludes it from autonomic control, making the pharmacodynamic impact of a drug in the cardiac transplant recipient dependent on the direct mechanism of action of the drug. We examined the dose-ranging effect of dex on heart rate (HR) and blood pressure in pediatric heart transplant patients.

METHODS: We studied nine children at least one year status post cardiac transplant, ages 6 to 18 years old, undergoing cardiac catheterization for endomyocardial biopsy. Inhalation induction, placement of a laryngeal mask airway (LMA), and maintenance with sevoflurane was performed. After the first set of invasive measurements, successive loads of dex 1 μ g/kg IV over 10 minutes were given up to three loads or until the arterial blood pressure or the HR changed by at least 20 percent from baseline under anesthesia. Sevoflurane was titrated down, keeping a BIS less than 60. This was followed by a 1 μ g/kg/hr infusion of dex. Non-invasive systolic and diastolic blood pressure (SBP and DBP) and HR were measured every five minutes throughout.

RESULTS: Five patients received three loading doses of dex, three patients received two loads, and one patient received one load. Relative to the pre-dex HR, the following was found: the mean HR after load 1 decreased by 4 bpm ($p=0.2$), mean HR after load 2 decreased by 13 bpm ($p=0.0008$), and mean HR after load 3 decreased by 17 ($p=0.04$). While the values for dose 2 and 3 were statistically significant, there was no clinical significance in that these values were within 20% of baseline. Comparing the pre-dex SBP and DBP to their values after each of three doses, there was an incremental increase in SBP and DBP, none of which were clinically or statistically significant. (Table 1)

DISCUSSION: Interestingly, there was a dose dependent decrement in HR despite the denervated state of the heart. This suggests that the cardiac α_2 AR or I₁-R may mediate chronotropy directly or that reinnervation may have occurred⁵. Further laboratory investigation will help to clarify these possibilities.

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Table 1. Dose-Ranging Mean Change in Heart Rate and Blood Pressure

	Mean Change HR Post dex load 1	Mean Change HR Post dex load 2	Mean Change HR Post dex load 3	Mean Change SBP Post dex load 1	Mean Change SBP Post dex load 2	Mean Change SBP Post dex load 3	Mean Change DBP Post dex load 1	Mean Change DBP Post dex load 2	Mean Change DBP Post dex load 3
	-4	-13	-17	1.3	7.1	7.6	3	4.25	0.8
P value	0.202	0.0008	0.04	0.61	0.15	0.17	0.51	0.36	0.89

S-265.**ABSENCE OF NEURODEGENERATION INDUCED BY DEXMEDETOMIDINE IN 7 DAY RAT PUPS: COMPARISON TO KETAMINE****AUTHORS:** J. E. Marchand¹, P. M. Bokesch²;**AFFILIATION:** ¹Anatomy and Cellular Biology, Tufts University, Boston, MA, ²Hospira, Inc., Lake Forest, IL.

INTRODUCTION: Anesthetics and sedatives with effects at GABA and NMDA receptors can cause neurodevelopment disturbances. Ketamine has been shown in rodent and primate neonates to produce neuronal degeneration (1). Dexmedetomidine (Precedex) is an alpha-2 agonist with sedative, anxiolytic and analgesic effects. This study was designed to determine if dexmedetomidine, at sedative concentrations, produces neuronal degeneration in postnatal rats.

METHODS: After IACUC approval, postnatal day 7 (PND7) rats were given 6 s.c. injections at 1.5 hr intervals of: (1) saline, (2) ketamine (KET), 20 ug/kg, (3) dexmedetomidine (DEX), 3 ug/kg, (4) DEX, 10 ug/kg or (5) DEX, 30 ug/kg. At these doses, KET and the high and medium DEX doses produced marked sedation and loss of righting reflexes. After a 24 hour survival, animals were anesthetized, transcardially perfused with formalin and brains removed for histological assessment of neuronal degeneration, by caspase-3 immunohistofluorescence, Fluor Jade-C staining and silver staining. Neurodegeneration in cortical, thalamic and hypothalamic regions was quantitated by silver staining. Regional differences in neurodegenerating neurons over different drug groups and saline were compared with ANOVA and Newman-Keuls post hoc test. A $p < 0.05$ was considered statistically significant.

RESULTS: KET induced significant neurodegeneration in the PND7 rat brain. The neurodegeneration was restricted to specific brain regions and was significantly greater than saline in lateral dorsal and anteroventral thalamus, and in posterior limbic and perirhinal cortices. In contrast to the neurodegenerative effects of KET, DEX injections at low, medium and high doses produced minimal, non-significant levels of neurodegeneration that were numerically similar to those after saline injection.

p Values Drug vs Saline for 4 Brain Regions				
	Ket-Saline 20 ug/kg	DEX-Saline 3 ug/kg	DEX-Saline 10 ug/kg	DEX-Saline 30 ug/kg
Lateral Dorsal Thalamus.	0.0064	0.4554	0.1227	0.7681
Anteroventral Thalamus	0.0048	0.2528	0.5728	0.1580
Perirhinal Cortex	0.0058	0.2110	0.6704	0.4943
Post. Limbic Cortex	0.0094	0.5499	0.6202	0.2679

DISCUSSION: This study shows that sedative doses of dexmedetomidine, in contrast to sedative doses of ketamine, do not produce neuronal degeneration in neonatal rodents. Mechanistically these differences may result from distinctly different pharmacological profiles, wherein dexmedetomidine produces sedative and analgesic actions through activation of alpha-2 adrenergic activation, (2) and ketamine produces its actions through antagonism of NMDA receptors. Importantly, these results suggest dexmedetomidine may be a safer alternative to ketamine for pediatric sedation and as an anesthetic supplement.

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S-266.**CEILING EFFECT OF DEXMEDETOMIDINE INDUCED ANALGESIA AND SEDATION FOR CHILDREN UNDERGOING TONSILLECTOMY SURGERY****AUTHORS:** S. R. Pestieau¹, Y. J. Johnson², J. L. Anderson², R. J. McCarter², J. C. Finkel²;**AFFILIATION:** ¹Anesthesiology and Pain Medicine, Children's National Medical Center, Washington, DC, ²Children's National Medical Center, Washington, DC.

INTRODUCTION: Despite their emetic potential and respiratory depressant effects, opioids are often the mainstay of analgesia for children undergoing tonsillectomy. Dexmedetomidine (dex) is a selective α_2 adrenoreceptor agonist which exerts a central sympatholytic action and induces sedation, anxiolysis as well as analgesia^{1,2}. The analgesic and sedative effects of dex and lack of respiratory depression make it a potentially attractive agent to provide perioperative analgesia for a variety of procedures. We previously reported that dex decreased emergence agitation and provided superior analgesia, when compared to fentanyl in patients undergoing tonsillectomy. In this study, we compared the analgesic efficacy of two doses of dex in terms of opioid sparing effect.

METHODS: Fifty children, 2-12 years old, received general anesthesia with desflurane and nitrous oxide for tonsillectomy. They were randomly assigned to receive a single intravenous dose of dex 2 $\mu\text{g/kg}$ or dex 4 $\mu\text{g/kg}$, given over 10 minutes immediately after inhalation induction, endotracheal intubation and prior to surgical stimulation. A blinded observer recorded hemodynamic parameters, times to emergence, and recovery criteria. Statistical analysis was performed with Pearson chi square and log-rank tests.

RESULTS: There was no difference in regards to demographics or the presence of obstructive sleep apnea. The incidence of emergence agitation (Steward agitation score), severe pain (Objective Pain Discomfort Scale score ≥ 6), and postoperative nausea and vomiting was similar between the two doses of dex. There was also no difference in the amount of rescue morphine given in the post-anesthesia care unit but the higher dose of dex showed a trend of increased time to first supplemental dose of morphine. Additionally, the higher dose of dex slightly delayed time to emergence and significantly increased the overall length of stay in the post-anesthesia care unit. (Table 1)

DISCUSSION: Dexmedetomidine, at 2 and 4 $\mu\text{g/kg}$ efficiently blocked the hemodynamic responses to nociceptive stimuli in children undergoing tonsillectomy. While the higher dex dose produced prolonged analgesic and sedative effects, these differences were not statistically significant. This suggests a ceiling effect of dex induced analgesia and sedation when administered as a single loading dose. Further PK/PD dose response studies are needed to determine optimal postoperative analgesic strategies.

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Table 1. PACU Pain and Sedation Characteristics

	Dex 2	Dex 4	P value
Time to emergence mean (SD) sec	375 \pm 223	490 \pm 363	0.1571
LOS in PACU mean (SD) min	66.9 \pm 23.7	81.6 \pm 33	0.0311
Incidence of pain in PACU (%)	14	14	0.853
Pain score ≥ 6 (%)	8	2	0.129
Incidence of agitation in PACU (%)	28	24	0.371
Agitation score ≥ 2 (%)	10	8	0.611
Time to 1st morphine dose mean (SD) min	61 \pm 9	137 \pm 123	0.0683

S-267.

ETHNIC DIFFERENCES IN PEDIATRIC MORPHINE PHARMACODYNAMICS; PRELIMINARY RESULTS

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INTRODUCTION: Previous studies report that Latino patients often receive lower doses of analgesics (1). This is frequently explained by disparities in health care, communication and cultural barriers. A study in adult volunteers showed decreased ventilatory response to CO₂ after morphine administration associated with differences in M6G plasma levels in Latinos when compared to Caucasians(2). The present study aims to compare morphine pharmacokinetics (PK) and pharmacodynamics (PD) in Latino (L) and non-Latino (NL) pediatric patients receiving morphine for post-operative pain treatment.

METHODS: Prospective double-cohort study comparing morphine PK and PD (Pain scores and side effects) between Latino Spanish speaking and non-Latino English speaking children, 1-17 years of age after tonsillectomy and adenoidectomy procedures. Plasma morphine, morphine-6-Glucuronide (M6G) and morphine-3-Glucuronide (M3G) levels were measured at 0, 10, 30 minutes, 1, 2, and 4 hours after a single morphine IV bolus (0.15 mg/kg). A standardized anesthetic (sevoflurane, O₂/N₂O 60%, decadron (0.5 mg/kg max 8 mg) was used. During recovery pain rescue boluses of hydromorphone, along with ondansetron and metoclopramide for nausea and vomiting (PONV) and diphenhydramine for pruritus were administered if needed. Data on pain scores (FLACC scale), PONV, pruritus and ventilatory assessment were recorded; only data from early recovery is considered in an effort to restrict analysis to morphine side effects. Statistical analysis was done using Mann-Whitney and chi-square/fisher's exact tests. Mean plasma levels of morphine, M6G and M3G at each point in time were compared between groups. Formal PK analysis is underway.

RESULTS: 38 subjects have been enrolled (20 L, 18 NL). There were non-significant differences in age and gender between groups. There were no differences in pain scores and hydromorphone boluses for rescue pain. (Table 1) There were significant differences in incidence and severity of side effects. PONV occurred in 30% of L and none in NL (p=0.02). Pruritus was 8 times more frequent (p=0.009) in L compared to NL. Three Latino patients needed hospitalization: 2 for treatment of severe PONV and one for monitoring for respiratory depression. There were no differences in morphine concentrations (Figure 1), M6G and M3G levels (not shown).

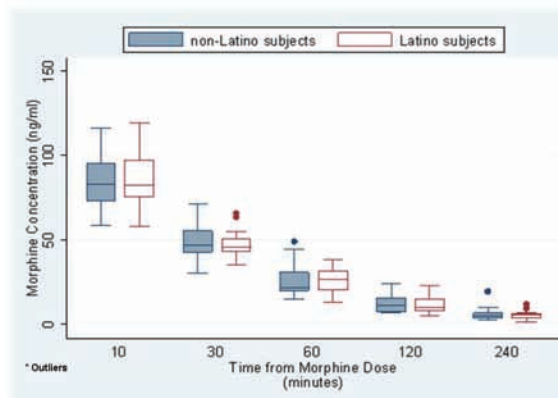
DISCUSSION: This preliminary report found significant differences in incidence and severity of PONV and pruritus between L and NL pediatric patients. No differences in analgesic effects or need of analgesic supplementation, nor in morphine, and morphine metabolite concentrations were found. Differences in genetic polymorphisms in the μ -opioid receptor between these two populations might explain these differences. Our findings are consistent with a previous study reporting differences in morphine side effects and similar analgesic profiles between patients with μ -opioid A304G and G304 polymorphisms (3). Evaluation of μ -opioid receptor polymorphisms in our study population is in progress.

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Table 1.

Subject characteristics	non-Latino N=18	Latino N=20	Significance
Age y (SD)	7.4 (3.9)	7.0 (3.2)	0.67
Gender male n (%)	11/18 (61%)	8/20 (40%)	0.19
Pain scores median (range)	3 (0-10)	3 (0-10)	0.66
hydromorphone boluses 0 1+	11 7	11 9	0.38
PONV yes n (%)	0/18 (0%)	6/20 (30%)	0.021
Pruritus yes n (%)	1/18 (5.5%)	9/20 (45%)	0.009
Respiratory depression yes n (%)	1/18 (5.6%)	3/20 (15%)	0.6



S-268.**TRANSIENT BACK PAIN AFTER CAUDAL: SHOULD WE TALK ABOUT IT? AN OBSERVATIONAL STUDY PRELIMINARY RESULTS**

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Even though it has been reported in a significant number of obstetric patients, back pain post caudal and/or epidural injections has not been addressed in children. Preliminary results from our study show that back pain and/or discomfort are present in 5.1% and 1.1% children on POD 2 and POD 15 respectively.

BACKGROUND AND OBJECTIVES: Currently, in paediatric anaesthesia we have no evidence based information to provide parents regarding the incidence of back pain after neuraxial injections performed for post-operative analgesia. Even though it has been reported in a significant number of obstetric patients, back pain post caudal and/or epidural injections has not been addressed in children. The main objective of this study is to examine the incidence of back pain post epidural analgesia (early and late onset) in post-operative children. In addition, possible relationship with factors such as: age, gender, position during surgery, operator, gauge and needle used, and number of attempts is explored.

In this article, we provide preliminary results of our ongoing study.

METHOD: A prospective observational study design was used. Patients receiving caudal or epidural analgesia/anaesthesia were recruited in the Post Anaesthesia Care Unit (PACU). Patients (if older than 7 years of age) or parents were contacted on postoperative day 2 (POD 2) and postoperative day 15 (POD 15) to answer a questionnaire with a set of 7 items

RESULTS: In a sample of one hundred and twenty two children, back pain and/or discomfort incidence was 5.1% and 1.1% on POD 2 and POD 15 respectively. Bruising around the injection site on POD 2 was present in 3.1% participants.

CONCLUSIONS: Preliminary results showed that transient self limiting back pain and/or discomfort after caudal and/or epidural is present in paediatric patients. Although this research design encompasses certain limits, this is the first report of its kind. Patient recruitment is ongoing for completion of the study and we plan to expand our sample size to explore factors that may be associated to transient back pain/discomfort after caudal anaesthesia.

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S-269.**REVIEW OF THE ANESTHETIC MANAGEMENT OF THE HYBRID PROCEDURE FOR HYPOPLASTIC LEFT HEART SYNDROME (HLHS)**

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BACKGROUND: Despite the advances in the surgical techniques for the management of patients with Hypoplastic Left Heart Syndrome (HLHS), surgical outcome for the high risk group of patients remains suboptimal. The Hybrid Approach (bilateral pulmonary banding, PDA stent, balloon atrial septostomy), an emerging alternative for the management of HLHS, allows for a less invasive procedure, thereby shifting the risk of the major Norwood procedure to an older age. There is a paucity of literature discussing the anesthetic management of patients undergoing the Hybrid procedure; therefore, we are reporting our experience anesthetizing these anatomically unique patients.

METHODS: After institutional review board approval, we retrospectively reviewed the records of 77 patients who underwent the Hybrid procedure as neonates between July 2002 and August 2008. We reviewed both the anesthetic and intensive care records.

RESULTS: The Hybrid procedure was performed in 77 patients (31 female and 46 male). The average age of the patients was 11.8 days with an average weight of 2.98 kg. Seventeen patients arrived to the Hybrid suite already intubated; no attempts were made to extubate these patients. The main narcotic used was Fentanyl at an average dose of 5.7 mcg/kg. The average increase in the Systolic Blood Pressure (SBP) after placement of the right and left pulmonary artery bands was 15.11 mmHg. The average drop in the systemic saturation after placement of the bands was 9.09%. Twenty-one patients received blood transfusion (27.3%) at an average dose of 12.93 ml (4.3 ml/kg). Forty patients received albumin during the case (51.94%) at an average dose of 14.97 ml (5 ml/kg). Thirty-six patients were extubated at the end of the procedure (46.7%).

DISCUSSION: Certain concepts must be considered while caring for patients with HLHS undergoing the hybrid procedure. During the induction period, it is very important to maintain the balance between the pulmonary and systemic circulations (QP: QS). Ideally, these patients should be maintained on room air at all times. During the course of the procedure hemodynamic instabilities such as arrhythmias or ST segment changes can occur especially during placement of the left pulmonary artery band. In most cases, these hemodynamic changes will respond to volume resuscitation (5-10 ml/kg crystalloids). However, some patients may require albumin or blood transfusion. Occasionally, a small dose of Epinephrine (1-2 mcg/kg) may be needed. Tightening of the branch pulmonary artery bands typically results in an increase in the systolic pressure of 10 mmHg and a decrease in the systemic saturation by 10%. Placement of a cerebral saturation probe and a right radial arterial line may help monitor flow changes through the retrograde arch. Our anesthetic goal is to attempt to extubate these patients unless they had any major hemodynamic instability during the case that required interventions.

Variable	Average	Median
Weight (Kg)	2.98	3.1
Age (days)	11.8	7
Fentanyl Dose (mcg)	17.06	12.5
FIO2 (%)	21	21
Crystalloids (ml)	60.43	50
Albumin (ml)	14.97	10
PRBCs (ml)	12.93	0
Pre Band and Stent SBP (mmHg)	55.52	54.5
Pre Band and Stent DBP (mmHg)	26.78	27.5
Pre Band and Stent MAP (mmHg)	37.23	38
Pre Band and Stent Saturation (%)	91.71	92
Post Band and Stent SBP (mmHg)	70.63	70
Post Band and Stent DBP (mmHg)	31.54	30
Post Band and Stent MAP (mmHg)	45.72	44.5
Post Band and Stent Saturation (%)	82.63	84
Average ending hemoglobin (g/dL)	13.2	12.7
Post operative length of stay (days)	18.23	13

S-270.

ONE LUNG ANESTHESIA FOR INFANTS, A CASE SERIES

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INTRODUCTION: Single lung ventilation options to improve surgical field visualization are limited in infants. We report our experience using one lung ventilation on 11 infants less than 10 kg.

METHODS: Preoperatively, all patients were spontaneously breathing room air with oxygen saturations greater than 98. For left thoracotomy, the smallest Arndt bronchial blocker(5F) was first inserted well past the vocal cords and a half-sized smaller, uncuffed, ET tube was placed through the cords adjacent to the blocker. A 2.2 mm Olympus LFP bronchoscope was inserted through the ET tube to localize blocker placement. For right thoracotomy, a conventional, one-half sized smaller, cuffed, endotracheal tube was inserted then guided into the left mainstem bronchus with the 2.2 mm bronchoscope. Standard ASA monitors were used and if desaturation to 90 % occurred, lung isolation efforts stopped and standard, two lung, ventilation resumed temporarily. Ventilator settings were pressure controlled, 20-22/4 cmH₂O, rate 20-24 per minute, with an FIO₂ from 0.5-1.0. An arterial blood gas was drawn 15 minutes after turning to the lateral position.

RESULTS: Patients' ages ranged from 2 days old to 20 months and weighted from 2.5-9.9 kg. 7 patients had lung resections, 4 had Aortic CoA repair. Lung isolation was rated good to excellent in all cases, but required additional blocker manipulation in 5. Initial placement took 5-18 minutes.

Oxygenation was adequate with the lowest PO₂ being 78, and the average PO₂/FIO₂ ratio was 166. Ventilation was often suboptimal however, with 9 of 11 patients having a PCO₂ of 47 or greater(69 max). In addition, the inline capnography readings were highly variable relative to arterial PCO₂ levels. The average difference was 23 with a maximum of 38. All patients were successfully extubated within 12 hours of surgery and had an uneventful recovery.

DISCUSSION: We found that lung isolation is possible and safe in infants with a few caveats. Prior experience taught to avoid the right bronchus for isolation. The most efficient blocker-placement method was placing the blocker distally into the left bronchus with the patient supine and then "fine-tuning" the position of the blocker after turning to the lateral position. Oxygenation was adequate, but conventional ventilator settings frequently resulted in hypercarbia which may not detectable with capnography. Therefore, arterial line placement for blood gas analysis is recommended. Single-lung ventilation can be safely administered to infants if Arndt blockers, pediatric bronchoscopes, and expertise in their use are available. Gas exchange may not always be adequate and blockers can become displaced so careful monitoring is essential.

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Average , Range ABG Data

P02/FI02	PH	PO2	PCO2	ETC02	PCO2-ETC02
166	7.28	140	50	27	23
78-303	7.17-7.38	78-303	36-69	12-47	11-38

S-271.

INFANTS VS CHILDREN UNDERGOING EARLY EXTUBATION AFTER CONGENITAL HEART SURGERY

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INTRODUCTION: Extubation of children rapidly or within 6 hours after congenital heart operations (early extubation EE) is being increasingly reported ^{1,2}. Factors which may delay early extubation include younger age, high inotrope score and prolonged cardiopulmonary bypass (CPB) times ². No study has compared infants (up to 1 year of age) with children (> 1 year) who are eligible for fast tracking. We investigated the effect of several variables that could influence extubation outcome in these patients.

METHOD: Sixty one patients (25 infants, 36 children) were studied over a 15 month period. Inhalational anesthesia was supplemented with moderate dose fentanyl up to 15 mcg/kg and antifibrinolytic therapy was used. Dopamine and milrinone were commonly used for inotropic support by the end of surgery. Patients were extubated rapidly postoperatively or within 6 hours depending on recovery from anesthesia. The variables investigated included the presence of a syndrome, redo surgery, CPB and aortic cross clamp times, use of circulatory arrest, inotrope score and the incidence of reintubation post porocedure. Chi square and Fisher's exact tests with p < 0.05 for significance were used.

RESULTS Children (86%) were more likely to be extubated than infants (56%) soon after surgery (p = 0.016). However, with inclusion of those patients extubated later but within the 6 hour timeframe, no significant difference was seen in the EE occurrence between infants (74%) and children (91%) (p = 0.1412). Eighty five percent of all patients underwent EE. Redo patients did not differ from non-redo patients in EE occurrence (p > 0.05). Four EE patients (3 infants, 1 child) and 2 delayed extubation patients (1 infant, 1 child) were re-intubated because of late complications. EE occurrence was not different between syndrome and non-syndrome patients (p > 0.5). Prolonged CPB times (> 150 min) and aortic cross clamp times (> 80 min) were not significantly associated with a reduced likelihood of EE (p > 0.5). EE was achieved only in children with limited circulatory arrest (< 22 min). The overall use of circulatory arrest reduced the occurrence of EE (p < 0.05). The incidence of early extubation was not reduced at higher inotrope scores > 7 (p = 0.152).

CONCLUSION Fast track infants are less likely than children to undergo immediate extubation after heart surgery, but are equally suitable for extubation within 6 hours of the procedure. The use of milrinone raises the inotrope score³, but this is not associated with a reduced chance for early extubation. Prolonged bypass times do not influence EE eligibility if adequate hemostasis, cardiopulmonary function and recovery from anesthesia are present.

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S-272.

EPIDURAL FIBRIN GLUE PATCH FOR POST-DURAL PUNCTURE HEADACHE IN A FIVE-YEAR-OLD CHILD

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INTRODUCTION: Epidural autologous blood patches (aBP) are an established treatment for post dural puncture headache (PDPH) in adults and in children. Epidural injections of Dextran 40 or normal saline are described alternatives. Epidural injection of fibrin glue has been used after unsuccessful therapy with blood patches in adults. We describe the use of fibrin glue for treatment of PDPH in a child.

CASE REPORT: A five-year-old girl with acute lymphoblastic leukemia (ALL) experienced massive headache when sitting up approximately 20 hours after a diagnostic/therapeutic lumbar puncture (LP) with a 22g spinal needle with cutting-type point. The patient had suffered from mild headache after a LP once before, starting right after waking up from anesthesia, and disappearing by the next morning. This time the headache developed the morning after the LP. The headache was treated with bed rest, acetaminophen, and codeine copious oral fluids, including a caffeinated soda. After four days with persistent pain, a CT was done, which showed no anatomical explanation for the headache. On day six after LP the headache was still unchanged. The child's mother denied a request to use of an aBP because of the ALL. Instead, an epidural patch with fibrin glue was performed under general anesthesia. When the girl sat up the first time five hours later, the headache had disappeared. A subsequent LP with a 25g non-cutting needle three months later was uneventful.

DISCUSSION: ALL is widely listed as a contraindication for the epidural use of an autologous blood patch in cases of PDPH. (1) Although the risk might be thought of as hypothetical, the parent in our case denied the use of aBP. Fibrin glue has been successfully used in adults with PDPH who had been unsuccessfully treated with aBP. Whole blood, directed or pooled, would be an alternative, but is not available from our laboratory. The injection of Dextran 40 or normal saline was declined in our case because of the likely lower success rate compared to fibrin glue. In a study in rats, fibrin glue was shown to be as successful as aBP in the treatment of PDPH and more successful than epidural injection of Dextran 40 or normal saline. Fibrin glue seems to offer new possibilities for the treatment of PDPH in children and adults. The only limitation appears to be the risk of an allergic reaction or viral infection because fibrin glue is derived from human blood. More data are necessary concerning the long-term effects of the use of fibrin glue in the treatment of PDPH.

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Keywords:

Post dural puncture headache, Epidural patch, Fibrin glue

S-273.

EARLY AND LONG-TERM PROTECTION DURING SEVERE BRAIN ISCHEMIA IN A NOVEL NEONATAL MOUSE MODEL USING SEVOFLURANE

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INTRODUCTION: Brain injury in infants due to hypoxia-ischemia (HI) leads to life-long developmental impairment. Volatile anesthetics, when administered prior to HI, have demonstrated short-term protective effects in neonatal rodent models. Whether these short-term effects translate into long-term improvements, however, remains controversial. Volatile anesthetics have not been tested during brain HI in neonatal rodent models, because their administration was not survivable with spontaneous ventilation in the usual models (1) and the degree of ischemia was difficult to ascertain in these models. To address these problems, we directly measured brain oxygenation during HI and examined long-term neurocognitive function using a newly developed neonatal mouse model of brain HI utilizing mechanical ventilation, which allowed the administration of volatile anesthetics during HI.

METHODS: After IACUC approval, the right common carotid artery was ligated in 10 day-old mice during brief sevoflurane anesthesia, followed by a 2-hour recovery with the dam. Littermates were then randomized to either: HI) spontaneously breathing 10% oxygen for 60 minutes; Sevo-HI) orotracheally intubated and mechanically ventilated with 3.5% sevoflurane in 10% oxygen for 60 minutes; or Room Air) spontaneously breathing room air for 60 min. Cerebral oxygenation was monitored in the center of the at-risk brain region and the contralateral hemisphere during HI or Sevo-HI using visible-light spectroscopy (Spectros Corp.). Arterial blood gases were obtained after sixty minutes of HI, Sevo-HI, or Room Air. Right/left brain hemispheric weight ratios and brain damage scores were determined one week following HI, Sevo-HI, or Room Air. Learning and behavior was assessed nine weeks following HI, Sevo-HI, or Room Air, using spontaneous locomotion and Morris water maze (MWR). Groups were compared using appropriate statistical tests with posthoc analysis for multiple comparisons. Significance was accepted at $P < 0.05$.

RESULTS: During HI, ipsilateral and contralateral brain oxygenation, arterial blood gases, and glucose were similar in both groups. One week after HI, brain hemispheric weight ratios were significantly higher in Sevo-HI compared with HI, and similar to Room Air. Nine weeks after HI, MWR hidden platform escape latency and pathlength, measures of spatial memory function, were significantly better after Sevo-HI compared with HI.

DISCUSSION: In order to test the neuroprotective effects of volatile anesthetics, we developed a novel modification of the newborn rodent unilateral carotid ligation/hypoxia-ischemia model in neonatal mice (2). By employing mechanical ventilation and endotracheal intubation, sevoflurane administration during HI was survivable. Despite similar degrees of brain HI, as measured with visible-light spectroscopy, and similar metabolic derangements, as measured with blood gas analysis, sevoflurane administration during HI conferred short-term structural and long-term functional protection, compared with unanesthetized littermates. These findings warrant further mechanistic studies using this model in order to improve developmental outcome in infants following HI.

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S-274.

WITHDRAWN

S-275.

WHOLE LUNG LAVAGE UNDER CARDIO - PULMONARY BY - PASS FOR TREATMENT OF PULMONARY ALVEOLAR PROTEINOSIS - REPORT OF 9 CASES AT MASIH DANESHVARI MEDICAL CENTER AND REVIEW OF ITS RISKS AND BENEFITS

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INTRUDUCTION: Pulmonary alveolar proteinosis (PAP) is a rare pulmonary disorder in which abnormal accumulation of surfactant in alveoli causes respiratory signs and symptoms. PAP is rare in children and infants, but if the disease involve and progress it may cause sever respiratory problems, respiratory insufficiency and even death. There are some management modalities for treatment of PAP but it seems the only effective treatment is whole lung lavage (WLL) using one-lung ventilation which is technically difficult in small children. So despite its risks and hazards cardio-pulmonary by - pass is the alternative method of choice for treating PAP. In this article we reported 9 cases of PAP which treated mostly with WLL under CPB.

METHODS: During a 7 year period 9 patients with PAP managed by whole lung lavage. among them one case managed by conventional one lung ventilation and others managed under CPB.

RESULTS: severe Hypoxia was presented in about $\frac{1}{3}$ of patients during procedure. 8 patients had excellent early and late post lavage conditions and normal or near normal life style while in one case severe intra-op bleeding cause early mortality. no serious complications presented at 6 month follow up.

DISCUSSION:PAP is a rare pulmonary disorder. The most effective method of management for these patients is whole lung lavage under general anesthesia. Due to our experiences it seems WLL can be done safely using CPB in pediatric patients.

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Summary of result of WLL in 9 pediatric patients with PAP

No. of patients	9
Mortality	2
Complication During WLL	4
Long Term Complication	-
Long Term Complication	7
Cure	7

S-276.**EPIDEMIOLOGY OF POST-ANESTHETIC ADVERSE EVENTS IN THE PEDIATRIC PACU****AUTHORS:** A. Kakavouli¹, M. Carson², E. Silverstein², S. Ohkawa², L. Sun²;**AFFILIATION:** ¹Pediatric Anesthesia fellow, Columbia Presbyterian, New York, NY, ²Columbia Presbyterian, New York, NY.

INTRODUCTION, In a previous study (1) we found that higher ASA status or younger age are predictive risk factors for pediatric intra-anesthetic adverse events for surgical and non surgical procedures. In this study, we used our Post-Anesthesia Quality Analysis Questionnaires (QAs), to determine whether patient's age and ASA status are similarly predictive risk factors for the reported pediatric adverse events in the anesthetic recovery area (PACU).

METHODS, After Institutional Review Board approval, we included for analysis all Post-Anesthesia QAs of patients younger than 21 years from November 1st 2007 through May 30th 2008. Every patient's assigned PACU nurse reported, in the QA form, patient's ASA status, age and gender, occurrence and type of adverse event (AE). The types of AEs were categorized as: respiratory, cardiovascular, temperature related, pharmacological, Emergence Agitation Delirium (EAD), nausea/vomiting, trauma and others. We excluded patients who had any reported intra-anesthetic AE(s) or incomplete information. The observation period was from patient's first vital recording until discharge from the PACU. Data were analyzed using unpaired t-tests and chi-square or Fisher exact tests as appropriate; p<0.05 was considered significant.

RESULTS, 2711 patients were included for analysis. We excluded 106 patients due to incomplete information or age older than 21 years and 83 due to reported intra-anesthetic AE. 1710 patients came from operative areas and 1001 from non-operative areas. 25% of patients (n=676) had ASA status III or higher. 9.7% of patients (n=262) were infants. 61.9% (n=1678) of patients were male. The overall AE incidence was 6.4% and was the same for male and female patients. The average age of patients who had AE (92.8±68.7 months, average±SD) and those who hadn't AE (90.5±68.3 months, average±SD) was comparable. AE incidence in patients with ASA status III or higher (10.1%) was greater than those with ASA status I/II (5.2%, p<0.01). The most common types of AE were nausea/vomiting (2%), temperature related (1.9%) and EAD (1.3%). Patients with ASA status ≥ III had more EAD (2.4% versus 0.9%), cardiovascular (0.6% versus 0.01%), and temperature related (3.7% versus 1.3%) AEs compared to patients with ASA status I/II (for all, p<0.01).

DISCUSSION, ASA status was an important predictor for reported AEs in the PACU; with EAD, cardiovascular, or temperature related AEs occurring more often in patients with ASA status III or higher compared to patients with ASA status I/II. In contrast, nausea/vomiting or respiratory AE did not seem to be influenced by ASA status. This may be because we excluded patients with intra-anesthetic AEs. Unlike intra-anesthetic AE, we did not find age to correlate with the incidence of reported AEs in the PACU.

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Type of Adverse events, incidences	ASA status I/II n=2035	ASA status ≥ III, n=676	Total, n=2711
Respiratory, n=10	0.4%	0.3%	0.4%
Cardiovascular, n=5	0.0%	0.6% *	0.2%
Temperature related, n=51	1.3%	3.7% *	1.9%
Pharmacological, n=0	0.0%	0.0%	0.0%
EAD, n=35	0.9%	2.4% *	1.3%
Nausea/vomiting, n=54	2.0%	1.9%	2.0%
Trauma, n=9	0.3%	0.4%	0.3%
Others, n=9	0.2%	0.7%	0.3%
Total AEs, n=173	5.2%	10.1% *	6.4%

* p<0.01, for AE between ASA status I/II vs ASA status ≥ III

S-277.**INCIDENCE OF PERI-ANESTHETIC ADVERSE EVENTS IN CHILDREN WITH CONGENITAL CARDIAC DEFECTS UNDERGOING NON-CARDIAC PROCEDURES REQUIRING ANESTHESIA****AUTHORS:** R. P. Moore¹, A. Kakavouli², S. Ohkawa², R. T. Baker², M. Carson², L. Sun²;**AFFILIATION:** ¹Anesthesiology, New York Presbyterian - Columbia University, New York, NY, ²New York Presbyterian - Columbia University, New York, NY.

INTRODUCTION: Inpatients with a history of congenital heart disease (CHD) have been shown to have an increased risk for mortality following non-cardiac surgery (1). Therefore, CHD patients are presumed to be at high risk for morbidity and mortality for all non-cardiac procedures but limited data is available (2). The purpose of this study is to report the epidemiology of CHD patients undergoing non-cardiac procedures requiring anesthesia care at our institution.

METHODS: Following IRB approval, prospective data for all CHD patients undergoing non-cardiac procedures during September and October of 2008 were collected. Non-cardiac procedures were defined as procedures that did not involve direct surgical manipulation of the heart. Data pertaining to demographics, biometrics, medical history, anesthesia care, procedure type, and outcome were collected. Primary outcomes were all major adverse events occurring within 72 hours post-operatively. These events were death or end-organ dysfunction. Secondary outcomes were alterations in planned care.

RESULTS: During the study period, a total of 1565 patients received anesthesia care, and we collected detailed data on 94 CHD patients presenting for non-cardiac surgery who required anesthesia care. These CHD patients had diverse diagnoses, biometrics, and disease burdens and were equally divided between outpatients and inpatients. The most common non-surgical procedures (70/94) were performed in the Cardiac Catheterization Lab (Cath Lab) Demographic, biometric, historic and surgical data are presented in Table 1.

15/94 CHD patients (patients (15.96%) experienced adverse events in contrast to the overall rate of 4.2% based on institutional QA self-reporting. Additionally, AE rate in this patient group was 18.6% in the Cath Lab and 8.3% outside the Cath Lab. Of the thirteen Cath Lab events, nine involved perturbations of the cardiovascular or respiratory systems resulting in six patients requiring continued post-operative intervention, two patients requiring mechanical ventilation and two unplanned outpatient admissions.

Table 1.

Patients	(N)	94
ASA	1-2 3 4	18 66 10
Gender	Male Female	62 32
Age	Mean±SD (months)	53.7 ± 52.7
Weight	Mean±SD (kg)	16.87 ± 14.1
Initial RACHS-1	1-2 3-4 5-6	23 21 23
# cardiac medications	0 1-2 3 +	33 43 18
Procedure Site	Cath Lab OR MRI	70 10* 14
Anesthesia Duration	Mean±SD (min)	164.6 ± 67.8
Diagnosis	Single ventricle 33	HPLHS 10
	S/P OHT 20	DCM - 10, HPLHS- 4
	TOF - 11	
	ASD / VSD / AVC - 9	
	Aortic Stenosis - 5	
Admission Status	Outpatient Inpatient Admitted	49 17 26 (2 unplanned)

*= T+A, Orchiopexy, Optho eua, PEG, Nissen, Ladds, PPM, vp shunt, cns angiogram, vitrectomy, scleral buckle

DISCUSSION: During the study period, CHD patients with diverse diagnoses, demographics, and biometrics experienced a much higher incidence of adverse events compared to the overall pediatric group that had anesthesia care. Events were primarily cardiovascular (7) or pulmonary (4) and occurred with a greater frequency in the Cath Lab.

These data suggest CHD patients undergoing non- cardiac procedures with general anesthesia are at increased risk for adverse events, with the greatest risk in those whose procedures were in the Cath Lab. Additional data are needed to confirm and validate these results.

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S-278.

THE CUMULATIVE ANESTHETIC EXPOSURE SCORE (CAES)

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INTRODUCTION: Anesthetics have been administered to assist with surgical amnesia for over 150 years, yet little is known about their specific mechanism of action. While it has been presumed that the effects of such agents dissipate once they are metabolized and the patient regains consciousness, it is entirely possible that such agents cause subtle and lasting effects which have previously gone undetected. Recent evidence implicates commonly administered anesthetics as causing apoptotic neurodegeneration in rodents(1). Research involving human cell cultures has demonstrated that amyloid accumulation and apoptosis may result from isoflurane exposure and reports have described the onset of Alzheimer's disease following anesthesia (2, 3). Given the rapidly evolving literature exploring the association between general anesthesia and long-term cognitive function, we developed a scoring system in an attempt to objectively quantify a patient's cumulative anesthetic exposure (CAES).

METHODS: After IRB approval, a retrospective chart review was performed on children under the age of 24 months who underwent general anesthesia during the first quarter of calendar year 2008. A total of 213 charts were reviewed. Potentially neurotoxic pharmaceuticals include any anesthetic agent with activity at GABA or NMDA receptors such as; nitrous oxide, volatile anesthetics, barbiturates, benzodiazepines, ketamine and propofol. The cumulative anesthetic exposure score (CAES) score was calculated from the anesthetic records as follows; for inhalational and intravenous (infusion) agents, a score of 1 was assigned for every 30 minutes of anesthetic exposure (0.5 for < 29 minutes). A bolus of any intravenous agent was assigned a score of 0.5 while benzodiazepine premedication was assigned a score of 1. The final CAES was obtained by adding the scores of each separate agent (IV or inhalational). For example, a patient premedicated with midazolam (1) and then undergoing a 45 minute general anesthetic with sevoflurane (1.5) and nitrous oxide (1.5) who also received a single bolus of propofol (0.5) would have a CAES of 4.5.

RESULTS: The mean CAES scores of children undergoing subspecialty surgical procedures were as follows; 1.1, 1.6, 2.1 and 3.1 for otorhinolaryngology, ophthalmology, general surgery and urology, respectively. The scores ranged from 0.8 to 8.

DISCUSSION: The broad range of scores reflects the fact that anesthetic management is not uniform and is dictated by variables such as; surgical procedure, time duration, patient preference, physiologic response, etc. The CAES attempts to quantify the cumulative exposure to anesthetic agents, and accounts for the combined simultaneous exposure to multiple agents. It was designed to provide a meaningful way to communicate the total exposure for any given patient; further studies are required to substantiate the total exposure score with long-term cognitive outcomes.

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Pharmacology - Basic Science

S-279.

MODULATION OF PERCEPTION BY PROPOFOL IS ASSOCIATED WITH A REDUCTION IN STIMULUS-RELATED ACTIVITY IN THE PUTAMEN

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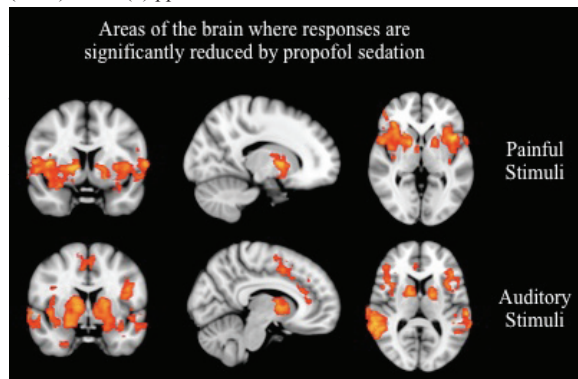
INTRODUCTION: While our understanding of anaesthetic activity at a molecular level has improved, much remains to be elucidated about anaesthetic modulation of central nervous system processing at a systems level. Functional magnetic resonance imaging (fMRI), which exploits the blood oxygenation level dependent (BOLD) signal contrast, may provide insights into modulation of network communications and help bridge the gap between anaesthetic actions at specific receptor sites and clinical and electro-encephalographic observations.

METHODS: We administered a target controlled infusion of propofol to eight healthy volunteers while presenting a paradigm of interleaved thermal pain (intensity 7/10) and auditory stimuli. fMRI data were acquired at three levels of propofol: a) baseline b) significant delay in motor task performance, and c) unresponsive to verbal stimulation. Target levels were established for each subject individually at a prior thresholding session. Auditory stimulation consisted of a list of 12 words, repeated three times. Recall was assessed by presenting the 12 words interspersed with 12 dummy words to yield a "Discrimination Index" (true positives - false positives) at each level. fMRI data was analyzed within the framework of the General Linear Model using FSL (FMRIB's Software Library), with regressors for each stimulus type and propofol level.

RESULTS Cerebral activation (as inferred from change in BOLD signal) in response to painful stimuli was unchanged by the lower infusion level. Deep sedation was associated with significantly reduced pain-related activation in the putamen and the insula bilaterally, while activation of the thalamus and primary somatosensory cortex was unchanged. Responses to auditory stimulation showed significant reductions, at both levels of sedation, in the putamen and auditory association cortex. The putamen showed significantly less activation with auditory stimuli in subjects with a larger decrease in DI across conditions.

DISCUSSION As expected we observed a reduction in activation in areas of the cortex associated with interpretation of noxious and auditory stimuli while activity in primary somatosensory and auditory cortices was preserved. While thalamocortical transmission persisted, responses in the putamen were significantly reduced. We propose two possible interpretations of this finding. Direct propofol modulation of putamen activation may *cause* failure of co-ordinated transmission to association and limbic regions or this failure may be a *consequence* of another mechanism of sedation.

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S-280.

MODELING THE EFFECTS OF MIDAZOLAM ON CORTICAL AND THALAMIC NEURONS

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INTRODUCTION: Controversy exists regarding the site where anesthetics act in the brain to produce sedation and unconsciousness. Actions in the cerebral cortex and thalamus are likely, although the relative importance of each site is unclear. Midazolam (MDZ) acts at the GABA_A receptor with phasic and tonic inhibition in the cortex but phasic inhibition in the thalamus. We used *in computo* modeling to investigate the sensitivity of cortical and thalamic neurons to MDZ at concentrations that produce unconsciousness. The model contains over 65,000 neurons which make over 4 million connections (1).

METHODS: The GABA_A receptor conductance of the model was manipulated to simulate the effects of MDZ at concentrations ranging from 8nM to 100nM; sleepiness to complete unconsciousness occurs in the 10nM to 40nM (free-drug) range (2). Prolongation of phasic inhibition was simulated by increasing the decay time constant and tonic inhibition was simulated by introducing a tonic current; the extent of phasic and tonic inhibition was appropriate for each simulated MDZ concentration. Phasic and tonic inhibition was simulated in cortex, but only phasic inhibition was simulated in thalamus. The computer generated data (cortical and thalamic neuronal firing rate) were analyzed using one way ANOVA. P<0.05 was considered statistically significant.

RESULTS: Simulation of MDZ effect decreased cortical neuronal firing rate (table 1). For example, the mean cortical neuronal firing rate decreased by 23% (P<0.001, N=9600) and 26% (P<0.001, N=9600) at MDZ concentrations of 22 nM and 40nM respectively. However, thalamic firing rate did not change.

CONCLUSION: *In computo* modeling of the thalamocortical system indicates that MDZ-induced GABAergic inhibition of cortical neurons plays a significant role in the transition from waking to unconsciousness. Although MDZ produces phasic inhibition in the thalamus, computer simulation suggests it is not significant enough to decrease thalamic neuronal firing. Thus, based on *in computo* modeling, MDZ at sedative concentrations (10-40nM) produces its effects by decreasing cortical neuronal firing.

Table 1: Simulation of MDZ (nM, free-drug concentration) effects on cortical and thalamic firing rate (Hz)

	Awake	MDZ 8	MDZ 22	MDZ 40	MDZ 100
Cortex	9.1±7.8*	7.7±7.3*	7.0±7.0*	6.7±6.9*	6.4±6.8*
Thalamus	8.1±10.0	8.4±10.4	8.4±10.4	8.5±10.5	8.5±10.4

Mean, SD. N=9600 for cortex and N=3200 for thalamus. *p<0.001 compared to all other cortical firing rates.

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S-281.

TETRACAINE INHIBITS ACID SENSING ION CHANNEL CURRENTS IN CULTURED MOUSE CORTICAL NEURONS

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INTRODUCTION: The primary action of local anesthetics is to block sodium channel. However, it has been shown that they have multiple pharmacological effects on other ion channels in central nerve system. Acid-sensing ion channels are proton-gated cation channels activated by protons, resulting in sodium and calcium influx. ASICs have been implicated in various physiological/pathological processes including learning/memory and acidosis mediated neuron injury (1). Our previous studies showed that lidocaine significantly inhibits the ASIC currents in cultured mouse cortical neurons (2). Here, we show that tetracaine has similar inhibition on ASIC currents in cultured mouse cortical neurons.

METHODS: Primary culture of mouse cortical neurons was obtained from E16 Swiss Mice. Whole-cell patch-clamp and fast perfusion techniques were employed to record the ASIC currents induced by pH drops from 7.4 to 6.0, 6.5, and 6.9. Fast perfusion was achieved with a multibarrel perfusion system. ASIC currents were recorded with Axopatch-200B amplifier and pClamp 8.2 software. Statistical significance is defined as $p < 0.05$, by paired t test.

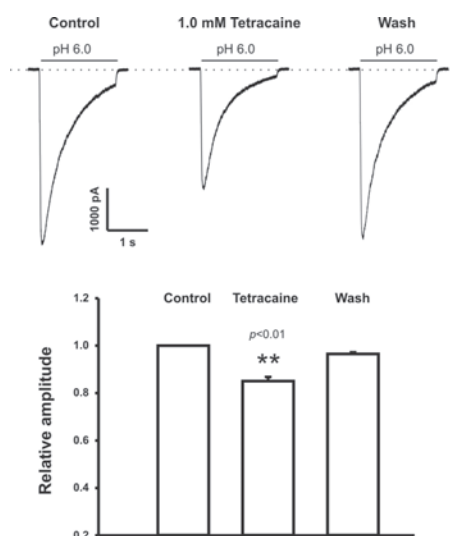
RESULTS: Lowering the extracellular pH to 6.9, 6.5, or 6.0 results in an inward ASIC current in cultured mouse cortical neurons. Bath application of tetracaine (1 mM), for 2-5 min significantly inhibited the amplitude of the ASIC currents by ~20 % (Figure 1) at pH 6.9 (A, B), 6.5 (C, D), and 6.0 (E, F). $n = 3-5$.

Figure 1. Inhibition of the ASIC current by tetracaine. $n = 5$, $p < 0.01$.

DISCUSSION: It has been shown that ASICs can be modulated by various endogenous and pharmacological agents (3). ASICs may be a novel target for pain transmission, neurodegenerative diseases, and acidosis mediated neuronal injury. Our result shows that tetracaine inhibits the ASIC currents in cultured mouse cortical neurons, which represents a new pharmacological effect of tetracaine in the central nerve system.

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S-282.

ISOFLURANE INDUCES A POSTCONDITIONING EFFECT ON BOVINE PULMONARY ARTERIAL ENDOTHELIAL CELLS EXPOSED TO OXYGEN-GLUCOSE DEPRIVATION

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Application of volatile anesthetics during the onset of reperfusion reduced ischemia-induced cardiac and brain injury and is called anesthetic postconditioning. This study was designed to evaluate whether volatile anesthetics induced a postconditioning effect in endothelial cells. Bovine pulmonary arterial endothelial cell (BPAEC) cultures were exposed to or not exposed to oxygen-glucose deprivation (OGD), a condition to simulate OGD *in vitro*, for 3 hr. The volatile anesthetics isoflurane or desflurane were applied during the early phase of simulated reperfusion. Cell injury was quantified by lactate dehydrogenase (LDH) release and flow cytometrical measurement after annexin V and propidium iodide staining. OGD and the subsequent simulated reperfusion increased LDH release and annexin V-positive staining cells, a characteristic of cell apoptosis. Posttreatment with isoflurane, but not desflurane, reduced this cell injury. This protection was apparent even when 2% isoflurane was applied at 60 min after the onset of reperfusion. The isoflurane postconditioning effect was abolished by glybenclamide, a general ATP sensitive K^+ (K_{ATP}) channel blocker, 5-hydroxydecanoate, a mitochondrial K_{ATP} channel blocker, and chelerythrine, a protein kinase C inhibitor. Diazoxide, a mitochondrial K_{ATP} channel activator, applied at the onset of reperfusion also decreased OGD-induced endothelial cell injury. This diazoxide-induced protection was abolished by chelerythrine and 5-hydroxydecanoate. We conclude that isoflurane, but not desflurane, induced a postconditioning effect in BPAEC. The effective time window of isoflurane postconditioning was from 0 to 60 min after the onset of reperfusion. This isoflurane postconditioning effect may be mediated by mitochondrial K_{ATP} channels and PKC. PKC may be downstream of mitochondrial K_{ATP} channels for this isoflurane effect.

S-283.

MODULATION OF VOLTAGE DEPENDENT N-TYPE CA₂⁺ CURRENTS BY VOLATILE ANESTHETICS IN RAT DORSAL ROOT GANGLION NEURONS

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INTRODUCTION: Due to their role in neuronal excitability and synaptic transmission, voltage-dependent Ca₂⁺ channels (VDCC) are important targets for volatile anesthetic (VA) action. Isoflurane has been shown to inhibit N type Ba₂⁺ currents in SH-SY5Y cells. G-protein activation strongly decreased its potency in inhibiting these currents. Conversely, isoflurane decreased the G-protein voltage-dependent modulation of N-type Ba₂⁺ currents(1). We investigated the presence of similar phenomenon in dorsal root ganglion (DRG) neurons.

MATERIALS AND METHODS: Primary cultures of adult rat DRG sensory neurons from cervical and thoracic regions were isolated from adult Sprague-Dawley rats. Cells were plated on glass coverslips and used 48-72 hours later for electrophysiology. A two-electrode whole cell perforated patch voltage clamp was used. Ag/AgCl electrodes were placed in direct contact with both the bath and pipette aqueous solutions. Output from the voltage clamp amplifier was sent to a microcomputer data acquisition interface. Data acquisition and analysis are performed using PClamp8 and Graphpad Prism4 as described before (1). Pipettes were pulled from borosilicate glass, fire polished and those with resistances 1-4 MΩ were used. For whole cell recordings the membrane capacitance and series resistance were compensated by about 80-90%, and the background resistance subtracted. Bath and pipette solutions used Ca₂⁺ as the permeant ion. For all experimental buffers, a solution saturated with isoflurane (>8 hrs under stirring in closed glass vials) was used with final concentration of Isoflurane being 0.6 mM. For making perforated patches β-Escin was used in pipette solution at concentration of 50 microM. Sodium, potassium and other Ca₂⁺ channels were blocked with appropriate blocking agents. γGTP was used at 120 μM inside the pipette solution to assess its interaction with Isoflurane inhibition of N type Ca₂⁺ currents. The conditions for obtaining N-type Ca₂⁺ currents in DRG neurons using perforated whole cell patch configuration were optimized and standardized.

RESULTS: N type Ca₂⁺ currents were obtained in multiple cells and their inhibition with Isoflurane was studied. Isoflurane at 0.6 mM showed a mean 53% inhibition of N type Ca₂⁺ currents. γGTP added to the pipette solution reduced the inhibition of Isoflurane to 8%. The baseline Ca₂⁺ currents were observed to be inhibited by γGTP.

CONCLUSION: The inhibition of N-type Ca₂⁺ currents with Isoflurane in the dorsal root ganglion cells was demonstrated. The addition of γGTP markedly reduced Isoflurane inhibition of N-type Ca₂⁺ currents. As expected the addition of γGTP inhibited the magnitude of baseline Ca₂⁺ currents.

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S-284.

GENERAL ANESTHETIC-INDUCED CENTRAL RESPIRATORY DEPRESSION: MECHANISMS AND ALCOHOL DEPENDENCE

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INTRODUCTION: Respiratory depression during anesthesia is a major concern and can be life threatening. The GABA_A receptors (GABA_ARs) in the central nervous systems (CNS) are major molecular targets of general anesthetics. GABA_ARs are also targets of alcohol; alcohol tolerance can produce cross-tolerance to anesthetics that act on GABA_ARs. How alcohol dependence affects central control of respiration during anesthesia is poorly understood. We study: 1) anatomical sites in CNS the general anesthetics act upon to produce central respiratory depression; 2) the molecular targets and cellular mechanisms underlying general anesthetic-induced depression of ventilatory drive; 3) how alcohol dependence affects central respiratory control during anesthesia.

METHODS: We generated alcohol dependent rats by chronic intermittent ethanol (CIE) treatment. We measured Loss of Righting Reflex (LORR) as an index of anesthesia and measured respiratory pattern in a whole-body plethysmograph *in vivo*. Using a medullary slice preparation from neonatal rat that contains the preBötzinger Complex (preBötC, the brain site that generates respiratory rhythm in mammals), we recorded respiratory-related rhythm from the hypoglossal nerve (XIIIn) and whole-cell patch-clamped preBötC neurons.

RESULTS: Application of propofol in clinically relevant concentrations induced an outward current in inspiratory neurons and decreased their excitability. It decreased the frequency of the respiratory rhythm recorded from the XIIIn, and eventually abolishing it. These effects were reversed by the GABA_A receptor antagonist bicuculline but not by the glycine receptor antagonist strychnine. Unilateral microinjection of propofol into the preBötC decreased respiratory frequency. Microinjection of propofol into ipsilateral hypoglossal nucleus decreased the amplitude but not the frequency of XIIIn rhythmic activity. Local pressure puff of GABA or glycine onto preBötC inspiratory neurons induced an outward current associated with an increase in membrane conductance. Bath application of 5 μM propofol enhanced both the GABA- and glycine-induced currents. Higher doses of etomidate (13mg/Kg) was required to induce similar duration of LORR in CIE rats compared to control rats (10mg/Kg) while no difference in dose of propofol (100mg/Kg) is required to induce similar duration of LORR. Etomidate in higher dose induced similar respiratory depression in CIE rats as in control rats. In contrast, equivalent doses of propofol induced more profound respiratory depression in chronic alcohol dependent rats.

DISCUSSION: These results suggest that 1) General anesthetics act on the preBötC and decrease the excitability of inspiratory neurons resulting in depression of respiratory rhythm. 2) The molecular targets of propofol are GABA_A and glycine receptors. GABA_ARs play a predominant role in respiratory depression. 3) Propofol also inhibits the hypoglossal nucleus which innervates the tongue muscles regulating the upper airway patency. 4) Alcohol tolerance can produce cross-tolerance to etomidate but not to propofol. 5) In contrast, alcohol tolerance can sensitize/up regulate the inhibitory response of respiratory control center to propofol.

S-285.

PHOSPHORYLATION OF ADENINE NUCLEOTIDE TRANSPORTER-1 (ANT1) AT RESIDUE TYR194 CRITICALLY REGULATES ANT FUNCTION AND IS MEDIATED BY SRC TYR-KINASE: IMPLICATIONS FOR CELLULAR RESPIRATION AND MITOCHONDRIAL PROTECTION

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INTRODUCTION: We have recently shown that reversible phosphorylation of mitochondrial proteins is essential in the regulation of respiratory function and energy metabolism [1]. We investigated the profiles of phosphorylated proteins in Wistar rat heart mitochondria protected by pharmacological pre- and postconditioning elicited by the volatile anesthetic isoflurane. Sixty-one spots were detected by two-dimensional blue-native gel electrophoresis coupled Western blotting using a phospho-Ser/Thr/Tyr-specific antibody, and 45 of these spots were identified by matrix-assisted laser desorption/ionization-time of flight mass spectrometry. Eleven protein spots related to oxidative phosphorylation, energy metabolism, chaperone, and carrier functions exhibited significant changes in their phosphorylation state when protected mitochondria were compared with unprotected. Twenty-six potential phosphorylation sites were identified in 19 proteins. Among these, a novel phosphorylation site was detected in adenine nucleotide translocator-1 (ANT1) at residue Tyr194. Changes in ANT1 phosphorylation between protected and unprotected mitochondria were confirmed by immunoprecipitation. The biological significance of ANT1 phosphorylation at Tyr194 was further tested with site-directed mutagenesis in yeast. Substitution of Tyr194 with phenylalanine (F), mimicking the non-phosphorylated state, resulted in the inhibition of yeast growth on non-fermentable carbon sources, implying a critical role of phosphorylation at this residue in regulating ANT1 function. Further experiments were performed to identify upstream kinases responsible for ANT1 phosphorylation at Tyr194 and to explore the effects of this phosphorylation on ADP/ATP transporter activity.

METHODS: Using recombinant DNA techniques glutathione S-transferase (GST)-tagged human ANT1 and hemagglutinin (HA)-tagged Src kinase (WT-Src) were expressed in HeLa cells. Immunoprecipitated proteins were used for in vitro phosphorylation assays. Expression of constitutively active (CA-Src) and kinase-dead (KD-Src) kinase constructs served as controls. Phosphorylation of ANT1 at Tyr194 was detected with a custom designed antibody. ANT1 transporter activity was determined in yeast W303-1B expressing yeast ANT isoforms, JL-1-3 (ANT-deficient yeast), JL-1-3 transformed with chimeric N-terminal yeast-human ANT1, and JL-1-3 transformed with Y194F-mutated chimeric N-terminal yeast-human ANT1 by measuring uptake of ¹⁴C-labelled ADP into yeast mitochondria.

RESULTS: Phosphorylation assays show that ANT1 is specifically phosphorylated by CA-Src and WT-Src but not KD-Src at residue Tyr194. ANT translocator function was completely abolished in Y194F-mutant yeast, mimicking the dephosphorylated state of ANT1.

Conclusions: Phosphorylation of ANT1 at residue Tyr194 is mediated by Src Tyr-kinase and critically regulates ANT function.

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S-286.

HYPOTHALAMIC KNOCKOUT OF LEPTIN RECEPTOR IN A MURINE MODEL LEADS TO EARLY OBESITY AND DIABETES

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INTRODUCTION: The obesity epidemic has significant implications for the perioperative care of patients due to its impact on numerous co-morbid conditions including obstructive sleep apnea, pulmonary hypertension, diabetes and heart disease. With the discovery of the leptin/leptin receptor system, neuronal control of weight homeostasis has come to be seen as a lynchpin of metabolic disarray and as a site for potential therapeutic intervention. Since the initial characterization of the metabolic dysfunction seen in leptin receptor knockout mice and leptin peptide knockout mice (db/db and ob/ob, respectively), scientists have aimed to determine which neuronal cell types or anatomical cell groups are responsible for specific obesity-related phenotypic outcomes. Ablation studies initially implicated the ventral medial hypothalamus (VMH) as a critical component of the neuronal network regulating body weight, adiposity, and glucose/insulin homeostasis. However, disruption of leptin signaling in subsets of VMH neurons have failed to closely recapitulate the db/db or ob/ob phenotypes of massive obesity and overt diabetes under chow-fed conditions.¹ To address whether the mechanism responsible for these relatively mild phenotypes resides in other hypothalamic neurons, we generated mice that lack most leptin signaling in the hypothalamus and evaluated obesity-related measures.

METHODS: We crossed mice expressing Cre recombinase under the control of the Nkx2.1 promoter to mice homozygous for a floxed mutant allele of the leptin receptor. The resultant double transgenic offspring, *Lepr^{HypKO}*, express a non-functional leptin receptor in cells that have ever expressed the *Nkx2.1* gene. These cell types include most of the hypothalamus.²

RESULTS: By 4 weeks on a chow diet, *Lepr^{HypKO}* were significantly heavier than control animals and had higher random-fed blood glucoses. By 8 weeks of age *Lepr^{HypKO}* animals were about twice the weight of controls. NMR imaging at five weeks revealed a 5- to 8-fold increase in fat mass of *Lepr^{HypKO}* with little difference in lean body mass between groups. Fat mass differences became more exaggerated between groups at 8 and 12 weeks. Insulin levels were elevated in *Lepr^{HypKO}* in both fasted and random fed states and glucose tolerance tests were impaired in *Lepr^{HypKO}* animals at 9 weeks. *Lepr^{HypKO}* animals tended to be longer than controls.

DISCUSSION: Genetic deletion of the leptin receptor from much of the hypothalamus reproduces ob/ob and db/db phenotypes with regards to weight, adiposity and glucose/insulin homeostasis but not with regards to linear growth. These results confirm the hypothalamus as a mediator of adiposity and will allow us to begin identifying hypothalamic neuronal cell subtypes responsible for distinct aspects of the db/db and ob/ob phenotypes. Isolating neuronal cell subtypes responsible for obesity could lead to novel therapeutic interventions for this widespread and potentially devastating disease.

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S-287.

ISOFLURANE BUT NOT THE NON-IMMOBILIZERS F6 AND F8 INHIBIT L OR N-TYPE CALCIUM CURRENTS ON NEUROBLASTOMA CELLS

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INTRODUCTION: Since the volatile anesthetic (VA)-mediated enhancement of the inhibitory neurotransmission alone does not account for VA-induced immobility [1], VAs may produce immobility through depression of the excitatory neurotransmission. Neurotransmission is essentially started by the calcium entry via neuronal calcium channels [2,3]. Voltage-dependent calcium channels (VDCC), therefore play a main role in the calcium entry and they could be targets for VAs [4]. Moreover, VDCC are sensitive to the action of several VA [4]. However, it is not known whether any of them could contribute to the VA-induced immobility. Previously it was found that in the human neuroblastoma SH-SY5Y cells the depolarization-evoked transient increase in cytoplasmic Ca^{2+} ($[Ca^{2+}]_{cyt}$) was inhibited by isoflurane (ISO) but not by non-immobilizers (NIMs). In these cells the depolarization-evoked $[Ca^{2+}]_{cyt}$ transient is triggered by opening of VDCC of the L- and N-type, and blocking of these channels results in a > 98% decrease in the KCl-evoked transient increase in $[Ca^{2+}]_{cyt}$ [5]. Therefore, we predicted that NIMs should not be affecting the L- and N-type currents in these cells. We tested this prediction by measuring N-type and L-type currents and comparing the effects of ISO and NIMs.

METHODS: Whole cell N-type calcium and single channel L-type calcium currents from differentiated SH-SY5Y cells were recorded in the presence of ISO (0.6 mM) or two structurally related NIMs, F6 (1,2-dichlorohexafluorocyclobutane) (35.6 μ M) and F8 (2,3-dichlorooctafluorobutane) (17.6 μ M). Current-voltage relationships were obtained before, during, and after application of ISO, F6 or F8. We compared the effects of ISO and NIMs on the magnitude of VDCC currents.

RESULTS: N-type calcium currents were inhibited by ISO but not by F6 or F8. We also found that the magnitude of L-type calcium current was decreased by ISO but not by F6 or F8 and that F6 enhanced the L-type calcium current magnitude.

DISCUSSION: Our results indicate that the ISO-mediated reduction of N- and L-type currents could contribute to the immobilizing action of ISO. Previously it was shown that ISO inhibits the K⁺-evoked $[Ca^{2+}]_{cyt}$ transients in SH-SY5Y cells [6]. We propose that the ISO-mediated reduction on the depolarization-evoked $[Ca^{2+}]_{cyt}$ transient in part results from the VA-mediated inhibition of L- and N-type Ca^{2+} channels. These effects could contribute to the mechanisms involved in the immobility action of ISO. Our current data support the idea that VDCC might be important targets involving the VA-induced immobility. We are currently extending these studies to spinal cord neurons, since the spinal cord has been identified as the major site at which VAs induce immobility.

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S-288.

LEARNING, NEUROGENESIS AND GENE EXPRESSION AFTER INHALED AND INTRAVENOUS ANESTHESIA, A SYSTEMATIC STUDY

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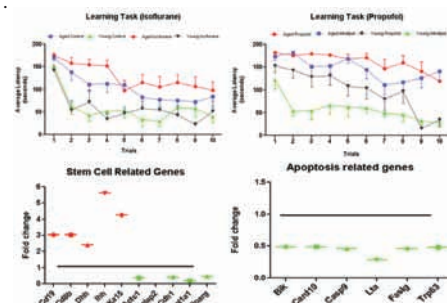
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OBJECTIVE: Postoperative Cognitive Dysfunction (POCD) has been used to describe mental changes in learning, attention and memory that occur in some patients after anesthesia and surgery. Whether its occurrence is a result of the effects of surgery, anesthesia, or a synergy between the two, still not well understood. Recent research has demonstrated that new neuronal cells are produced in the adult hippocampus, a process known as neurogenesis. Ongoing neurogenesis plays a role in cognitive processes such as learning and memory. New neuron production is suppressed by factors such as increasing age, alpha- amino butyric acid receptor activity and stress, among others. Similarities between these effects and those of anesthetics suggest that anesthetics may alter new cell production, and raise the possibility that POCD may result from anesthetic-induced alteration of adult neurogenesis. To test this hypothesis, we investigated the effects of isoflurane and propofol anesthesia on learning, hippocampal cell proliferation and mRNA expression in young and aged rats.

METHODS: Young and aged rats were anesthetized for 3 hours with 1.5% isoflurane or 35mg/kg/hr propofol. Additional young and old rats exposed to room air or propofol vehicle served as controls. After isoflurane or propofol anesthesia all groups received a 50 mg/ Kg IP injection of BrdU to assess neurogenesis. A novel appetitive olfactory learning test was used to assess learning and memory two days after anesthesia. After 7 days, rats were euthanized; the brains removed and divided midsagittally. The hippocampus from one hemisphere was removed and stored at -80°C for later determination of RNA expression using PCR Arrays, which profile the expression of stem cell and apoptosis related genes. The other half of the brain was used for BrdU Immunohistochemistry and BrdU+ cell were counted using unbiased stereology. Learning data were analyzed using two-way ANOVA for repeated measures and BrdU data was analyzed using unpaired t-test.

RESULTS: Learning in aged isoflurane anesthetized rats was impaired compared with controls (p=0.0463), but new cell production was not affected. Learning in young isoflurane anesthetized rats compared with controls did not achieved significance, but new cell production was decreased (p= 0.0171). In aged propofol anesthetized rats learning and new cell production were not affected by the anesthetic exposure. Young propofol anesthetized rats showed impaired learning (p=0.0157) as well as significantly decrease in the number of new cell production (p=0.0128) indicating an anesthetic-specific effect. In addition, PCR array results showed both up and down-regulation of genes involved in stem cell regulation and down-regulation of genes involved in apoptosis a week after anesthesia exposure.

CONCLUSION: Although these data are preliminary, they suggest that the effects of anesthetics in the brain persist longer than thought at the molecular, cellular and neuronal systemic level.



S-289.**EFFECTS OF ISOFLURANE ON THE EXPRESSION OF NMDA RECEPTOR SUBTYPE NR2B IN DEVELOPING RAT BRAIN****AUTHORS:** Y. Luo¹, Q. Xue², L. Chen², B. Yu²;**AFFILIATION:** ¹Anesthesiology, Shanghai Jiaotong University School of Medicine, Shanghai, China, ²Shanghai Jiaotong University School of Medicine, Shanghai, China.**OBJECTIVE:** To evaluate the effect of isoflurane on cultured cortex cell viability in different days in vitro (DIV), also the expression of NMDA receptor subtype NR2B. To find out the basic background of the drug safety in neonatal.**METHODS:** Primary cultured rat cortical neurons were established from the 18-day-old embryos of SD rats. Isoflurane 2% was blow for 6 hours in the following days 2DIV, 5DIV, 7DIV; with or without NR2B antagonist - Ifenprodil in varied concentration. LDH and MTT were measured for the viability of those cells. β tubulin-III staining for the dendrites' length and number. NR2B staining was detected to find the different expression of NR2B in those varied developing stage.**RESULTS:** After isoflurane 2% for 6hs, cortex neurons viability increased in MTT assay, especially on 5DIV. The length and the number of dendrites were also increased during the same period. For those Ifenprodil 100 μ M was added into the medium before isoflurane, 5DIV cortex neurons' MTT value was upgraded significantly. Ifenprodil 50 μ M with isoflurane made the length and number of dendrites decreased. The expression of NR2B degraded by 50 μ M ifenprodil.**CONCLUSIONS:** Isoflurane elevated the viability of cortex neurons in the early culture stages. The neuron dendrites grew faster and the numbers was also increased, especially in early culture stage. The development of neuron was more rely on the NMDA receptor subtype NR2B, while the effect of isoflurane on the neuron viability may not by the same signal pathway.**REFERENCE:** 1. Linda Klimaviciusa, Dzhamilja Safiulina et al. The effects of glutamate receptor antagonists on cerebellar granule cell survival and development. *NeuroToxicology*, 2008, 29(1), 101-108
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Table1. Isoflurane and Ifenprodil effects on processes' length of cortical neurons at different DIV

GROUP	2DIV	5DIV	7DIV
NAIVE	84.8 \pm 8.24 [#]	228 \pm 24.3	194 \pm 17.3 [#]
ISOFLURANE	171 \pm 17.1 [*]	374 \pm 74.4	367 \pm 42.5 [*]
ISO+IFEN50	113 \pm 1.16 [#]	270 \pm 25.2	284 \pm 39.1

The data are mean \pm S_E

*P<0.05 versus naïve group

P<0.05 versus isoflurane group

Table 2. Isoflurane and Ifenprodil effects on processes' number of cortical neurons at different DIV

GROUP	2DIV	5DIV	7DIV
NAIVE	1.67 \pm 0.203 [#]	2.43 \pm 0.319 [#]	2.12 \pm 0.237
ISOFLURANE	2.32 \pm 0.183 [*]	4.12 \pm 0.352 [*]	2.58 \pm 0.229
ISO+IFEN50	1.87 \pm 0.127	1.88 \pm 0.127 [#]	1.76 \pm 0.422

The data are mean \pm S_E

*P<0.05 versus naïve group

P<0.05 versus isoflurane group

Table3. Isoflurane and Ifenprodil effects on NR2B expression of cortical cells at different DIV

GROUP	GREY DENSITY
2DIV	NAIVE
	0.922 \pm 0.015 [#]
	ISOFLURANE
5DIV	ISO+IFEN50
	0.868 \pm 0.149 [#]
	0.868 \pm 0.0484
7DIV	NAIVE
	0.821 \pm 0.0105
	ISO+IFEN50
	0.678 \pm 0.0133 [#]
	0.982 \pm 0.0440
	1.06 \pm 0.0171
	0.797 \pm 0.0413 [#]

The data are mean \pm S_E

*P<0.05 versus naïve group

P<0.05 versus isoflurane group

Fig 1 Isoflurane and Ifenprodil effects on LDH & MTT assay of cortical cells at different DIV

*P<0.05vs NAIVE;# P<0.05vs ISOFLURANE,

Fig2. Isoflurane and Ifenprodil effects on NR2B possitive Density of cortical cells at different DIV

*P<0.05vs NAIVE;# P<0.05vs ISOFLURANE,

Fig 3 Fluorescence microscopy images of cortical neurons labeled with β -tubulin(Green) under the effect of Isoflurane and Ifenprodil at different DIV

S-290.

**ISOFLURANE AGGRAVATES THE DECREASES OF
NACHRS SUBTYPE ALPHA7 EXPRESSION IN RATS
CEREBRAL AND HIPPOCAMPAL NEURONS INDUCED
BY A β 25-35**

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BACKGROUNDS: Isoflurane has been reported to induce A β oligomerization and speculated to enhance the cognitive dysfunction in Alzheimer's disease^[1]. Nicotinic acetylcholine receptors (nAChRs) subtype α 7 located in the CNS plays an important role in the cognitive modulations in Alzheimer's disease, and participate in the mechanisms of isoflurane anesthesia^[2], while its functions can also be inhibited by the neurotoxicities of A β . The understandings of isoflurane's effects on the neurotoxicity of A β and its influence in the α 7 receptors expressions in neurons can reveal the exact actions of isoflurane on Alzheimer's disease, but, they are still unknown.

METHODS: The neurotoxicity model of A β 25-35 (25 μ M applied for 24h) was established on the primary cultured rats cortical and hippocampal neurons. Isoflurane was applied at 2% for 6h as the long-term treatment. Neuronal viabilities were indicated by MTT assessment and the LDH releases levels, α 7 receptor expression and neuroapoptosis indicated by the caspase-3 fragment were measured by the both immunocytochemistry and western blot methods.

RESULTS: A β 25-35 25 μ M applied for 24h produces significant neurotoxicity on cultured rats cortical and hippocampal neurons. Isoflurane treatment has no effect on the viabilities of normal cultured and A β 25-35 injured rats neurons. Isoflurane aggravates the decreases of α 7 expression induced by A β 25-35, while it has no effect on rats cortical and hippocampal neuron-apoptosis both under normal cultured and A β injured conditions.

CONCLUSIONS: Isoflurane aggravates the decreases of nAChRs subtype α 7 expression in rats cortical and hippocampal neurons induced by A β 25-35 injuries, but has no effects on the viabilities and apoptosis of these cultured rats neurons.

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S-291.**THE VARIANT CONTRIBUTION OF HISTAMINE TO THE HEMODYNAMIC EFFECTS OF CW002, A CYSTEINE-REVERSIBLE NEUROMUSCULAR BLOCKING DRUG**

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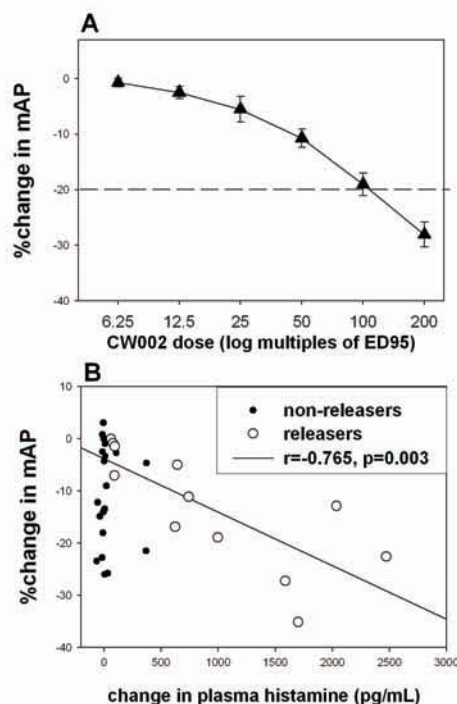
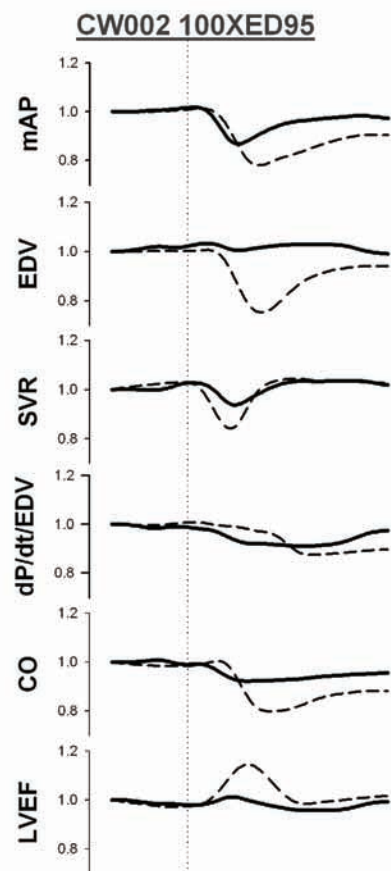
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The unique pharmacology of gantacurium, a non-depolarizing neuromuscular blocking drug that is rapidly inactivated by endogenous cysteine, has led to the formulation of related intermediate-duration compounds that can be immediately reversed by intravenous injection of cysteine. One such compound is CW002, a non-halogenated, symmetrical benzyloquinolinium fumarate diester. Both gantacurium and CW002 can reduce blood pressure when administered in doses exceeding 25 times the ED₉₅. However, while the hemodynamic effects of gantacurium can be directly linked to dose-related histamine release, this does not appear to be true for CW002. The present study was designed to test the hypothesis that CW002 has direct cardiovascular effects that are augmented when histamine is also released.

METHODS. Six anesthetized beagles received incrementally larger doses of CW002 starting with 6.25XED₉₅ and doubling the dose at 15 minute intervals up to 200XED₉₅. Before and 1 minute after injection, blood was obtained for analysis of plasma histamine; animals with increases ≥ 400 pg/mL following any dose of CW002 were regarded as "releasers". Mean arterial pressure (mAP), cardiac output (CO), and left ventricular pressure (LVP) and volume were recorded. From these data, systemic vascular resistance (SVR) was calculated, LV contractility indexed from pressure and volume data as dP/dt/end diastolic volume (EDV), and LV ejection fraction (LVEF) derived. Changes from pre-dose baseline of $\geq 20\%$ for hemodynamic variables were regarded as a clinically significant response with statistical significance for changes in mAP and plasma histamine determined by repeated measures analysis of variance.

RESULTS. CW002 produced a dose-related decline in mAP that was $\geq 20\%$ at 200XED₉₅ (figure 1A). However, only 2 animals were histamine releasers at any dose. Figure 1B depicts the relationship between changes in mAP and plasma histamine for all CW002 doses. When data from all dogs are considered, there is no correlation ($p=0.62$). In contrast, there is significant mAP-histamine change correlation for releasers (open circles, $p=0.003$). Figure 2 compares hemodynamic responses to a 100XED₉₅ dose of CW002 in a releaser (dashed line) and non-releaser (solid line) with all data normalized to pre-injection baseline. These data indicate that concomitant histamine release augments the direct vasodilatory response to CW002 (greater decrease in mAP, SVR, EDV, and a rise in LVEF) but does not markedly alter the effect of CW002 on contractility.

CONCLUSIONS: Results of this preliminary study indicate that the hemodynamic effects of high-dose CW002 reflect direct actions of the drug that, in some subjects, are augmented by histamine release. These data reinforce that the direct cardiovascular effects of CW002 in supra-therapeutic doses are quite modest, and suggest that when changes in mAP in response to CW002 are considered in a large population, the average response may well be affected by the subpopulation that are histamine releasers.

Figure 1**Figure 2**

S-292.

EFFECTS OF ISOFLURANE AND PHOSPHORYLATION BY PROTEIN KINASE C ON THE TETRODOTOXIN-RESISTANT Na^+ CHANNEL $\text{Na}_v1.8$

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INTRODUCTION: Voltage-gated sodium channels (Na_v) contribute to neuronal action potentials, and are potential targets for CNS depression by inhaled anesthetics. Nine homologous subtypes ($\text{Na}_v1.1$ - $\text{Na}_v1.9$) have been identified; all can be blocked by tetrodotoxin (TTX), but with marked differences in potency. Volatile anesthetics inhibit Na_v function in isolated nerve terminals, and in mammalian cells expressing TTX-sensitive and TTX-resistant Na_v isoforms. Activation of Protein Kinase C (PKC) leads to a reduction in peak Na^+ current (I_{Na}) in Na_v via phosphorylation of specific serine residues. A major site of phosphorylation by PKC in the brain-type Na^+ channel ($\text{Na}_v1.2$) is located in the inactivation gate in the DIII-DIV linker at S1506.¹ $\text{Na}_v1.8$ is highly expressed in nociceptive dorsal root ganglion neurons and is functionally linked to nociception.² In this study we analyzed the role of phosphorylation by PKC in modulating $\text{Na}_v1.8$ and its sensitivity to the inhaled anesthetic isoflurane.

METHODS: We mutated the PKC phosphorylation site in $\text{Na}_v1.8$ homologous to S1506 in $\text{Na}_v1.2$, S1452 in rat $\text{Na}_v1.8$, to S1452A by site-directed mutagenesis. The effects of the PKC activator phorbol 12,13-dibutyrate (PDBu) and isoflurane on Na^+ currents (I_{Na}) were studied using whole cell patch-clamp electrophysiology.

RESULTS: In wild-type $\text{Na}_v1.8$ the application of 100 nM PDBu significantly reduced I_{Na} compared to control. In $\text{Na}_v1.8$ -S1452A this reduction in I_{Na} was less pronounced. Additional treatment with a clinically relevant concentration of isoflurane (0.35 mM, ~1 MAC) did not further decrease I_{Na} . Both agents did not alter the voltage-dependence of activation in $\text{Na}_v1.8$ wild-type or the mutant. PDBu caused a hyperpolarizing shift in the voltage-dependence of inactivation in wild-type but not in the mutant. Co-application of isoflurane together with PDBu resulted in a more pronounced left shift in both $\text{Na}_v1.8$ wild-type and $\text{Na}_v1.8$ -S1452A.

DISCUSSION: PKC inhibits $\text{Na}_v1.8$ in part by phosphorylation of S1453; since mutation of this residue only partially prevents the effects of PKC activation, other PKC phosphorylation sites are likely to exist. A convergent mechanism exists for inhibition of $\text{Na}_v1.8$ by both PKC and volatile anesthetics that involves enhanced inactivation.

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S-293.

GENE THERAPY FOR PERI-OPERATIVE RESPIRATORY COMPLICATIONS BY DOMINANT-NEGATIVE TRAF6 PROTEIN

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INTRODUCTION: Development of respiratory complications takes place upon infection with microbial pathogens and causes significant morbidity and mortality peri-operatively. Bacterial DNA, which carries unmethylated CpG dideoxynucleotide 20 times more commonly than that of vertebrates, triggers strong host immune responses through its receptor Toll-like receptor (TLR) 9. Through its Toll/interleukin-1-receptor (TIR) domain, TLR9 recruits the adaptor molecules such as MyD88, IL-1receptor associate kinase (IRAK) and tumor necrosis factor receptor-associated factor (TRAF) 6, which ultimately lead to the activation of nuclear-factor kappa B (NF-kappaB), a major end-point of the TLR signaling. TRAF6, originally cloned as a CD40-interacting molecule, is composed of highly conserved COOH-terminal TRAF domain and an NH_2 -terminal effector domain. Whereas receptor-independent oligomerization of the NH_2 -terminus is sufficient to induce NF-kappaB activation, the COOH-terminus seems to serve only for receptor docking, and therefore may act as a dominant-negative molecule for TLR-signaling. The concept of the gene transfer of the COOH-terminus of TRAF6 protein as a possible therapeutic target for peri-operative respiratory complications was tested.

METHODS: RAW 264.7 cells, a murine macrophage-lineage cell line, were transiently transfected with the deletion mutant of TRAF6 expression plasmid together with *cis*-acting NF-kappaB-dependent reporter plasmid. The cells were then stimulated with CpG oligodeoxynucleotide (ODN) and the relative luciferase activities were measured.

RESULTS: Co-transfection of the deletion mutant of TRAF6 protein dose-dependently suppressed NF-kappaB activation following the stimulation with CpG ODN. By contrast, NF-kappaB activation mediated by the stimulation with poly(dI:dC), a ligand for TLR3, was not affected by the co-transfection with the deletion mutant of TRAF6 protein.

DISCUSSION: Nucleic acids exposed in the cells of the innate immune systems such as macrophages can evoke immune responses. The mechanisms of the DNA sensing system include Toll-like receptor 9 and the series of the adaptor proteins. By targeting its signaling adaptor protein TRAF6, we have shown here that the immune responses mediated by bacterial DNA are efficaciously attenuated, thereby paving the way to the new therapeutic approaches to the life-threatening peri-operative respiratory complications such as acute respiratory distress syndrome (ARDS).

DISCUSSION: The decrease of evoked muscle tension and tetanic muscle tension suggests that Botox and alphaBT in the doses studied had definitive neuromuscular effects. Despite decrease of ACh release by Botox, evidenced as decrease of evoked muscle tension and tetanic muscle tensions, no fade was seen during repetitive stimulation. The lack of fade in association with decrease of twitch by Botox suggests that decrease of ACh release (prejunctionally) does not necessarily cause fade. In the alphaBT group, fade was observed in all groups. When the margin of safety was decreased by the occupation of AChRs by alphaBT, fade was seen. This suggests that fade is also a function of the postjunctional receptors available for neuromuscular transmission. This is consistent with that seen in myasthenia gravis, a postjunctional disease related to AChR number, where fade is observed. Fade observed during repetitive stimulation is not always a prejunctional phenomenon because fade was observed following postjunctional AChR block by alphaBT.

Botox group		Day1		Day4		Day13	
	Side	Saline	Botox	Saline	Botox	Saline	Botox
TOF	Injection	0.98±0.02	0.96±0.03	0.99±0.02	0.97±0.03	0.99±0.01	1.00±0.02
	Contralateral	0.97±0.04	0.98±0.03	0.98±0.04	0.99±0.03	0.99±0.02	0.98±0.01
Tetanic fade	Injection	0.97±0.08	1.02±0.08	0.99±0.09	0.94±0.11	1.01±0.03	1.06±0.05
	Contralateral	0.97±0.08	0.99±0.07	0.96±0.09	0.97±0.06	1.01±0.04	1.03±0.05
alphaBT group		Day1		Day4		Day13	
	Side	Saline	alphaBT	Saline	alphaBT	Saline	alphaBT
TOF	injection	0.98±0.02	0.32±0.13*	1.00±0.02	0.53±0.13*	0.99±0.01	0.46±0.09*
	contralateral	0.97±0.04	0.98±0.02	0.97±0.07	0.99±0.02	0.98±0.01	0.94±0.03
Tetanic fade	injection	0.97±0.08	0.36±0.19*	0.98±0.08	0.24±0.08*	1.01±0.04	0.31±0.11*
	contralateral	0.97±0.08	1.01±0.06	0.95±0.14	1.03±0.03	1.01±0.06	0.94±0.06
*P<0.05 versus contralateral side, as well as both sides of saline group							

S-295.

REMIFENTANIL INCREASES THE ACTIVITY OF THE GLUTAMATE TRANSPORTER, EAAC1 EXPRESSED IN *XENOPUS* OOCYTES

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BACKGROUND: Remifentanyl has gained wide clinical acceptance during anesthesia due to its short context-sensitive half time and organ-independent metabolism. However, its mechanism as an anesthetic remains unclear. Glutamate transporters may be important targets for anesthetic action in the central nervous system (CNS) and the authors investigated the effects of remifentanyl on the activity of the major neuronal glutamate transporter, EAAC1 (excitatory amino acid carrier 1).

METHODS: EAAC1 was expressed in *Xenopus* oocytes by injection of its mRNA. By using two-electrode voltage clamping, membrane currents were recorded before, during, and after application of L-glutamate (30 μ M) in the presence or absence of remifentanyl. Oocytes were exposed to the protein kinase C (PKC) activator and inhibitor to study the role of PKC on EAAC1 activity.

RESULTS: L-Glutamate induced an inward current in EAAC1 expressing oocytes. This response was increased in a bell-shaped manner in the presence of 0.1 μ M to 1 mM remifentanyl. The kinetic study showed that remifentanyl significantly increased V_{max} (3.1 ± 0.2 μ C for controls group vs. 4.9 ± 0.3 μ C for the remifentanyl-treated group; $n = 12-15$; $P < 0.05$). However, remifentanyl did not cause a significant change in K_m . Treatment of the oocytes with phorbol-12-myristate-13-acetate (PMA), a PKC activator, caused a significant increase in transporter current (1.00 ± 0.03 to 1.35 ± 0.03 μ C; $P < 0.05$). Oocytes pretreated with the PKC inhibitor alone (staurosporine) abolished remifentanyl-enhanced EAAC1 activity.

CONCLUSIONS: Our data suggest that remifentanyl enhances EAAC1 activity and that PKC seems to be involved in mediating this effect.

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S-296.

PROPOFOL PREVENTS ANANDAMIDE-INDUCED CELL DEATH IN ENDOTHELIAL CELLS

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BACKGROUND: In addition to its general anesthetic properties, propofol also acts as inhibitor of fatty amide acid hydrolase (FAAH), which metabolize endogenous cannabinoids including anandamide (AEA). AEA is generated during septic shock by macrophages and platelet and is believed to be a causative mediator under the shock. We investigated whether pretreatment with propofol affects AEA-induced cell death in cell culture.

METHODS: Survival and viability of human umbilical vein endothelial cell (HUVECs) were tested by the trypan blue exclusion test and a cell proliferation assay using propofol, CB1 and CB2 antagonists (AM251 and AM630 respectively), and the potent FAAH inhibitor URB597. Propofol, URB597, AM251 and AM630 were added to cells and incubated for 30 min before AEA administration, except in an experiment to study the effect of timing of the propofol treatment relative to the AEA exposure. After incubation, 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) was added to each well, and the wells were incubated for 4 h. The formazan produced in the MTT assay was dissolved in DMSO and optical density was read at 570nm.

RESULT:

Effect of propofol pre-treatment on AEA-induced cell death

Pretreatment with propofol could significantly improved the cell viability (47% to 83%) at the concentration of 100 μ M.

Effect of timing of the propofol treatment relative to the AEA exposure

Propofol improved cell viability from 60 min before to 30min after AEA exposure. Although post-treatment with propofol was less effective than pre-treatment, it still had significant effect against AEA-induced cell death.

Effect of cannabinoid receptor antagonist on AEA-induced cell death

The potent selective cannabinoid receptor antagonists, AM251 and AM630, did not block or increase AEA-induced cell death at any concentrations.

Effect of FAAH inhibitor on AEA induced cell death

Although propofol inhibited AEA-induced cell death in dose dependent fashion (1 μ M to 500 μ M), URB597 increased AEA-induced cell death in dose dependent fashion (0.1 μ M to 100 μ M).

CONCLUSION This study demonstrated that AEA induces cell death in HUVECs, and that both pre-treatment and post-treatment with propofol, are able to inhibit AEA-induced cell death. However AM251 and AM630 did not block AEA induced cell death. Hence AEA-induced cell death involves non-CB1/non-CB2 receptors pathway. We also confirmed that potent FAAH inhibitor, URB597, increased AEA-induced cell death, but propofol, which is also FAAH inhibitor, strongly inhibits AEA-induced cell death.

When AEA is secreted at high level, such as in septic shock and re-perfusion injury, AEA might play a crucial role in endothelial cell injury. Treatment with propofol is candidate strategy for protection against cell damage induced by AEA exposure under these conditions.

Pharmacology - Clinical

S-297.

DEXMEDETOMIDINE DOES NOT INDUCE HYPOXEMIA IN POSTOPERATIVE ICU PATIENTS: COMBINED STUDIES USING RABBIT EXPERIMENTAL MODEL

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INTRODUCTION: Clinical use of dexmedetomidine (DEX) for postoperative analgesia and sedation has been widely adopted. As an α_2 -agonist however, it may cause undesirable influences such as systemic hypotension and hypoxemia involving the inhibitory effect of hypoxic pulmonary vasoconstriction (HPV) in critically ill patients. Pulmonary vasoconstrictive effects of DEX should be examined in terms of application, especially for high risk patients. Therefore, effects of DEX on systemic and pulmonary circulation, blood gas analysis and sedative levels for postoperative cardiac patients in ICU were studied. Furthermore, effects of DEX on systemic and pulmonary circulation, plasma concentration, and HPV response using an *in situ* rabbit model were also explored.

METHODS: Patients (n=10) that underwent elective cardiac surgeries, and obtained written informed consent were included in this prospective study. After extubation, when respiratory and circulatory states in ICU were stable, DEX (0.4 μ g/kg/h) administration was started without a loading dose. Systemic blood pressure, heart rate, pulmonary arterial pressure (PAP), cardiac index, blood gas analysis and Richmond agitation-sedation scale (RASS) were measured. In animal study, an experiment was conducted according to a protocol approved by the Institutional Animal Care and Use Committee. White male rabbits (n=30) were anesthetized with pentobarbital and ketamine, and intubated for mechanical ventilation (Paco₂:35~40mmHg), then effects of DEX infusion were observed. A second group of rabbits (n=36) was used for an *in situ* HPV study (isolated-lung-perfusion) model with hypoxic (3%O₂ and 5%CO₂) challenges. Data were expressed as mean \pm SE. Statistical analysis was established by using repeated measures (ANOVA) followed by the Bonferroni post hoc test. Significance level was set at P<0.05.

RESULTS: In ICU patients, DEX did not significantly negatively impact upon circulatory variables, blood gas analysis (Paco₂ and Pao₂) or RASS scores. In rabbits study, high blood concentration of DEX (60 and 100 ng/mL) caused significantly decrease in mean arterial blood pressure and heart rate, however PAP did not change. In the HPV response model, each mean PAP was not decreased nor increased by administration of DEX (0.5 to 60ng/mL) compared to baseline, and those were not changed by hypoxic challenges as well.

DISCUSSION: The present study did not show any increase in hypoxic variables or circulatory depression in ICU patients when DEX (0.4 μ g/kg/h) was administered without a loading dose. This indicates that DEX had satisfactory sedative effects when used in this dosage style. Using rabbits, DEX at a clinically equivalent dose did not affect systemic and pulmonary circulation. DEX was also able to maintain HPV response in a rabbit lung-perfusion model. Therefore, for postoperative sedation the average dose of DEX (0.4 μ g/kg/h) can be safely used without circulatory depression and/or hypoxemia in ICU patients.

S-298.

PHARMACOKINETICS OF DEXMEDETOMIDINE FOR LONG TERM SEDATION

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INTRODUCTION: The purpose of this study was to evaluate the pharmacokinetics (PK) of dexmedetomidine (DEX) infusions in mechanically ventilated patients sedated >24 hours. Accumulation of DEX metabolites, G-Dex-1, G-Dex-2 and H-1 was assessed in all patients and a subset of patients with renal failure as part of the SEDCOM trial.

METHODS: This was a Phase 4, double-blind, randomized, multi-center, comparator study evaluating the safety and efficacy of DEX in ICU patients requiring >24 hours of sedation. DEX was infused with an optional loading dose up to 1 mcg/kg over 10 mins, and then titrated with continuous infusion doses ranging from 0.2 mcg/kg/h to 1.4 mcg/kg/h. Plasma samples were collected 2 and 4 hours after starting infusion, just prior to the end of infusion, and 4 and 8 hours after terminating drug infusion. Population methods determined the PK of DEX and data visualization techniques assessed accumulation of these inactive metabolites based on renal function.

RESULTS: Samples from 65 patients were included in the population PK analysis for DEX. Median DEX infusion duration was 86h (range 26-280h). Both one and two-compartment models were fit to the data. Due to the sparse sampling schedule, the one-compartment model had greater relevance with average clearance of 39.4 L/hr, elimination half-life of 2.67 hr, and volume of distribution of 152 L. These results are similar to PK results for short-term administration (<24 hours) and lower doses (\leq 0.7 mcg/kg/hr infusions). End-of-infusion concentrations of DEX metabolites were higher in patients with severe renal impairment (creatinine clearance < 30 ml/min by Cockcroft-Gault) compared to those with higher renal function, but all metabolite concentrations were less than prior toxic thresholds.

CONCLUSIONS: The PK of DEX during prolonged infusions is similar to data for infusions <24 hours. DEX demonstrates linear PK for both short- and long-term use at continuous infusion doses of 0.2 - 1.4 mcg/kg/hr.

The end-of-infusion concentrations for the three inactive metabolites increased with decreasing renal function but remained below established toxic levels. No DEX dose adjustment is necessary based on infusion duration or renal function.

S-299.**IMPACT OF HYPERCAPNEIC HYPERVENTILATION AND THE QED-100 DEVICE ON RECOVERY OF PHARYNGEAL FUNCTION AFTER SEVOFLURANE ANESTHESIA****AUTHORS:** R. McKay¹, K. T. Hall²;**AFFILIATION:** ¹Anesthesia and Perioperative Care, University of California San Francisco, San Francisco, CA, ²University of California San Francisco, San Francisco, CA.

INTRODUCTION: Previous investigation has shown faster emergence after sevoflurane when the QED-100 device is used in conjunction with hypercapnic hyperventilation (1). The QED-100 contains a filter that removes volatile anesthetic and increases dead space in the circuit, allowing hyperventilation without concomitant decrease in PaCO₂. Whether this faster emergence correlates with faster elimination of small MAC-fractions of anesthetic and recovery of normal pharyngeal function is unknown. Sub-hypnotic MAC-fractions of sevoflurane have been shown to impair pharyngeal function in healthy volunteers (2) and patients (3).

METHODS: Forty-four patients undergoing laparoscopic surgery were randomly assigned to standard versus QED-100 emergence. All received 2 mg midazolam, fentanyl 1 µg/kg, propofol 2 mg/kg, and succinylcholine 1 mg/kg. Anesthesia was maintained with sevoflurane at end-tidal 1.7-2.0% in oxygen, fentanyl 1.5 µg/kg/hour, and rocuronium 0.3 mg/kg/hour, titrated to acceptable surgical relaxation. End-tidal CO₂ was maintained between 35-38mmHg. All received ondansetron 4 mg and 70 µg/kg neostigmine + 10-14 µg/kg glycopyrrolate prior to extubation.

At the conclusion of surgery, sevoflurane was discontinued and oxygen flow increased to 10 L/min. In the device group, minute ventilation was doubled and end-tidal CO₂ targeted at 50-60 mmHg. Control group was ventilated to end-tidal CO₂ between 38-45 mmHg. A blinded observer noted time from discontinuation of sevoflurane until first response to command, and, at pre-determined intervals thereafter (2,6,14,22 and 30 minutes), ability to swallow 20 mL of water according to a protocol described previously (3). Secondary outcomes (100-mmVAS for nausea, pain, energy and wakefulness) were measured at 15-minute intervals during the first hour and at 24 hours after emergence.

Statistical analysis was by Mann-Whitney, chi square or t-test where appropriate.

RESULTS: Patients receiving the device had longer anesthetic and greater MAChours, although these differences were not statistically significant (table). Device subjects received more fentanyl and rocuronium, although amounts were similar when considered as a function of anesthetic duration.

Time from discontinuation of sevoflurane until first response to command and ability to swallow were shorter in patients receiving the device (table). There was a non-significant trend toward greater ability to swallow at 2 and 6 minutes after response to command.

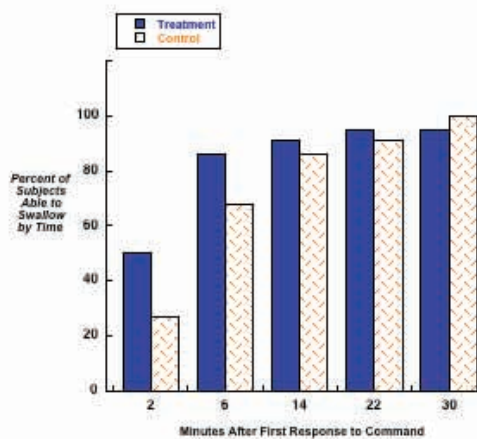
Antiemetic rescue was more prevalent, and nausea more frequent and severe, at 15 and 30 minutes after emergence in the control group. Other secondary outcomes (pain, wakefulness and energy) were similar between groups.

DISCUSSION: These findings confirm that pharyngeal recovery after sevoflurane is faster with hypercapnic hyperventilation+QED-100 compared to standard management. These findings may have been minimized by greater sevoflurane MAChours, a factor known to correlate with delayed pharyngeal recovery (4). Impact on early nausea may reflect more efficient elimination of small MAC fractions of sevoflurane.

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Demographic Data & Results			
Number of subjects	Treatment (QED-100) 22	Control 22	P-Value
Age (years)	22	22	N.S.
Gender (% female)	64	77	N.S.
ASA I/II/III	8/12/2	9/9/4	N.S.
Minutes sevoflurane	196 ± 64	166 ± 49	0.09
MAC hours sevoflurane	3.28 ± 1.11	2.81 ± 0.85	0.12
BMI (kg/m ²)	26.5 ± 5.5	27.5 ± 5.7	N.S.
Fentanyl µ/k (µ/k/h)	6.81±2.59 (2.16±0.55)	5.19±1.37 (1.98±0.59)	0.013 (0.28)
Rocuronium µ/k (µ/k/h)	0.82±0.27 (0.28±0.12)	0.56±0.20 (0.22±0.10)	0.001 (0.14)
Response to command after discontinuation of sevoflurane (seconds)	350 ± 133	569 ± 342	0.027
Time first able to swallow after discontinuation of sevoflurane (seconds)	655 ± 305	1081 ± 571	0.045
Nausea (VAS 0-10)			
15 minutes	0.00 ± 0.00	2.34 ± 2.66	0.0002
30 minutes	0.18 ± 0.66	1.39 ± 2.49	0.0456
45 minutes	0.95 ± 2.10	1.40 ± 2.09	N.S.
60 minutes	0.73 ± 1.78	1.39 ± 1.99	N.S.
24 hours	1.22 ± 2.25	2.59 ± 4.17	N.S.
Rescue antiemetic, PACU			
0-30 minutes, n (%)	1 (4.5)	7 (32)	0.019
0-60 minutes, n (%)	2 (9.0)	8 (36)	0.031
Opioid in PACU, n (%)			
0-30 minutes	22 (100)	19 (86)	N.S.



S-300.**COMPARISON OF PROPOFOL VS. PROPOFOL/
REMIFENTAL ANESTHESIA IN UPPER GI ENDOSCOPIC
ULTRASOUND EXAMINATION (EUS)**

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INTRODUCTION: Propofol has gained wide acceptance for anesthesia in GI endoscopy (1). It is often used as the sole anesthetic agent but has also been combined with the short-acting opioid remifentanyl (2). However, the benefits of propofol/remifentanyl combination over propofol alone have not been demonstrated. This randomized, double-blinded study sought to test the working hypothesis that propofol/remifentanyl combination provides superior conditions than propofol alone during anesthesia for EUS and to compare the incidence of hypoxia and hypotension between the two techniques.

METHODS: With IRB approval and patient consent, 100 patients undergoing EUS were randomly assigned to two groups. The same drug administration protocol, delivering identical volumes, was used for both groups for blinding purposes. For anesthesia, Group A received propofol 10 mg/mL and Group B received propofol 5 mg/mL + remifentanyl 1 mcg/mL. Group A received propofol 1.5 mg/kg for induction followed by an infusion of propofol 200 mcg/kg/min and Group B received propofol 0.75 mg/kg + remifentanyl 0.15 mcg/kg for induction followed by an infusion of propofol 100 mcg/kg/min + remifentanyl 0.02 mcg/kg/min. Additional boluses of propofol 200 mcg/kg in Group A, or propofol 100 mcg/kg + remifentanyl 0.02 mcg/kg in Group B were administered slowly until adequate depth of anesthesia was reached. The infusion rate and bolus delivery were adjusted based upon the clinical judgment of the blinded anesthesiologist. The quality of anesthesia, as determined by patient response, was rated by the blinded endoscopist using a 4-point scale (1=minimal response, 2=mild response, 3=moderate response, 4=severe response). Episodes of hypoxia (O₂ saturation <85%) or hypotension (SBP <90 mmHg) were also noted.

RESULTS: Ninety-six patients completed the study. The two groups were matched with respect to patient characteristics. Anesthesia scores, analyzed using nonparametric Wilcoxon test, and the incidence of hypoxia and hypotension, analyzed using Student's t-test, were not statistically significant (Table 1).

Table 1.

	Propofol (n=49)	Propofol/Remifentanyl (n=47)	p-value
Mean Anesthesia Scores	1.37 ± 0.1	1.51 ± 0.1	0.15
Hypoxia	4/49 (8%)	6/47 (13%)	0.46
Hypotension	2/49 (4%)	6/47 (13%)	0.12

DISCUSSION: In this study, when anesthesia induction and maintenance in EUS is carried out slowly according to the described protocol, combining propofol and remifentanyl does not produce better anesthesia conditions or a lower incidence of hypoxia and hypotension than when propofol is used alone. Although there was a trend for better anesthesia conditions and lower incidence of complications when propofol was used alone, the difference between the two groups was not statistically significant because the study was powered to detect relatively large, clinically meaningful differences.

REFERENCES:

1. J Clin Anesth 2007; 19:397-404
2. J Clin Anesth 2008; 20:352-355

S-301.**IS GENDER RELEVANT FOR ATRACURIUM AND
ROCURONIUM PHARMACODYNAMICS?**

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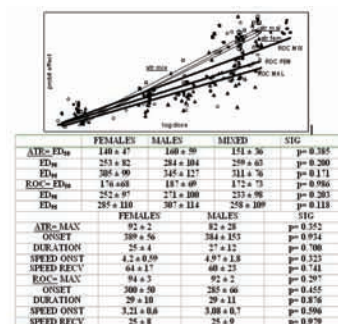
INTRODUCTION: The gender aspect, for clinical pharmacology of anesthetic agents in general and muscle relaxants particularly, have recently attracted the attention of some authors. The influence of gender on potency and course of action for both atracurium (ATR) and rocuronium (ROC) have been studied before (¹⁻²). But results coming from the same group and protocol on other muscle relaxants are conflicting (³⁻⁴). The present trial was undertaken in order to clarify the findings on ATR and ROC.

MATERIAL & METHODS: Adult, elective and consenting male, female or mixed gender group of patients received no paralyzing doses of either ATR or ROC (n= 135 e/a) during induction of intravenous-nitrous oxide anesthesia. Electromyography and TOF stimulation for neuromuscular monitoring were used for assessment of maximal blockade. After Log dose/Probit effect transformation a single dose-response curve was obtained and ED₅₀, ₉₀ and ₉₅ were calculated for each patient solving Hill's equation, considering γ as the ratio Probit/Log. Two additional groups of similar female and male patients received single bolus dose of either ATR (250 µg.Kg⁻¹) or ROC (400 µg.Kg⁻¹) and maximal effect, onset time, speed of action, clinical duration and speed of recovery were assessed by the same methods. Analysis of variance, Student-Newman-Keuls, T test and p<0.05 level for significance were used for statistical comparisons.

RESULTS: During dose response studies, female were significant younger but males and average mixed group were heavier. Any statistical difference between groups was found for potency and slope of the curves for neither ATR nor ROC (p= 0.975 and 0.879 respectively). For time course of action no significant difference was noticed among pharmacodynamic parameters studied (Figure).

DISCUSSION: Differences in methodology, with other studies on gender correlation with ATR and ROC potencies and course of action, are wide (¹⁻²). A multipurpose versus specific study, single versus cumulative dose-response, mechano versus electromyographic monitoring, use of paralyzing doses, inconsistencies for recovery parameters and lack of a MIX group, prevents from any similarity with present results. It is well known that γ for concentration-effect curve, C_{ss}, duration and sensitivity for ATR, doesn't change with gender (⁵⁻⁷) and, conflicting results as well, have been published on gender and related duration differences for ROC (⁸⁻⁹). In conclusion: present comprehensive study does not give support for any significant difference on gender related pharmacodynamics of ATR and ROC.

REFERENCES: 1) Anesth Analg 1997; 85: 667.- 2) J Clin Anesth 1999; 11: 397.- 3) Br J Anaesth 1998; 80: 720.- 4) Anesthesiology 2007; 107: A398.- 5) Br J Anaesth 1993; 70: 38.- 6) Br J Anaesth 1992; 60: 217.- 7) Br J Anaesth 1985; 57: 1052.- 8) Anaesthesist 2000; 49: 609.- 9) J Clin Anesth 2003; 15: 446.-



S-302.

EFFICACY AND SAFETY OF A STANDARDIZED
INTRAOPERATIVE INSULIN INFUSION PROTOCOLAUTHORS: G. Edelman¹, A. Rakic²;AFFILIATION: ¹Anesthesiology, University of Illinois at Chicago, Chicago, IL, ²University of Illinois at Chicago, Chicago, IL.

INTRODUCTION: Controversy exists around the role of tight glucose control in critically ill ICU patients. Although early work indicated improved outcomes in these patients (1), recent work has questioned the safety of aggressive insulin infusion regimens (2). In cardiac surgery patients, glycemic control is associated with improved outcomes (3). In patients undergoing noncardiac surgery however, data regarding glycemic control is sparse. We present our experience in intraoperative continuous insulin infusions for glucose management in noncardiac surgery, with focus on safety and efficacy.

METHODS: Following IRB approval, 102 adult noncardiac surgery patients receiving general anesthesia were retrospectively studied. Patients with an intraoperative blood glucose (BG) value > 150 mg/dl received a standardized intraoperative insulin infusion, identical to that utilized in our ICU. The insulin infusion protocol is a multistep accelerated algorithm, with patients demonstrating insulin resistance being rapidly advanced to higher dose ranges. Insulin boluses are excluded. Insulin infusions were targeted to BG of 80-150 mg/dl. No continuous dextrose infusions were used in any patient. Regular BG determinations were performed, with recommended 60 minute time intervals. Safety metrics of the insulin regimen included rates of low BG (60-80 mg/dl) or hypoglycemia (BG < 60 mg/dl). Efficacy was determined by the rate of obtaining target BG (< 150 mg/dl). Proportion of subjects reaching target BG were statistically compared by chi-square with multiple comparisons by Bonferroni correction.

RESULTS: Overall, the 102 subjects received 281 BG measurements. The insulin infusion times ranged from 50 to 631 minutes (min) with a mean time of 197 min ± 113 (SD). Sixty percent of patients reached the target BG of 150 mg/dl (60/102 subjects). The proportion of patients reaching target BG increased with infusion duration (p<0.01), with 69% of patients at target by 279 min of infusion. One subject had a BG value of 47 mg/dl with two subjects having low BG episodes of 66 and 76 mg/dl. No adverse outcome was ascribed to the insulin regimen in any patient.

DISCUSSION: This retrospective pilot study demonstrates that a standardized, moderately strict ICU insulin infusion protocol can be safely and effectively used in an operating room setting. Although the intraoperative infusion times are limited by duration of surgery, it is demonstrated that the majority of patients will reach target BG within 4½ hours. This result compares favorably with our local ICU experience, where normoglycemia is obtained within 4 to 5 hours of insulin infusion. It should be noted that no exogenous glucose infusions were used to prevent hypoglycemia. Despite this omission, the incidence of hypoglycemia was within our local benchmark at ≤ 1%, as was the incidence of low BG at ≤ 5%.

REFERENCES: 1) NEJM 2001;345:1359-67. 2) J Thorac Cardiovasc Surg 2003;125:1007-21. 3) JAMA 2008;300:933-944.

S-303.

ROCURONIUM PHARMACODYNAMIC STUDIES:
A COMPARISON OF M-NMT[®] MODULE TO
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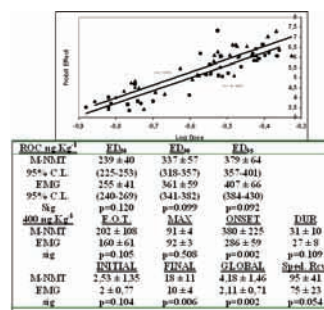
INTRODUCTION: The Relaxograph[®] (Datex, Finland) (EMG) monitor has been widely used during clinical research on neuromuscular blocking drugs. As locally maintenance services are not longer available, this device was discontinued. For replacement, the M-NMT module (GE Health Care, Finland) (M-NMT) was introduced for the same purposes. The present trial is intended to report initial pharmacodynamic studies on rocuronium (ROC) performed with M-NMT and compared with previous results coming from EMG studies, both during similar clinical conditions.

MATERIAL & METHODS: In *part one*: during intravenous-nitrous oxide anesthesia, adult, elective-consenting patients received three successive small fractional doses of ROC, after previous administration comes to a stable effect. Maximal blockade was assessed either by EMG or M-NMT (n=11 e/a), by the same strictly clinical protocol. In each case and after Log dose-Probit effect transformation a cumulative dose-response curve was obtained. Considering factor γ from the regression line and solving Hill's equation, ED_{50,90} and γ_{95} were calculated for each patient. In *part two*: during similar clinical conditions, two additional groups of patients received a bolus ROC 400 µg.Kg⁻¹ and early onset time (up to 80%), maximal effect, onset time, speed of action (initial, final, global), clinical duration and speed of recovery were assessed either by M-NMT (n=21) or EMG (n=25).

RESULTS: Any significant difference between groups was noticed for the anthropometric data. Final doses and effect were 383±39 µg.Kg⁻¹ for EMG group and 381±44 for M-NMT, p= 0.926 and 91±5 % and 90±6, p= 0.687, respectively. Neither zero (0) nor 100% effect was noticed and neuromuscular blockade ranged 5 to 98% during the entire procedure. Differences in potency and slope of the curves didn't reach statistical significance (p= 0.904). Log-probit correlation (R²) was 0.782 and 0.786 during EMG and M-NMT monitoring. Solving regression line equations, both probit and effect were statistically satisfactory predicted. After 400 µg.Kg⁻¹ bolus administration, onset time was shorter and final and global speed of action significantly faster during EMG monitoring. Speed of recovery differences didn't reach statistical level (Figure).

DISCUSSION: Reliability on M-NMT module both for the assessment of potency and interchangeable figures with EMG results was clearly demonstrated. Differences noticed for time and speed could be linked to different methods for assessment, as a chronometer was used during EMG study and data from the trend on the screen for M-NMT. Present results do not support early doubts raised during confusing descriptions on methodology (1-2), neither any screen malfunction was noticed (3) when M-NMT is used in the electromyographic mode. To keep the same device for time monitoring is strongly advised if such trials are planned.

REFERENCES: 1) Anesth Analg 2002; 95: 1826.- 2) Br J Anaesth 2003; 91: 608.- 3) Anesthesiology 2006; 104: 1109



S-304.

PROPOFOL-REMIFENTANIL SUPPRESSED THE HEMODYNAMIC CHANGES DURING INDUCTION OF ANESTHESIA IN COMPARISON WITH SEVOFLURANE-REMIFENTANIL

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INTRODUCTION: To investigate the time course of hemodynamic changes during induction of anesthesia, we compared blood pressure (BP), heart rate (HR) and rate-pressure product (RPP) between propofol-remifentanil or sevoflurane-remifentanil anesthesia in humans.

METHODS: Anesthesia was induced by propofol TCI (target blood concentration 3µg/ml) or inhalation of sevoflurane to keep BIS range between 40-50, and infusion of remifentanil 0.5 µg/kg/min. At 4 min later, the trachea was intubated, which was facilitated with intravenous infusion of vecuronium 0.1 mg/kg. After this, anesthesia was maintained with 2µg/ml of propofol or 1.0 % end tidal sevoflurane concentration and remifentanil infusion at 0.1 µg/kg/min. The lungs were mechanically ventilated with 40 % oxygen in air. BP and HR were recorded and RPP was calculated at pre-induction, pre-intubation, post-intubation (immediate, 1min, and 5min). Data were analyzed with SPSS software 8.0.1 for Windows (SPSS Institute, Chicago, IL) and are presented as mean ± standard deviation. To compare differences between the two groups in BP, HR and RPP, unpaired t-test was performed. Statistical significance was defined as p < 0.05.

RESULTS: A total of 50 patients were studied. There were no significant differences in demographic data between both groups. Patients in the propofol-remifentanil group had significantly suppressed the increase in BP and HR after tracheal intubation in comparison with sevoflurane-remifentanil groups. And there was a significant difference in RPP between both groups. Conclusions: Our data suggest that propofol-remifentanil can suppress the sympathetic stimulation by tracheal intubation more than sevoflurane-remifentanil.

S-305.

CAN CUMULATIVE AND SINGLE DOSE-RESPONSE BE EQUIVALENT?

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INTRODUCTION: Any method used to examine the potency of muscle relaxants drugs should fulfill with their pharmacokinetic properties. Accordingly, regular cumulative dose-response (CML) technique underestimates the values when comparison is made to single-dose (SGL) calculation. This crucial drawback prevents from that practical method to be employed as a controllable guide for clinical use (¹⁻⁴). Several proposals have been made in order to overcome these limitations (³⁻⁵), but instead of simplifications, more requirements arise to be coped. The aim of the present trial is to draw a variant of the CML method both simple and accurate, applicable for most clinical needs.

MATERIAL & METHODS: Two groups of adult, elective and consenting patients were randomly assigned to receive atracurium (ATR) or rocuronium (ROC) in order to assess their potencies. Single (n= 45 e/a) or three successive cumulative doses (n= 11 e/a) were administered to each patient and maximal blockade assessed by electromyography. After Log dose-Probit effect transformation a regression line was obtained and ED₅₀ and ED₉₀ were calculated for each patient by solving Hill's equation, using Probit/Log ratio for γ estimation. CML results were then corrected (CML[®]) by substitution of the second and third cumulative doses and effects figures for their actual values and calculations repeated. Analysis of variance, Student-Newman-Keuls test and p<0.05 were used for statistical comparisons.

RESULTS: Consistently and significantly ED₅₀ and ED₉₀ assessed by CML were larger than those coming from both SGL and CML[®]. No significant differences for potency were noticed between SGL and CML[®]. Slope of the curves significantly differs among methods, both for ATR and ROC. Solving equations for regression lines statistically predicted probits and from them also effects (Table).

DISCUSSION: For an earlier modification, the two-dose cumulative technique, a previous extrapolation of ED₉₅ for each patient, after its ED₅₀ was calculated from one dose, is a prerequisite needed for solving the problem (³). Although computer instead of paper and drawing has been now introduced, this methodology still seriously interferes with clinical conditions during the period of the potency assessment. A second administration to complete a fixed total dose is necessary to compile with another modified technique (⁵). For such a method SGL and CML are estimated simultaneously and a large sample size is invariable needed to complete calculations. Also patients and figures as well, are partially the same for comparison, leading to a probably bias. In conclusion: present cumulative variant, by using only one small sample size, statistically and fairly reproduces SGL values for ATR and ROC potencies, retaining CML advantages.

REFERENCES: 1) Anesth Analg 1994; 78: 608.- 2) Anesth Analog 2000; 90: 1191.- 3) Anesthesiology 1989; 70: 732.- 4) Anesthesiology 1980; 53: 161.- 5) Can J Anaesth 1993; 40: 127.-

	1)Single Dose	2)Cumulative	3)Cumulative [®]	SIG
Rocuronium				
ED ₅₀	172 ± 73	264 ± 52	162 ± 81	203>1-3-
ED ₉₀	233 ± 98	327 ± 65	254 ± 126	203>1-3-
1 st Dose (µg/Kg.1)		175 ± 31		
Effect (%)		13 ± 8		
2 nd Dose		304 ± 33	128 ± 27	
Effect		67 ± 13	54 ± 10	
3 rd Dose		383 ± 39	79 ± 28	
Effect		91 ± 5	24 ± 9	
Atracurium				
ED ₅₀	141 ± 61	193 ± 83	141 ± 70	203>1-3-
ED ₉₀	222 ± 96	279 ± 77	254 ± 126	203>1-
1 st Dose (µg/Kg.1)		93 ± 33		
Effect (%)		8 ± 6		
2 nd Dose		160 ± 42	74 ± 18	
Effect		19 ± 10	11 ± 9	
3 rd Dose		249 ± 15	80 ± 34	
Effect		71 ± 11	61 ± 19	

S-306.**BIS VALUES FOR VARIOUS REMIFENTANIL-PROPOFOL EFFECT SITE CONCENTRATIONS THAT ABOLISH RESPONSE TO TIBIAL PRESSURE**

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INTRODUCTION: Prior work has characterized the synergistic interactions of opioids and sedatives on analgesia and sedation. Propofol and remifentanyl have a significant synergistic interaction on analgesia and to a much lesser extent on sedation. The aim of this study was to investigate how the Bispectral Index Scale (BIS) changed for various remifentanyl:propofol ratios titrated to abolish a response to a consistent stimulus. It was hypothesized that the BIS would be lower for low remifentanyl, high propofol concentration pairs (low ratios) and higher in high remifentanyl, low propofol concentration pairs (high ratios) needed to abolish a response to 50 psi of tibial pressure.

METHODS: After IRB approval, thirty-nine volunteers were given target controlled infusions of propofol and remifentanyl with increasing effect site concentrations administered in a stepwise fashion. At each target concentration, response to 50 psi and BIS were recorded. Propofol-remifentanyl effect site concentration pairs that abolished response to 50 psi were organized into twelve groups according to the ratio of remifentanyl to propofol. Drug units were ignored when computing ratios. BIS values and drug ratios were compared by group with an ANOVA. If significant, a post hoc analysis was done with a Fisher's protected least significant difference (PLSD) t test. A p-value < 0.05 was considered significant.

RESULTS: Drug ranges and mean BIS and ratio for each group are presented in Table 1. An ANOVA test of both BIS (dependent) and drug ratio (dependent) to group (independent) revealed p-values of < 0.001. Post hoc analysis of BIS with a Fisher's PLSD is presented in Table 2. An X indicates mean BIS values are significantly different between groups listed in table 2. Groups 11 and 12 both have ratios of infinity so remifentanyl effect site concentrations were compared. Drug ratios between groups 2-4, 4-5 and 5-6 were not significantly different. The mean BIS of volunteers tolerating 50 psi are not significantly different for drug ratios between 0.49 and 4.53 and with remifentanyl-only above 15ng/mL. BIS is significantly lower when no opiate is administered and significantly higher when the opiate to sedative ratio is 8.54 or when remifentanyl-only is below 15ng/mL.

Group	Freq	Remi (ng/mL)	Prop (mcg/mL)	Ratio	BIS (mean ± SD)
1	14	[0 - 0]	[2 - 10]	0.00	31.2 ± 15.4
2	14	[0.39 - 1.0]	[2 - 5]	0.26	53.5 ± 12.0
3	13	[0.39 - 1.22]	[0.81 - 2.20]	0.49	60.1 ± 11.1
4	13	[0.84 - 1.65]	[1.47 - 2.67]	0.63	60.2 ± 14.3
5	14	[1 - 2.20]	[1 - 2.20]	0.92	59.6 ± 11.4
6	15	[0.84 - 3.30]	[0.81 - 2.67]	1.25	60.6 ± 14.2
7	13	[2.20 - 5.0]	[1.10 - 3.0]	1.76	59.7 ± 13.4
8	14	[1.65 - 5.0]	[0.81 - 1.5]	2.39	69.8 ± 14.6
9	12	[2.20 - 5.0]	[0.56 - 1.10]	4.68	69.9 ± 17.2
10	8	[2.2 - 6.4]	[0.26 - 0.56]	9.52	84.7 ± 17.1
11	15	[2.25 - 15]	[0 - 0]	inf	81.5 ± 20.8
12	13	[18 - 60]	[0 - 0]	inf	68.1 ± 18.1

Group	1	2	3	4	5	6	7	8	9	10	11	12
1	-	X	X	X	X	X	X	X	X	X	X	X
2	X	-						X	X	X	X	X
3	X		-							X	X	
4	X			-						X	X	
5	X				-					X	X	
6	X					-				X	X	
7	X						-			X	X	
8	X	X						-		X	X	
9	X	X							-	X	X	
10	X	X	X	X	X	X	X	X	X	-		X
11	X	X	X	X	X	X	X	X	X		-	X
12	X	X								X	X	-

DISCUSSION: These results confirm our study hypothesis. At a consistent stimulus, BIS values for low remifentanyl, high propofol effect site concentrations were significantly lower than BIS values for high remifentanyl, low propofol effect site concentrations. However, BIS values were similar for remifentanyl:propofol ratios in groups 3-9, covering a wide range of opioid-sedative concentration pairs often used in clinical practice. This data may be useful when interpreting BIS values when using anesthetic techniques where the opioid to sedative ratio is substantially different from common practice.

S-307.

EFFECT OF PETHIDINE, FENTANYL AND MORPHINE ON POSTANESTHESIA SHIVERING

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INTRODUCTION: Postanesthesia shivering is an undesirable event of unknown etiology. This double blind clinical trial intended to compare the efficacy of pethidine 50 mg, fentanyl 50 mg, morphine 2 and 4 mg with that of pethidine 25 mg in treating postanesthesia shivering.

METHODS: 50 patients who shivered following general anesthesia were randomly treated with intravenous pethidine 50 mg, fentanyl 50 mg, morphine 2, morphine 4mg, or pethidine 25 mg. They were monitored in the recovery room for 30 minutes and the grade of shivering, the cessation time and the recurrence of the event, duration of disappearance of shivering, axillary temperature, opioid related complications, and cold sensation were recorded.

RESULTS: The groups did not differ significantly regarding patient demographics, surgical data, the recurrence, grade, cessation time and the abatement duration of shivering as well as the cold sensation. Postanesthesia shivering terminated faster in the pethidine 50 mg group and slower in the morphine 2 mg group than the pethidine 25 mg control group. The incidence of nausea was significantly higher in the pethidine 50 mg group at 15 minutes after the treatment. Patients in the morphine 4 mg group had significantly higher axillary temperatures.

DISCUSSION: All study opioids were found to be effective in treating postanesthesia shivering.

S-308.

SYSTEMIC LIDOCAINE PROVIDES BETTER PERIOPERATIVE GLUCOSE CONTROL IN DIABETIC PATIENTS

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INTRODUCTION: Systemic lidocaine is a safe alternative to epidural anesthesia for perioperative pain control. It modulates the surgery induced stress response because of anti-inflammatory activity [1]. Epidural analgesia abolishes hyperglycemic response to surgery [2]. Systemic lidocaine may mimic the effect of epidural anesthesia resulting in a better glucose control for diabetic patients.

METHODS: In this prospective, comparative study we collected blood glucose levels of 77 diabetic patients undergoing different types of surgery within a 12-week period. Inclusion criteria were as follows: diagnosis of diabetes, no regional anesthesia, length of general anesthesia > 120 minutes and pre-operative blood glucose level < 175 mg/dl. Glucose levels were measured pre-operatively in SAS, every hour during surgery and after arrival in PACU. According to our departmental guidelines hyperglycemia above 175 mg/dl is suggested to be treated with insulin. 29 patients underwent intravenous lidocaine infusion during surgery and 48 did not (control group). Statistical analyses were performed using an unpaired Student's *t*-test and Kruskal-Wallis One Way Analysis of Variance on Ranks. Data are presented as mean±SD or as median with 75% interquartile range when appropriate.

RESULTS: There was no difference between the groups in age (control group vs. IVlidocaine group 56±12.3 vs. 59±9.0 years, *p*= 0.274), BMI (34±10.3 vs. 33±8.9, *p*= 0.816) and length of surgery (235±78.9 vs. 280±127.2 minutes, *p*= 0.062). PreOP glucose values were not significantly different (123±25.3 mg/dl for the control and 133±23.2 mg/dl for the group receiving IV lidocaine, *p*=0.08). In the control group the glucose level increased significantly (*p*<0.05) compared with the preOP values to a maximum level to 140 % and reached postoperatively to a level of 143 %. For patients with systemically lidocaine more stabilized glucose values were observed without a significant elevation (maximum glucose level 118 %, PACU 114 %). The amount of insulin (units) was not significantly different between both groups (3.3 ±7.52 in the control group vs. 2.9 ±7.32 units in the lidocaine group, *p*= 0.802).

CONCLUSION: Systemic lidocaine attenuates the hyperglycemic response to surgical stimuli in diabetics and may be beneficial in perioperative glucose control.

REFERENCES: 1. Ann Surg 2007; 246: 192-200; 2. Br J Surg 1979; 66: 543-546

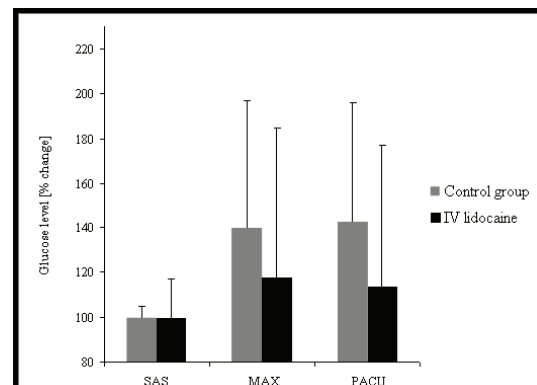


Figure 1: Comparison of glucose levels. Data are shown as percentages with 75% interquartile range. **p*<0.05 compared with SAS level.

S-309.

WITHDRAWN

S-310.

THE ROLE OF STEROIDS IN DECREASING CYTOKINE RELEASE DURING BILATERAL KNEE REPLACEMENT

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INTRODUCTION: The cytokine IL6, a major mediator of inflammation is known to increase during total joint replacement surgery. Thought to lead to shock, it participates in the inflammatory state seen in sepsis, and may play a major role in the development of fat embolism syndrome (FES). Low dose steroids (200-300mg of hydrocortisone per day) have been found to increase survival in sepsis. Used prophylactically in patients with long bone fractures, steroids have been shown to decrease the incidence of FES (Schonfeld 1983). The exact role of IL6 in joint replacement has not been fully studied since FES frequency in such procedures is low. Using a double-blind, placebo controlled design, this study intended to see whether the administration of two doses of hydrocortisone would alter IL6 levels over 24 hours.

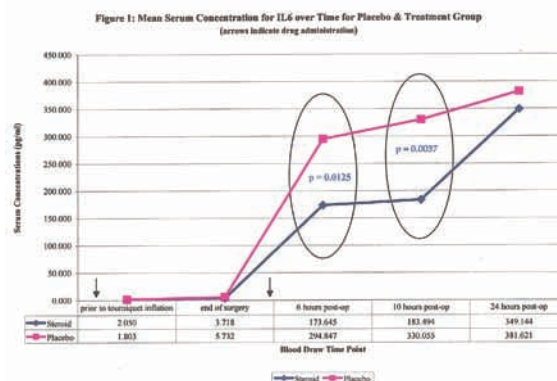
METHODS: With IRB approval, 30 patients undergoing bilateral knee replacement were randomly assigned to receive either placebo or 100mg hydrocortisone within 2 hours of surgery and 8 hours later. Anesthesia was standardized for all patients. Demographics, intra- and post-operative data were recorded. Blood samples were collected prior to tourniquet inflation, end of surgery, at 6, 10 and 24 hours post-op and analyzed for IL6 levels using an ELISA assay. Independent-samples t-tests and contingency tables were conducted to assess significance.

RESULTS: With 15 patients per group placebo vs. treatment, patient demographics were as follows, respectively: age (years) 71±9 vs. 64±7 (p -value=0.0318); BMI 29.571±5.647 vs. 30.976±5.904; gender % female 9 (60%) vs. 6 (40%); ASA status 27 patients class 2 (14 vs. 13) and 3 class 3 (1 vs. 2). Aside from age, there were no significant differences in the demographic data between the groups.

Mean serum concentrations of IL6 (pg/ml) split by group over 24 hours can be seen in Figure 1. Hydrocortisone given in 2 doses 8 hours apart significantly decreased IL6 levels at 6 ($p=0.0125$) and 10 hours ($p=0.0037$) post-op.

DISCUSSION: This study shows the use of hydrocortisone to be successful in decreasing IL6 levels for the first 10 hours after surgery. Once steroids were discontinued, IL6 level in study group increased to level of control group consistent with the duration of pharmacological effects of hydrocortisone. Its exact role in the development of FES in joint replacement is not known, but IL6 likely contributes to the overall clinical picture. In studies looking at the prophylactic use of steroids in long bone fracture patients, lower incidence of FES was noted. An alteration in the inflammatory state seen in this setting as manifested by a decrease in IL6 may be the mechanism. Future studies looking at the use of hydrocortisone over 24 hours and clinical outcomes are needed for further evaluation.

REFERENCES: Annals of Internal Medicine. 1983 Oct; 99(4):438-43.



S-311.

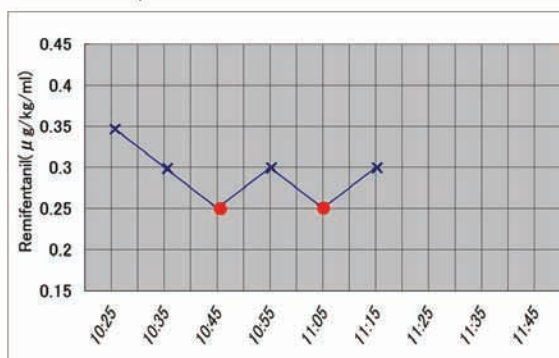
MINIMUM REMIFENTANIL TO INHIBIT THE SYMPATHETIC NERVE STIMULATION DURING LAPAROSCOPIC CHOLECYSTECTOMY

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Sympathetic nerve stimulation that occurs when pneumoperitoneum (PP) is conducted is a nociceptive stimulus, which is different from the operational stimulus that breaks down tissues. Reportedly, when the operative stress attributable to the sympathetic nerve stimulation is assessed by measuring catecholamine, higher remifentanyl concentration is expected to decrease the secretion of catecholamine 1). In the present study, we determined the optimum dose of remifentanyl ED50 and ED95 using Dixon's Up-and-Down method as the index of circulation dynamics. After obtaining consent from this hospital's ethical committee, we conducted the experiment with 10 patients who had given informed consent. They were to undergo elective laparoscopic cholecystectomy (LC) of ASArisk 1-2. Without preliminary medication, we began to administer intravenous fluid 2 h before introducing anesthesia. It was started with TIC and propofol 3 $\mu\text{g}\cdot\text{ml}^{-1}$; the perioperative concentration was maintained with the concentration added by 1 $\mu\text{g}\cdot\text{ml}^{-1}$ to that of the effect-site concentration at bedtime. After confirming that the patient had fallen asleep, the operation was started with remifentanyl of 0.5 $\mu\text{g}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$. At the same time, rocuronium was administered to perform intubation. From 10 min after PP was started, remifentanyl was decreased by degrees, i.e., by 0.05 $\mu\text{g}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$, observing circulation dynamics (blood pressure and heart rate). Given that no change occurred 7 min later, remifentanyl was decreased again by degrees, by 0.05 $\mu\text{g}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$. When any change of circulation dynamics or brain waves was found, it was increased by degrees, by 0.05 $\mu\text{g}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$, to determine the optimum concentration. The ending time of the experiment was set as when the site to be crossed four times was identified or when the operation had ended (Dixon's Up-and-Down method). The optimum dose of remifentanyl ED50 was 0.254 $\mu\text{g}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$, and that of remifentanyl ED95, 0.473 $\mu\text{g}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$. Consequently, the optimum doses of remifentanyl ED50 and ED95 were, respectively, 0.473 $\mu\text{g}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ and 0.254 $\mu\text{g}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$.

Dixon's Up and Down method



S-312.

ISOPROTERENOL INCREASES BIS DURING CARDIAC CATHETER ABLATION

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Adrenergic tone is an important factor in the development of spontaneous supraventricular arrhythmias as well as inducibility in the electrophysiology laboratory. Analgesia and sedation have significant anti-adrenergic effects and intravenous isoproterenol is frequently used to counteract this effect and provoke supraventricular arrhythmias. Moreover, intravenous isoproterenol is now being utilized routinely during protocols of ablation for atrial fibrillation to "unmask" reconnection of pulmonary vein conduction. The effects of isoproterenol on cerebral and respiratory function during the analgesic/sedated state have not been well studied. Patients who underwent cardiac catheter ablation under total intravenous anesthesia (TIVA) demonstrated BIS spikes when isoproterenol was administered. All patients received propofol infusions and opioid (fentanyl and/or remifentanyl) with midazolam premedication. In all 7 patients, BIS spikes were noted with isoproterenol. 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. Isoproterenol appears to act on the brain when administered under TIVA during cardiac ablation. BIS values increase significantly in the patients studied. A carefully controlled study to determine the dose response relationship would be needed to characterize the threshold dose of isoproterenol. Anesthetics may need to be administered during isoproterenol infusion to avoid undesirable awakening. BIS appears to be an important tool for the optimization of TIVA when isoproterenol is administered during cardiac catheter ablation.

S-313.

PHARMACOKINETICS OF DEPOBUPIVACAINE FOLLOWING INFILTRATION IN PATIENTS UNDERGOING TWO TYPES OF SURGERY AND IN NORMAL VOLUNTEERS

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INTRODUCTION: DepoBupivacaine (DB), a controlled-release formulation of bupivacaine in multivesicular liposomal DepoFoam[®], was designed to provide prolonged (72h) local analgesia after local administration into the wound. This analysis evaluated the pharmacokinetics (PK) of a single administration of DB compared with immediate-release bupivacaine hydrochloride (Bup) during inguinal herniorrhaphy, during total knee arthroplasty (TKA), and following subcutaneous administration in normal volunteers.

METHODS: During inguinal herniorrhaphy, 4 doses of DB were compared with commercial Bup (Table 1) in a randomized, double-blind, dose-ranging study. During surgery, 40 mL of DB or Bup/epi were infiltrated into tissue surrounding the wound. In patients undergoing TKA, 3 doses of DB were compared with Bup with epinephrine (Bup/epi) (Table 2) in a randomized, double-blind, dose-ranging study. During surgery, 60 mL of DB or Bup/epi were infiltrated into tissue surrounding the wound. In normal volunteers, we evaluated 4 doses of DB (Table 3) in a randomized 4-way crossover study. DB was administered subcutaneously at the flank. A standardized HPLC assay measured plasma concentrations and a single-compartment first-order model was used to calculate standard PK variables.

RESULTS: Administration of a single dose of DB during surgery resulted in sustained plasma concentrations of bupivacaine compared with Bup. C_{max} and AUC values were dose-proportional. Identical doses (300mg) in the surgical models delivered nearly identical C_{max} and AUC. However, subcutaneous infiltration of DB to normal volunteers resulted in much lower C_{max} and much higher AUC than surgical infiltration. Plasma concentration of bupivacaine following subcutaneous infiltration was nearly constant from 24 to 96 or more hours following administration, suggesting zero order release. In study subjects, plasma bupivacaine was only 5% of C_{max} at 216h, as predicted.

Table 1. Inguinal herniorrhaphy PK data

Parameter	DB				Bup
	175mg n=12	225mg n=12	300mg n=12	350mg n=14	100mg n=26
C_{max} (ng/mL)*	241±88	303±84	365±130	415±122	336±156
t_{max} (h) [†]	12.0	10.1	12.1	12.1	0.6
AUC _{0-12h} (ng·h/mL)*	9251±4068	9958±4196	16028±5455	18127±6931	4372±1560
$t_{1/2}$ (h)	15.9±6.7	14.0±5.1	14.6±4.6	18.9±6.2	8.5±2.9

*Mean±SD; [†]median.

Table 2. TKA PK data

Parameter	DB	300mg	450mg	Bup/epi
	150mg n=10	n=9	n=26	150mg n=7
C_{max} (ng/mL)*	217±86	351±123	500±173	170±102
t_{max} (h) [†]	24	24	24	24
AUC _{0-12h} (ng·h/mL)*	9794±5780	18702±8747	28913±12440	6587±4841
$t_{1/2}$ (h)	12.2±2.6	17.9±6.6	18.8±5.1	10.9±2.4

*Mean±SD; [†]median.

Table 3. SC PK data

Parameter	DB	300mg	450mg	600mg	750mg
	n=47	n=47	n=16	n=16	n=16
C_{max} (ng/mL)*	153±53	217±74	310±114	428±142	
t_{max} (h) [†]	55±21	54±37	49±34	55±33	
AUC _{0-12h} (ng·h/mL)*	9258±2275	12934±4312	18397±4860	24613±7560	

*Mean±SD; [†]median.

DISCUSSION: A single local administration of DB intraoperatively resulted in sustained plasma bupivacaine concentrations (>100ng/mL) in subjects undergoing inguinal hernia repair and TKA. Plasma bupivacaine concentration was dose-proportional across all doses studied.

S-314.

DOES RANITIDINE AFFECT MIVACURIUM AND ROCURONIUM POTENCY?

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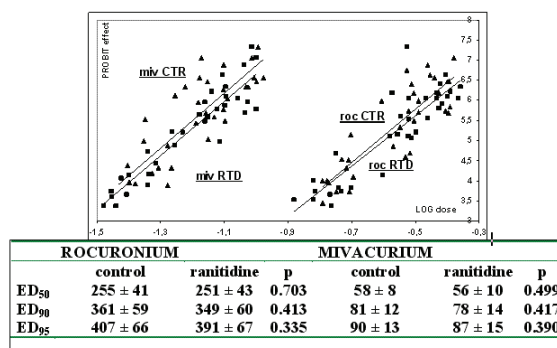
INTRODUCTION: Histamine H2 receptor antagonists are often used to increase pH and decrease the volume of gastric contents before induction of anesthesia ⁽¹⁾. According to some authors, ranitidine (RTD), a prototype of such drugs, inconsistently inhibits cholinesterase in vitro and can also produce neuromuscular block by another mechanism ⁽²⁾. Consequently, RTD interacts differently with depolarizing and non-depolarizing agents. Other potential differences results can be related to the route of administration. Conflicting clinical and contradictory experimental data joined together to give a complex final result for this subject. The aim of present trial is to study the potency of mivacurium (MIV) and rocuronium (ROC) after the use of RTD in the preanesthetic setting.

MATERIAL & METHODS: Two groups (n= 22 e/a) of adult, elective and consenting patients received fractional doses of MIV or ROC, either after placebo or intravenous RTD. After Log/dose and probit/effect conversion, a cumulative dose-response curve was obtained and ED₅₀, ₉₀ and ₉₅ were calculated for each patient. Electromyography and TOF stimulation were used for monitoring and analysis of variance and p<0.05 level, for statistical comparisons.

RESULTS: Any significant differences were noticed among ED's values when either placebo or RTD were used before MIV and ROC. Slope of the curves didn't show statistical differences between placebo and RTD for MIV (p= 0.328) nor ROC (p= 0.692) (Figure).

DISCUSSION: Experimentally in vivo RTD exerts a triphasic effect on succinylcholine action, producing potentiation first, reversal and again potentiation ⁽³⁾. Also in vivo RTD produced marked antagonism to neuromuscular paralysis induced by atracurium ⁽⁴⁾ and gallamine ⁽²⁾. In vitro, high RTD concentrations potentiate, and low concentrations antagonize the action of vecuronium ⁽⁵⁾. During clinical conditions neither onset nor recovery periods for vecuronium or MIV changed after RTD was administered ⁽⁶⁻⁷⁾. As RTD can be considered a poor enzyme inhibitor ⁽¹⁾, the possibility exists that a biphasic dose dependent neuromuscular effect could take place during RTD changes from low to higher concentrations, similar to that described during experimental assays ⁽⁸⁾. A final null effect resulting in such conditions and also similar to that described in vivo ⁽¹⁾ could explain the lack of action on MIV and ROC potency. In conclusion: present results show no clinical interaction between intravenous administered RTD and potency for MIV and ROC.

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S-315.

IMPACT OF MORBID OBESITY ON INTRAOPERATIVE INSULIN INFUSION REQUIREMENTS

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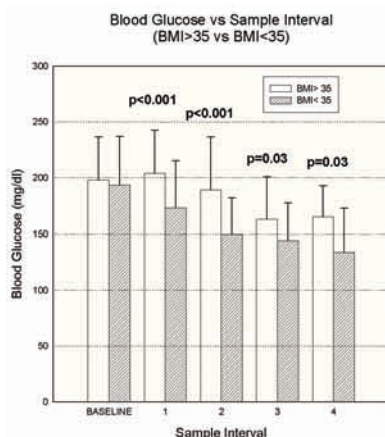
INTRODUCTION: Controversy exists regarding the role of tight glucose control in critically ill ICU patients (1,2). In patients requiring glucose management during noncardiac surgery however, data regarding the safety and efficacy of glycemic control is sparse. Furthermore, many variables influence the hyperglycemic response and the response to exogenously administered insulin. As such, we present our findings in intraoperative continuous insulin infusions for glycemic control, focusing on the effect of morbid obesity (MO) as defined by BMI > 35.

METHODS: Following IRB approval, 102 adult noncardiac surgery patients requiring glycemic control during general anesthesia were retrospectively studied. Patients with intraoperative blood glucose (BG) values > 150 mg/dl received a standardized intraoperative insulin infusion regimen, identical to that used in our ICU. The insulin infusion protocol is a multistep algorithm, with patients demonstrating insulin resistance being rapidly advanced to higher doses. Insulin boluses are excluded by protocol. Insulin infusions were targeted to BG of 80-150 mg/dl. No continuous dextrose infusions were used in any patient, though many patients did receive exogenous glucose in the form of preoperative antibiotics and other single dose medications. Regular BG determinations were performed, with recommended 60 minute testing intervals. Efficacy was determined by the rate of obtaining target BG (< 150 mg/dl). Statistical comparisons between BG values for MO and non-MO subjects were performed by unpaired t-tests with significance taken at p<0.05. All results are expressed as mean ± standard deviation (SD).

RESULTS: Thirty five MO and 67 non-MO subjects were included. Initial pretreatment BG values were similar in both groups (MO: 197.9±38.8 mg/dl, non-MO: 193.6±43.4 mg/dl). The non-MO group had reached goal BG by 2 hours, and remained there for the remainder of surgery. In the MO group, target BG was not reached at the end of the 4 hour data collection. At all time intervals MO patients remained significantly more hyperglycemic than their non-MO counterparts, even though their glucose values had placed the MO into higher dosage algorithms.

DISCUSSION: This retrospective pilot study demonstrates that although our ICU insulin infusion protocol can be effective in non-MO subjects in an operating room setting, it is not effective in controlling blood glucose values in MO patients. BMI > 35 mg/kg² is a predictor for decreased efficacy of glycemic control via insulin infusion, and suggests that these patients require a more aggressive starting treatment algorithm to attain glycemic control within the 4-5 hours typically required on our ICU.

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S-316.

INTRAVENOUS GLUCAGON FOR INTESTINAL RELAXATION DURING CYSTECTOMY AND DIVERSION PROCEDURES

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INTRODUCTION: Cystectomy and continent diversion (CD) procedures involve the creation of an artificial continent bladder from the patient's ileum or distal ileum and right colon for Indiana and Struder pouchs. These procedures have historically employed papaverine to relax and enlarge the bowel to achieve a larger and more functional neobladder for the patient¹. While papaverine has been effective there is no FDA indication for intestinal relaxation and its use is may be complicated by acute drops in blood pressure. Glucagon infusions have been used successfully for the purpose of intestinal relaxation in endoscopic and radiologic procedures with no hemodynamic instability associated with short term bolus or infusion². Our hypothesis was that glucagon would be associated with a lower incidence of hypotension compared with papaverine.

METHODS: With IRB approval, the records of 10 patients undergoing CD with glucagon infusion (G) and a reference group of the 20 randomly selected patients managed with papaverine (P) were reviewed. A glucagon solution was prepared 10 minutes prior to infusion by reconstitution of 1 IU in 50 ml normal saline. After cystectomy, a bolus of 4.8µg/kg was infused over 5 minutes followed by a continuous infusion of 9.6 µg/kg/h until bowel relaxation was found to be adequate and stopped at the surgeon's request. Mean arterial pressures (MAP) and pressor use were obtained from the electronic anesthesia record at 5 minute intervals for 30 minutes prior and 30 minutes during the infusion. Data were compared with paired t-test.

RESULTS: In 9/10 patients in G and 19/20 patients in P no significant decrease in MAP was observed. Total phenylephrine use was not significantly different between groups with G and P - 1333±810 µg vs. 1357±1119 µg (mean±STD). Surgeon perception of bowel relaxation was favorable. No complications attributable to glucagon were noted.

DISCUSSION: The principal limitations of this report are the small number of cases and retrospective nature of the report. The 10 patients in group G represent all such procedures performed in a large referral practice over an 8 month period, and while no significant differences in rates of hypotension or pressor use were observed, we cannot exclude the possibility that papaverine infusions were suboptimal for bowel relaxation. A larger multicenter study would be required to address these limitations.

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S-317.**PERIOPERATIVE ADMINISTRATION OF MAGNESIUM CONTAINING SOLUTION DID NOT IMPROVE THE POSTOPERATIVE SHIVERING OCCURRENCE RATE****AUTHORS:** A. Kuwabara;**AFFILIATION:** Anesthesiology, Tokyo Women's Medical University, Tokyo, Japan.

Postoperative shivering is likely to occur even in instances of controlled intraoperative temperature. Shivering is well known to increase prognostic or perioperative complications. When it actually does occur, the major coping strategies include the use of drugs such as meperidine and positive warming. In terms of drug dosage, the effects of various drugs have been reported. Among them is the effect of magnesium. Furthermore, magnesium reportedly lowers the shivering threshold (1). With the hypothesis that starting to administer magnesium-containing transfusion material before an operation is expected to lower the occurrence of shivering associated with the rapid loss of central effects of opioids by stopping the dose of remifentanyl as an opioid with short duration of effects, we performed a randomized control double-blind study. For this study, we received approval from this hospital's ethical committee and obtained informed consent from participants. We randomly divided 40 patients scheduled to undergo ureteroscopic operation (TUR-BT, TUL, and other non-abdominal surgeries) into two groups: a control group, in which subjects were administered magnesium-free Ringer solution before and during operation; and a magnesium-administered group, in which the subjects were administered a 0.1-g-magnesium-containing infusion solution before and during the operation. Starting from 21:00 on the day prior, infusion was continued until 10:00 of the day of the operation, at which time the patient entered the operating room. The infusion was continued during the operation in both groups. Anesthesia introduction and maintenance was controlled using TCI propofol and remifentanyl without muscle relaxants. The central tympanic temperature was measured every 5 min after the patient entered the operating room. For 15 min after the subject awoke, the presence of shivering was observed. The degree was observed using shivering scores when shivering occurred. Cular inspection and electromyography of the brachial region were used to observe shivering. Magnesium blood concentration was measured when the subject entered the operation room and when the operation was finished. The shivering occurrence rates were 5% in the control group and 5% in the magnesium-administered group. The blood concentrations of magnesium were 2.07mg/dl in the control group and 2.24mg/dl in the magnesium-administered group. When the operation was over, the tympanic temperature was 36.6°C in the control group and 36.2°C in the magnesium-administered group. Consequently, magnesium 2mEq/L-containing infusion solution administered before and during the operation did not improve the shivering occurrence rate.

S-318.**THE RELATIONSHIP BETWEEN THE CHOICE OF ANESTHETIC AGENTS AND EARLY POSTOPERATIVE SHIVERING AND PONV****AUTHORS:** M. Tani¹, H. Morimatsu², N. Tanioka², K. Sato², K. Morita²;**AFFILIATION:** ¹Anesthesiology, Chikamori Hospital, Kochi, Japan, ²Okayama University Hospital, Okayama, Japan.

INTRODUCTION: Shivering and postoperative nausea and vomiting (PONV) are uncomfortable post anesthesia complications and associated with further sequelae such as myocardial ischemia or aspiration. Some risk factors have been mentioned, however, there are few study investigated with multivariate model on shivering. Moreover we have some option for anesthetic agents and there is a possibility that the choice is associated with occurrence of the complications. We assessed risk factors and causative relationships for anesthetic agents and postoperative shivering and PONV in the recovery room with multivariate analysis.

METHODS: By retrospective chart review, we evaluated 358 adult postoperative patients undergone elective surgeries under general anesthesia. Patients were excluded if transferred to the intensive care unit. We collected the data on the occurrence of shivering and PONV, body temperature, duration of anesthesia, anesthetic method (sevoflurane based anesthesia or total intravenous anesthesia (TIVA) with propofol) and type of opioid (remifentanyl or fentanyl) used. Data were expressed as means with 95% confidence intervals or proportions. Comparisons between the groups were conducted using Student's t test or Fisher's exact test as appropriate. Multivariate logistic regression models were constructed to identify independent factors.

RESULTS: Shivering occurred in 27/358 (7.5%) patients. The occurrence was higher in the TIVA group (14.3%) than the sevoflurane group (3.0%) (P=0.006), and in the remifentanyl group (9.88%) than in the fentanyl group (4.03%) (P=0.033). In univariate model, age, duration of anesthesia, TIVA and remifentanyl were significantly associated with shivering (Table 1). However, age (P=0.03) was the only independent factor in multivariate model. TIVA and remifentanyl were not independent factors. PONV occurred in 43/358 (12.0%) patients. The occurrence was higher in the sevoflurane group (14.7%) than the TIVA group (2.2%) (P=0.0002). In univariate model, age, gender, and sevoflurane based anesthesia were significantly associated with PONV (Table 2). In multivariate model, however, sevoflurane based anesthesia (P=0.0084) and female (P=0.015) were independent factors.

DISCUSSION: Age was the only independent factor on shivering in the recovery room. The selections of TIVA or sevoflurane based anesthesia and remifentanyl or fentanyl did not relate to shivering. TIVA and gender are independent factors on PONV in the recovery room. The choice of remifentanyl or fentanyl was not associated with PONV.

Table1: Univariate analysis of factors on shivering

	Shivering + (n=27)	Shivering - (n=331)	P value
Age (yrs)	46.6 (40.1-53.2)	54.7 (52.9-56.6)	0.0196
Gender : male (%)	51.8	49.3	0.800
Body temperature (°C)	36.4 (36.18-36.69)	36.6 (36.49-36.63)	0.34
Duration of anesthesia (min)	319.1 (250.3-387.8)	248.3 (230.8-265.8)	0.050
Anesthesia : TIVA (%)	50.0	24.2	0.006
Opioid : remifentanyl (%)	76.9	56.3	0.033

Table2: Univariate analysis of factors on PONV

	PONV + (n=43)	PONV - (n=315)	P value
Age (yrs)	48.5 (43.3-53.7)	54.9 (53.0-56.8)	0.023
Gender : male (%)	27.9	52.1	0.002
Body temperature (°C)	36.6 (36.37-36.78)	36.5 (36.47-36.62)	0.080
Duration of anesthesia (min)	267.0 (220.1-313.9)	250.3 (231.9-268.6)	0.513
Anesthesia :TIVA (%)	5.00	28.7	0.0002
Opioid : remifentanyl (%)	45.2	59.2	0.089

S-319.

MUSCLE RELAXANTS POTENCY: M-NMT^(R) MODULE VS RELAXOGRAPH^(R) COMPARISON FOR ASSESSMENT

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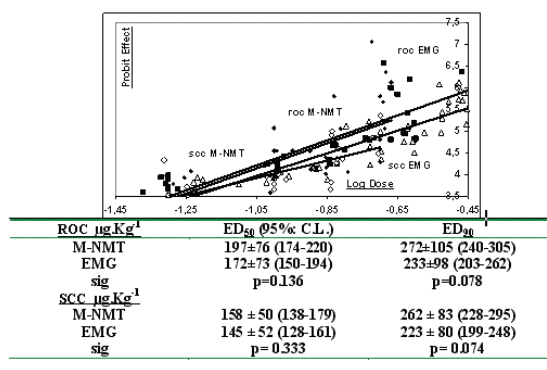
INTRODUCTION: For years we used electromyography (EMG) for neuromuscular clinical investigation and the Relaxograph[®] (Datex, Finland) devices for monitoring, until it's recently withdraws from active service. Since then M-NMT module (GE Health Care, Finland) was introduced for the same purposes. The aim of this trial is to compare first results obtained with M-NMT and those coming from previous EMG clinical research, both during rocuronium (ROC) and succinylcholine (SCC) dose-response curves development under the same clinical conditions.

MATERIAL & METHODS: Two adult, elective and consenting groups of patients anesthetized with intravenous agents-nitrous oxide, received single doses of ROC (42 to 416 $\mu\text{g}\cdot\text{Kg}^{-1}$) (n=85) or SCC (50 to 214 $\mu\text{g}\cdot\text{Kg}^{-1}$) (n=64) and maximal effect assessed either by EMG or M-NMT during strictly similar protocol. A regression line was obtained after log dose-probit effect transformation and ED_{50} and ED_{90} were calculated for each patient solving Hill's equation, considering γ as the Probit/Log ratio. T test and $p < 0.05$ significance level were used for statistical comparisons.

RESULTS: Neither zero (0) nor 100% effect was noticed and neuromuscular blockade ranged 2 to 98% during the entire procedure. Differences in potency and slope of the curves didn't reach statistical significance ($p = 0.518$ and 0.148 for ROC and SCC). Log-probit correlation (R^2) was 0.773 and 0.750 during EMG and M-NMT monitoring for ROC and 0.451 and 0.528 respectively for SCC. Solving regression line equations, both probit and effect were statistically satisfactory predicted (Figure).

DISCUSSION: M-NMT has been successfully used for acceleromyography during clinical research⁽¹⁾ and compared to mechano and phonomyography⁽²⁻⁴⁾. But due to confusing descriptions the same authors claim the device has not been scientifically validated⁽⁵⁻⁶⁾ and have poor and malfunctioning screen design as well⁽⁷⁾. Using M-NMT in the electromyographic mode, present results shows to be perfectible interchangeable with EMG. If the same clinical conditions are maintained during protocol, M-NMT module can be reasonable used for assessment and comparisons of the potency of muscle relaxants agents.

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S-320.

EFFECT OF INDUCTION OF FORCE-INJECTION WITH MIDAZOLAM ON STRESS RESPONSE TO TRACHEAL INTUBATION IN ELDERLY PATIENTS

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Midazolam, conducting as a commonly used medication for introduction, could induce respiratory depression and circulation inhibition dose dependently. Because geriatric patients may have altered drug distribution and diminished hepatic and/or renal function, reduced doses of midazolam are recommended. Accordingly, electing possible dosage of Midazolam which could decrease the stress response to tracheal intubation effectively and cut down the interference to respiration and circulation during the induction in elderly patients is a problem demanding attention.

The volume dose of midazolam during induction is 0.05mg/kg in this study. And we observe the effect of induction of force-injection with midazolam on haemodynamics and serum cortisol response to tracheal intubation in elderly patients.

sixty ASA I or II patients aged over 65-year-old weighing 61-74 kg undergoing selective operation under general anesthesia were randomized into 4 groups (n = 15 each) according to midazolam doses-0.01(I), 0.02 (II), 0.03 (III), 0.04(IV) $\text{mg}\cdot\text{kg}^{-1}$ before induction of anesthesia. Five minutes later, anesthesia was induced with midazolam (I $0.04\text{mg}\cdot\text{kg}^{-1}$, II $0.03\text{mg}\cdot\text{kg}^{-1}$, III $0.02\text{mg}\cdot\text{kg}^{-1}$ and IV $0.05\text{mg}\cdot\text{kg}^{-1}$), fentanyl $2\mu\text{g}\cdot\text{kg}^{-1}$, etomidate $0.3\text{mg}\cdot\text{kg}^{-1}$ and rocuronium $1\text{mg}\cdot\text{kg}^{-1}$. Tracheal intubation was performed at 1.5 min after rocuronium injection. BP (SBP and MAP), HR, SpO_2 and RR were continuously monitored and recorded resting state in room (T_1 , baseline), 5 min after midazolam injection (T_2), immediately before intubation (T_3), immediately and 1, 2, 3, 4, 5 min after intubation ($T_{4,5,6,7,8,9}$). Blood samples were taken from artery at T_1 and T_9 for determination of plasma serum cortisol concentration.

SBP, MAP and HR decreased significantly at T_2 as compared to the baseline values at T_1 in the experimental groups. Compared with those in the experimental groups, the SBP, MAP and HR and variation of SBP and HR at T_4 in group IV became higher. Compared with group III, in group I, the variation of SBP and HR decreased significantly. The serum cortisol was significantly smaller in group I, II and III at T_9 than at baseline. But it was contrary in group IV.

Induction of force-injection with midazolam can decrease the stress response to tracheal intubation in elderly patients effectively.

Regional Anesthesia

S-321.

WITHDRAWN

S-322.

LD50 FOR ACUTE LIPID ADMINISTRATION

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INTRODUCTION: Infusion of lipid emulsion has been shown to successfully reverse cardiovascular collapse caused by systemic local anesthetic toxicity. However, the upper limit of safety for acute lipid administration is unknown and has direct bearing on clinical management. We estimated the LD50 of acute lipid emulsion infusion in rats using the Dixon up-down method. We also assessed metabolic and histological consequences of high-dose lipid infusion.

METHODS: Intravenous line and ECG electrodes were placed in male Sprague-Dawley rats under general anesthesia. After recovery a single intravenous injection of 20% lipid emulsion was given over 30 minutes: 20, 40, 60, and 80 mL/kg. Triglycerides were measured immediately after infusion and surviving rats were sacrificed at 48 hours for determination of serum amylase, liver function tests and histological analysis of major organs.

RESULTS: There were no observable, adverse effects of acute lipid infusion. Dixon's "Up-Down" method (Figure 1) gave a maximum likelihood estimate for LD50 of 67.72 (S.E. \pm 10.69) mL/kg. Triglycerides were markedly elevated immediately after infusion in all animals, but returned to baseline levels at 48 hours. Lab abnormalities at 48 hours included elevated amylase (range, 1816-2804 U/L) and transaminases (e.g. AST, range 45-284 U/L) at all lipid doses. Histological appearance of heart, lung, liver, brain, and kidney were normal except vascular congestion and diffuse microvesicular steatosis was observed in the liver at 80 mL/kg.

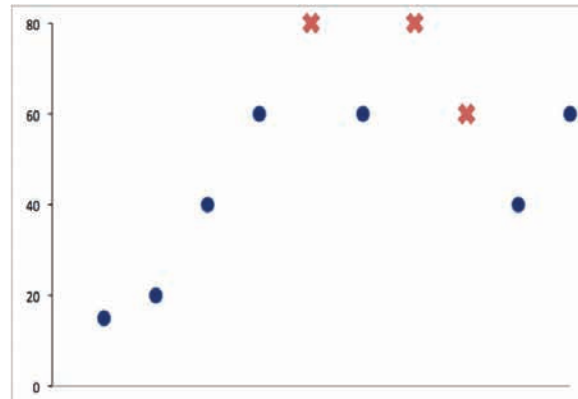


Figure 1: LD50 was estimated using the 'Up-Down' method which employs an iterative dose-selection algorithm; starting with an initial exposure of 20 mL/kg, each subsequent dosage was raised or lowered based on the survival of the preceding animal. Maximum likelihood estimate for LD50 with standard error was 67.72 \pm 10.69 mL/kg (n = 9).

DISCUSSION: Rapid intravenous lipid emulsion infusion is not without risks. However, the LD50 in rats is roughly an order of magnitude greater than that typically given in acute LA toxicity (published range, 1.2-6.0mL/kg). These data cannot be easily extrapolated to humans because of differences in PK/PD and size. Furthermore, lab abnormalities indicate potential adverse effects at all doses examined. Caution should be exercised in acute lipid emulsion infusion, especially in patients with compromised liver, lung or pancreatic function.

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S-323.**REGIONAL ANESTHESIA OR GENERAL ANESTHESIA FOR UPPER LIMB TRAUMA SURGERY: A CROSS-SECTIONAL SURVEY OF PATIENT EXPECTATIONS****AUTHORS:** B. D. O'Donnell¹, G. Iohom²;**AFFILIATION:** ¹Anaesthesia and Intensive Care Medicine, Cork University Hospital, Cork, Ireland, ²Cork University Hospital, Cork, Ireland.

INTRODUCTION: Regional anesthesia (RA) has several advantages compared to general anesthesia (GA) for upper limb surgery including improved analgesia, reduced postoperative nausea and vomiting, and earlier ambulation [1]. Public acceptance is essential to the practice of RA. Little is known regarding anesthesia-related expectations of patients presenting for upper limb trauma surgery (ULTS). We conducted a prospective cross-sectional survey of ULTS patients.

METHODS: Following ethics approval, patients admitted through the emergency room for ULTS were invited to participate in the survey. A 32-item questionnaire was designed exploring prior anesthetic experience, knowledge of anesthesiologists and anesthesia, expectations of anesthesia, the preoperative anesthesia visit and factors influential in choice of anesthesia.

Patients were encouraged to complete the questionnaire independently. Assistance was permitted at the patient's request or in the case of dominant upper limb injury.

Data were analyzed using EpiInfo™ 2002 (Centers for Disease Control and Prevention, USA) statistics software.

RESULTS: Two hundred and twenty three patients were invited to participate. Thirty-one patients were excluded due to: literacy problems (n=2); failure of questionnaire completion (n=12); questionnaire loss (n=7); language difficulties (n=3); unknown (n=7). The survey was completed by 192 patients (86%).

Table 1 summarises group characteristics and survey results. Anesthesiologists were correctly identified as doctors by 52% of respondents. 58% indicated likely acceptance of a nerve block technique. Most were unaware of their planned anesthesia (53%), while 93% had not been visited by an anesthesiologist. The surgeon was the most common information source regarding anesthesia (40%). Most respondents believed anesthesia involved 'going to sleep' (82%) and 71% expected to receive GA.

The preoperative anesthesia visit was rated as important by 65% of patients and 78% indicated the provision of information would increase the likelihood of RA acceptance. Information regarding perioperative analgesia and postoperative nausea and vomiting would influence over 80% in favouring RA. 47% indicated their preferred level of intraoperative sedation as heavy, while 23% indicated a preference for no sedation.

DISCUSSION: This survey highlights a knowledge deficit amongst patients with regard to the potentially advantageous role of RA in ULTS. Patient expectations centre on the provision of GA, while most surveyed indicated willingness to accept RA if appropriate information were provided prior to surgery. Most patients indicated acceptance of RA for ULTS with no or light sedation. A structured and timely anesthesia preoperative visit may improve the uptake of RA for ULTS. The surgeon, as the first patient information source, has an important role to play. Patient awareness and acceptance of RA is essential.

Table 1 Summary of Key Survey Results

Age Median [Range]	35 [17-77]
Sex	Male 128 (67%) Female 64 (33%)
ASA Status	I 145 (75.5%) II 38 (19.8%) III 9 (4.7%)
Question	'Yes' Response % (95% CI)
Prior Anesthesia Experience	
Previous Anesthesia	59% (52-66)
Type of Anaesthesia	GA (93%) Local Anesthesia (5%) Spinal/ Epidural (2%)
Complications Attributed to Anesthesia	None (81%) PONV (11%) Other (8%)
Knowledge about Anesthesiologists and Regional Anesthesia	
An anesthesiologist is:	Doctor with specialist training 52% (45-59) Technician 19% (14-25) Don't Know 17% (12-23) Nurse with specialist training 7% (4-12) Surgeon in training 5% (3-9)
I learned about anesthesia from	Anesthesiologists 23% (18-30) Other 22% (16-28) TV 18% (13-24) Word of Mouth 16% (11-22) Nurses 10% (7-16) Surgeons 7% (4-12)
Are you aware that you could have your procedure performed by making your arm numb?	45% (38-52)
Have you heard of nerve blocks or regional anesthesia?	32% (26-39)
Have you been to the dentist and had a procedure using local anesthesia?	79% (72-84)
The Preoperative Visit	
Do you expect to see your anesthesiologist prior to surgery?	66% (59-73)
Is it important to see your anesthesiologist prior to surgery?	65% (59-73)
Have you had the opportunity to discuss anesthesia with an anesthesiologist?	7% (4-12)
A visit from my anesthesiologist will:	
	Answer questions 92% (87-95) Reduce fear 90% (85-94) Increase satisfaction 89% (83-93)
The provision of information would increase the likelihood of acceptance of nerve block anesthesia.	78% (72-84)
Expectations Regarding Anesthesia for Upper Limb Surgery	
Would you be happy to have your procedure performed using a nerve block?	58% (51-65)
Those unhappy (n=81) indicated why:	
	'Want to be asleep' 31% (21-43) 'Don't know, don't like the idea' 25% (16-36) 'Don't want to hear the operation' 20% (12-30) 'Fear of pain' 16% (9-26) Other 8%
When you think of anesthesia what do you imagine?	
	'Go to sleep' 82% (76-87) 'Have numb arm' 11% (7-16) 'No thoughts or expectations' 7% (4-11)
What anesthesia do you expect?	
	'General Anesthesia' 71% (64-77) 'Nerve Block' 8% (4-13) 'Combination of both' 4% (2-9) 'No thoughts or expectations' 17% (12-23)
Have you been told what type of anesthesia you will receive?	47% (40-55)
If so, who informed you as to the type of anesthesia you will receive? (n=91)	
	Surgeon 40% (30-50) Surgical resident 25% (17-36) Nurse 25% (17-36) Anesthesiologist 10% (5-18)
Factors which may influence anesthesia choice	
Regional anesthesia for upper limb surgery improves pain relief for up to 24 hours, would this influence your anesthetic choice?	80% (74-86)
Regional anesthesia for upper limb surgery reduces postoperative nausea and vomiting, would this influence your anesthetic choice?	81% (74-86)
Please indicate the level of sedation you would like to receive if you were to have regional anesthesia:	
	None 23% (17-30) Light Sedation 'Arousable to voice' 30% (23-37) Heavy Sedation 'Deeply sedated' 47% (40-55)
Please indicate on a scale of 0-5 the importance of the following if you are making a choice of anesthetic technique:	Mean (SD)
	Safety 3.7 (1.7) Better pain relief 3.5 (1.6) Skill of anesthesiologist 3.4 (1.8) Earlier ambulation 2.9 (1.7) Less nausea and vomiting 2.8 (1.6)

REFERENCES 1. Anesth Analg 2005; 101:1634 -42.

S-324.

CONTINUOUS PARAVERTEBRAL NERVE BLOCKS FOR POSTOPERATIVE PAIN MANAGEMENT AFTER SECONDARY BREAST RECONSTRUCTION USING TISSUE EXPANDERS

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INTRODUCTION: Secondary breast reconstruction of one or both breasts with tissue expanders is recognized as one option following radical mastectomy. ¹This study was designed to assess the effectiveness of a continuous paravertebral block (CPVB) for the postoperative pain management following Secondary breast reconstruction with tissue expanders.

METHODS: This case series consisted of 10 consecutive patients who underwent secondary breast reconstruction of one or both breasts with tissue expanders and with uni or bilateral CPVB performed prior to surgery using a blind approach.² After appropriate determination of surface landmarks, an 18 gauge Touhy needle was introduced 2.5 cm lateral from the spinous process at the level of T4 and injected with 15 ml of ropivacaine 0.5%. A 20 gauge epidural catheter was placed in the paravertebral space. In the recovery room, each paravertebral catheter was infused with ropivacaine 0.2% (7-10 ml/hr). Postoperative pain scores using a verbal analogue scale (VAS; 0=no pain to 10 = worst possible pain) and morphine consumption were collected over the first 24 hrs. Data are presented as mean \pm SD.

RESULTS: Patients age was 47.5 ± 9.2 years, weight was 63.9 ± 16.2 kg and height was 162.3 ± 5.9 cm. In the recovery room, the first VAS was 3.5 ± 1.9 . Over the first 24 hrs VAS was 1.9 ± 2.0 and morphine consumption was 25 ± 20 mg. No complications secondary to continuous paravertebral infusion were observed.

DISCUSSION: This study suggests that CPVB provides effective and lasting postoperative analgesia in patients undergoing secondary breast reconstruction of one or both breasts with tissue expanders.

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2. Can J Anaesth 2008; 55:587-94

S-325.

SAFETY OF LONG-TERM TUNNELED EPIDURAL CATHETER FOR MANAGING TOTAL KNEE ARTHROPLASTY PATIENTS WITH RESTRICTED MOTION

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INTRODUCTION: Despite advances in surgical technology and perioperative anesthetic management, poor range of motion after primary and revision total knee arthroplasty (TKA) can result from inadequate postoperative analgesia, which limits patient participation in physical therapy (Surg Technol Int. 2006;15:221-4). Range of motion is an important measure of outcome after TKA (J Bone Joint Surg Br 2007;89:893-900). This study describes the short-term safety and efficacy of prolonged indwelling tunneled epidural catheters to manage post-procedural pain in patients with or at risk for restricted motion after TKA.

METHODS: 101 consecutive tunneled epidural catheters were placed in patients with a history of chronic pain and/or poor range of motion prior to TKA or procedures to treat restricted range of motion after TKA. Fluoroscopy was used to direct the tip of the tunneled epidural catheter ipsilaterally to permit the use of low concentrations of local anesthetics. The catheters were left in place for 4-6 weeks postoperatively. Patients were sent home with home health care nursing and out patient physical therapy. Pre- and post-procedural range of motion, pain scores, and complications were assessed.

RESULTS: Epidural catheters were maintained an average of 39.4 days. Epidural related complications were rare when assessed over a mean follow up of 205 days after the catheter was removed. There was significant improvement in range of motion and decreases in pain scores were achieved with this described protocol for patients with stiff TKA. From a mean preoperative flexion of 84.6° , postoperative improvements were seen during the epidural infusion period (98.5° , $P < 0.0001$), at six weeks (101.4° , $P < 0.0001$) and at the latest follow-up (103.8° , $P < 0.0001$). Pain rating, as measured by a 0-10 verbal rating scale (10 is the worst pain), showed a significant decrease over time ($P < 0.0001$) from a preoperative value of 6.5 ± 2.7 to a value of 3.6 ± 2.6 ($P < 0.0001$) during (average of 6 weeks results) the indwelling catheter period. Patients who underwent revision TKA for preoperative stiffness demonstrated the largest increase in flexion from a mean of 67.1° to a mean of 102.5° degrees at the latest follow-up visit ($P < 0.0001$). There were no instances of catheter related spinal infections or complaints of spinal headache, but two patients sustained falls in the early post-operative.

DISCUSSION: The long-term tunneled epidural catheter technique is a safe and effective method to provide a prolonged delivery of effective analgesia to high risk patients in whom this is critical for optimizing functional outcomes after TKA.

S-326.**CONTINUOUS POPLITEAL AND SAPHENOUS BLOCK FOR FOOT SURGERY****AUTHORS:** B. L. Ladlie;**AFFILIATION:** Anesthesiology, Mayo Clinic Florida, Jacksonville, FL.

INTRODUCTION: Unexpected hospital admission and extended hospital stay are common following foot and ankle surgery due to inadequate postoperative pain control (1-2). In an attempt to improve patient satisfaction and achieve painless foot and ankle surgery we began placing continuous saphenous blocks with continuous popliteal blocks. We present a case series of eight patients who underwent foot and ankle surgery with the use of a dual infusion pump for post-operative pain control.

METHODS: We enrolled eight ankle surgery patients (table 1). Following lateral placement of PSNB, an ultrasound (US) guided trans-sartorial approach was used for the saphenous blocks. The vastus medialis was identified then scanned medially to locate the saphenous nerve deep to the sartorius. A Contiplex (B-braun) needle was directed in plane (Fig 1) and 10 ml 0.5% ropivacaine injected prior to threading a catheter 3-5 centimeters. Patients received a disposable elastomeric pump (On-Q) containing 600 ml 0.2% ropivacaine. The pump has dual ports with dial controlled flow rate. We recorded pain scores and narcotic usage daily by phone and the patients removed their own catheters when the pump was empty.

RESULTS: Eight patients were included in the series. Three patients required re-evaluation after discharge. Of the patients who returned to the hospital for evaluation for incomplete analgesia, two received no relief from saphenous catheter boluses but good analgesia after a popliteal bolus. The third patient's pain was completely relieved by saphenous bolus. The final three patients had pain scores ranging between 0/10 and 2/10 without further intervention after placement.

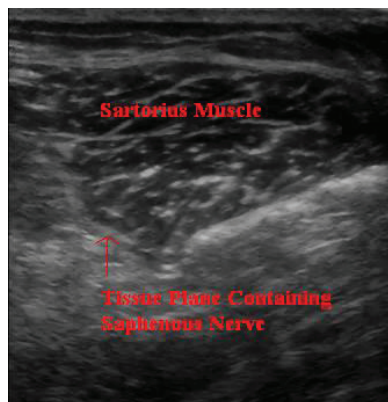
DISCUSSION: Possible advantages of a dual catheter technique are encouraging and bring complete analgesia of long duration within reach. It does require experience with US, catheter techniques, and a system for follow-up. It remains unclear what infusion rates will yield the best results. With increasing experience, we expect to determine which surgeries merit both catheters and whether an effective PSNB is dependent on a bolus function.

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1. (1998). "Unanticipated admission after ambulatory surgery--a prospective study." *Can J Anaesth* 45(7): 612-9.
2. (1991). "Outpatient orthopedic surgery: a retrospective study of 1996 patients." *Can J Surg* 34(4): 363-6.

Table 1

Patient	Surgery	Gender	Age (Years)
1	R ankle arthrodesis	M	81
2	R subtalar fusion	M	55
3	L chevron osteotomy	F	46
4	R total ankle replacement	F	48
5	Removal hardware R ankle	F	55
6	L foot excision of accessory navicular bone	M	56
7	Tarsal metatarsal joint arthrodesis	F	47
8	R foot excision of accessory navicular bone	M	28

**S-327.****CONTINUOUS PARAVERTEBRAL NERVE BLOCKS FOR POSTOPERATIVE PAIN MANAGEMENT AFTER RADICAL MASTECTOMY WITH AXILLARY NODE DISSECTION (RMAND)****AUTHORS:** G. M. Moreno¹, S. McElroy¹, I. Colaizzi¹, T. Fleming¹, J. E. Chelly²;**AFFILIATION:** ¹Division of Acute Interventional Perioperative Pain, UPMC Magee Hospital, Pittsburgh, PA, ²Division of Acute Interventional Perioperative Pain, UPMC Magee Hospital, Pittsburgh, PA.

INTRODUCTION: Although single paravertebral blocks (SPVB) has been demonstrated to provide effective postoperative analgesia, their effects are usually short lasting.^{1,2} This study was designed to assess the effectiveness of a continuous paravertebral block (CPVB) for the postoperative pain management following RMAND.

METHODS: This case series consisted of 10 consecutive patients who underwent RMAND with the same surgeon and with CPVB performed prior to surgery using a blind approach.³ After appropriate determination of surface landmarks, an 18 gauge Touhy needle was introduced 2.5 cm lateral from the spinous process at the level of T1-T2 and injected with 15 ml of ropivacaine 0.5%. An epidural catheter was placed in the paravertebral space. In the recovery room, each paravertebral catheter was infused with ropivacaine 0.2% (7-10 ml/hr). Postoperative pain scores using a verbal analogue scale (VAS; 0=no pain to 10 = worst possible pain) and morphine IV consumption were collected over the first 24 hrs. Data are presented as mean (range).

RESULTS: Patients age was 62.1 (35-87) years, weight was 69 (52-87) kg and height was 161 (152-173) cm. In the recovery room, the first VAS was 4.5 (0-8). Over the first 24 hrs VAS was 2.2 (0-4) and morphine IV consumption was 12.5 (1.5-24.5) mg. Side effects reported during the postoperative period were nausea 3% and itching 1%. None patients reported vomiting or other side effect secondary to opioids. No complications secondary to continuous paravertebral infusion were observed.

DISCUSSION: This study suggests that CPVB provides effective and long lasting postoperative analgesia in patients undergoing RMAND. With this techniques the morphine consumption was 12.5 mg compared to 40 mg of morphine reported with the use either of SPVB at T4 or a wound infusion (WI).² Furthermore, the side effects provide associated with the use of this technique appears to be more favorable than the use either of SPVB at T4 or WI.² Thus, with SPVB or WI PONV were more frequent.

CONCLUSION: This study supports the concept that CPVB at T1-T2 represents a more effective and safe alternative to postoperative pain than SPVB at T4 or WI for patients undergoing RMAND

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1. *Anesth Analg* 2008;106: 997-1001.
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S-328.

ULTRASOUND VERSUS ELECTRICAL STIMULATION GUIDANCE FOR FEMORAL PERINEURAL CATHETER INSERTION: A RANDOMIZED, CONTROLLED TRIAL

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BACKGROUND: Femoral perineural catheters have proven analgesic benefits following knee surgery.^{1,2} However, the optimal method to place the catheter in close proximity to the femoral nerve is still undetermined. Electrical nerve stimulation-based and ultrasound-guided approaches for femoral perineural catheter placement have been described,^{1,3} but no study has compared these two techniques in a randomized fashion. Therefore, we tested the null hypothesis that femoral perineural catheters, placed using nerve stimulation alone or *via* ultrasound-guidance alone, require similar times for placement and produce equivalent results.

METHODS: Preoperatively, subjects scheduled for knee surgery with a femoral perineural catheter for postoperative analgesia were randomly assigned to either the nerve stimulation (NS) or ultrasound (US) technique. The primary outcome was the procedural duration (min), starting when the ultrasound probe (US group) or catheter-placement needle (NS group) first touched the patient and ending when the catheter-placement needle was removed after perineural catheter insertion. For the NS group, the target nerve was located using a stimulating current < 0.6 mA with the placement needle, a stimulating catheter was advanced 3-5 cm beyond the needle tip while maintaining a motor response at a current < 0.8 mA, and a 40 mL bolus of mepivacaine 1.5% with epinephrine 2.5 mcg/mL was administered *via* the catheter. For the US group, the target nerve was located using ultrasound, 40 mL of mepivacaine 1.5% with epinephrine 2.5 mcg/mL was administered *via* the needle circumferentially around the nerve, and a flexible epidural catheter was placed and confirmed using ultrasound.

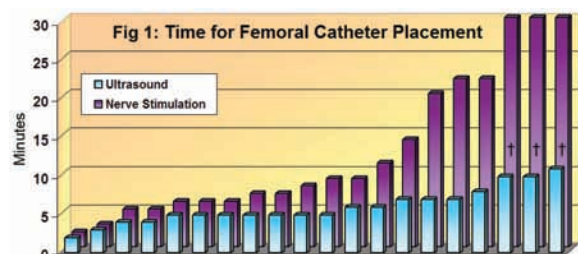
RESULTS: Femoral perineural catheters placed by US (n=20) took a median (10th-90th %ile) of 5.0 (3.9-10.0) min compared to 8.5 (4.8-30.0) min for NS (n=20, p=0.012, Figure 1). Secondary outcomes are presented in Table 1.

DISCUSSION: Placement of femoral perineural catheters takes less time using US-guidance compared to NS. In addition, procedure-related pain scores and incidence of vascular puncture are lower when using US.

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Table 1. Secondary outcomes

	Group US (n=20)	Group NS (n=20)	P-value
Placement success rate (%)	100%	85%	NS
Vascular puncture (#)	0	4	0.039
Discomfort (NRS 0-10) during placement [median (10 th -90 th %iles)]	0.5 (0.0 - 3.1)	2.5 (0.0 - 7.6)	0.015
Fluid leakage at site (#)	1	3	NS



S-329.

ADJUVANT DEXAMETHASONE PROLONGS THE DURATION OF INTERSCALENE BLOCK WITH BUPIVACAINE; A PROSPECTIVE RANDOMIZED TRIAL

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BACKGROUND: Dexamethasone has been recently used as an additive to improve the quality and duration of local anesthesia. However, there has been no study to examine different doses of dexamethasone following a peripheral nerve block. We have studied the effects of addition of two different doses of dexamethasone on duration and quality of interscalene block in patients undergoing shoulder surgery in ambulatory surgery settings.

METHODS: The study design was reviewed and approved by institutional review board for human subjects. After obtaining an informed consent, a total of 90 patients undergoing shoulder surgery using interscalene block with 0.5% bupivacaine were randomly assigned into three groups: Group (CTRL) received no additive, group (Low) received 4 mg and group (High) received 8 mg dexamethasone added to the mixture of local anesthetic. Post-operative analgesia was assessed using the Visual Analog Pain Scale and the Post-Operative Opioid Consumption. Analysis was by intention to treat. Statistical significance was tested using a two-way analysis of variance.

RESULTS: Four patients were excluded from the study due to either a failed block or inadequate follow up. Dexamethasone prolonged the duration of analgesia (21.6±2.4 [Low], 25.2±1.9 [High] vs. 13.3±1.0 hours) and duration of motor block (36.7±4.1 [Low], 39.2±3.9 [High] vs. 24.6±3.3 hours) when compared to controls (P<0.05). Post-operative opioid consumption (equipotent oral morphine) for the first 48 hours was significantly lower in dexamethasone groups (35.0±4.6 [Low] and 29.4±4.2 [High] mg vs. 52.4±5.2 mg) in the control group (p<0.05). There were no adverse events related to dexamethasone during the 4-week follow up period.

CONCLUSION: The addition of dexamethasone to bupivacaine significantly prolonged the duration of motor block and improved the quality of analgesia following interscalene block. There is no difference between low dose and high dose of dexamethasone in duration of analgesia and motor block.

Post-operative pain and demographic data

	Low Dose Dexamthasone 4 mg (N=28)	High Dose Dexamthasone 8 mg (N=30)	CTRL No additive (N=28)
Age mean(range)	45.29 (18-78)	43.65 (16 - 66)	50.06 (18 - 66)
Gender (M/F)	23/5	20/10	17/11
Mean surgical time (min)	112±24	103±18	109±19
Mean analgesia duration (hr)	21.6±2.4	25.2±1.9	13.3±1.0

S-330.**ENHANCED ULTRASONIC NEEDLE VISUALIZATION USING ACOUSTIC RADIATION FORCE IMAGING METHODS**

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INTRODUCTION: Acoustic radiation force imaging methods can improve the visualization of peripheral nerves for regional anesthesia (RA) procedures over conventional B-mode images by taking advantage of the mechanical contrast that exists between nerves and their adjacent soft tissue structures (e.g., muscle, fat, fascia) [1,2]. While improved nerve visualization will help anesthesiologists during RA procedures, equally important is accurate visualization of needles relative to the nerves of interest. It is known that needles can be difficult to visualize in B-mode images (1) when they are at steep angles of insertion relative to the transducer face, and (2) when they are misaligned with the imaging plane. This work investigates the use of Acoustic Radiation Force Impulse (ARFI) imaging to improve needle visualization by overcoming the fundamental acoustic limitations of B-mode imaging and taking advantage of the mechanical differences between needles and soft tissues.

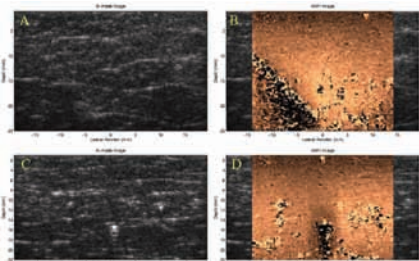
METHODS: ARFI imaging was performed using a modified Siemens Antares scanner with linear arrays operating between 4-10 MHz. Multiple radiation force excitation focal depths (10-25 mm) were utilized to visualize structures over a range of depths. ARFI imaging was performed in excised bovine muscle with different gauge needles inserted at different orientations relative to the ultrasound transducer. ARFI imaging was also performed in vivo to evaluate the improvement in visualizing needles relative to nerves. B-mode and ARFI data were acquired concurrently, providing exact spatial registration.

RESULTS: Needles at steep angles of insertion (> 50 degrees) are readily apparent in ARFI images, but are not visualized in corresponding B-mode images, as demonstrated with an 18G needle in excised bovine muscle in Figs. A & B. Needles in cross-section are also more readily visualized in ARFI images compared with B-mode images. Figs. C & D show an 18G needle oriented parallel to the transducer face in cross-section in excised bovine muscle. Similar improvements in needle visualization have been demonstrated in vivo with needles performing injections near the brachial plexus and sciatic nerves.

DISCUSSION: ARFI images provide contrast improvements of >600% over B-mode images for both nerve and needle visualization. While needles are brightly hyperechoic when properly aligned with a B-mode imaging plane, misalignment and moderate angles of insertion can cause the majority of acoustic energy to be reflected away from the transducer face. In contrast, ARFI needle images show mechanical perturbations the needles create in the surrounding soft tissue, which are independent of needle orientation. This provides more robust RA image guidance that will provide anesthesiologists with additional injection approaches and improve outcomes.

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**S-331.****ASSESSMENT OF THE VERTEBRAL ROTATION ON THE BASIS OF POSTEROANTERIOR RADIOGRAPHIC MEASURES IN SCOLIOSIS**

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INTRODUCTION: The complicated nature of the three dimensional deformity in scoliosis will lead to technical difficulties in performing the spinal and epidural block procedure. Accurate preoperative prediction of vertebral rotation is therefore essential in scoliosis patients. Several authors have studied rotation of the vertebra around the longitudinal axis in scoliotic spinal deformity. It remains unclear, however, whether vertebral rotation positively correlate with curvature of scoliotic spine. Thus, this study aimed to assess the vertebral rotation on the basis of posteroanterior radiographic measures.

METHODS: After obtaining approval from the human ethics committee of our hospital, we retrospectively reviewed chest and abdominal radiographs of 190 consecutive scoliosis patients aged over 65 years undergoing upper and lower abdominal surgery. Subsequently, 18 patients who met the criteria were included in the further analysis. Inclusion criteria consisted of: Cobb angle greater than 10 and smaller than 30 degrees on the posteroanterior radiograph; and transaxial computed tomography presenting the vertebrae of interest available. All radiographic measurements were conducted by one reviewer, while measures included Cobb angle on the plain radiographs and vertebral rotation on the computed tomography images. Vertebral rotation to the convex side was measured relative to the midsagittal plane at the apical vertebra level. Radiographic measures were analyzed statistically using the simple linear regression analysis with Graphpad Prism 4.03 (GraphPad Software Inc., San Diego, CA).

RESULTS: Median (range) age, weight and height of the patients at the time of surgery were 77 years (68-83), 45.07kg (32-68) and 153.28 cm (145-161.2), respectively. Curvature of the spine started from Th11 to L3, ended at L3 to L5 and apical vertebrae were located at Th11 to L4. The median degrees of Cobb angle and vertebral rotation were 16.72degrees (range, 10.5-26.2) and 9.53 degrees (range, 3.8-23.0), respectively. Lateral curvature of all patients was accompanied by vertebral rotation in the same direction. However, the degree of vertebral rotation was not found to be significantly correlated with the degree of Cobb angle, based upon simple linear regression analysis ($r^2=0.06$).

DISCUSSION: In some clinical situations, spinal and epidural block may be beneficial for patients with scoliosis. Spinal deformity, however, will cause hazardous multiple attempts at block procedure. Improved knowledge of the three dimensional deformity will help the spinal and epidural block procedure in scoliosis. In our study, median degree of vertebral rotation was less than 10 degrees and was, in addition, not associated with Cobb angle, although our study population would include scoliosis patients of various etiologies. In conclusion, vertebral rotation or lateral alignment of the needle insertion direction will be negligible concern during spinal and epidural block procedure in patients with mild scoliotic spinal deformity.

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ULTRA-SOUND GUIDED NEUROAXIAL ANESTHESIA; ACCURATE DIAGNOSIS OF *SPINA BIFIDA OCCULTA* BY ULTRASONOGRAPHY

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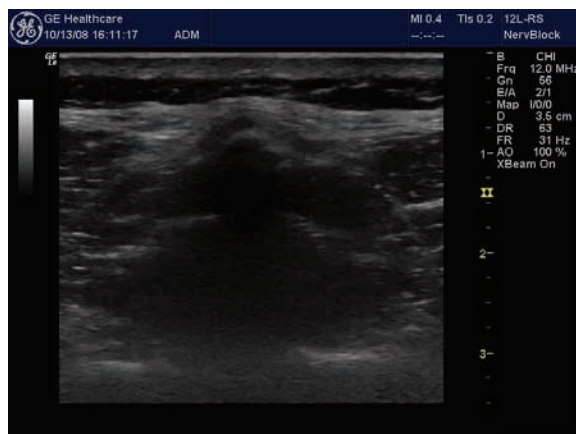
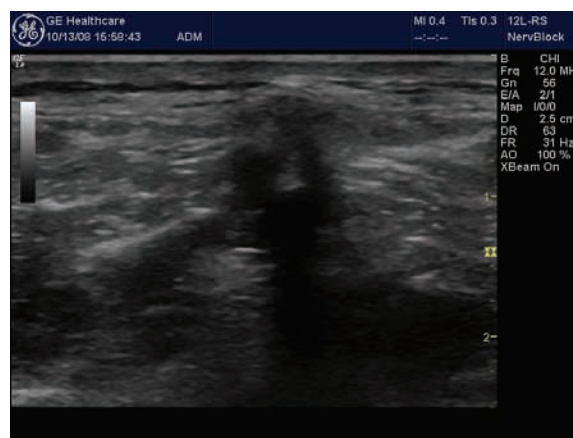
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INTRODUCTION: Spina bifida, a congenital malformation that results from an incomplete closure of the embryonic neural tube, is characterized by an incompletely formed spinal cord and by the incompletely fused vertebrae. It is one of the most common birth defects worldwide with an incidence of ranging 0.2-3 cases per 1000 births. In patients with the mildest form of the disease *spina bifida occulta*, the skin at the site of the disease is usually normal, and they live free of any symptoms related to the disease. However, because the most common areas of the malformation are the lumbar and the sacral area, serious complications may unavoidably take place when neuroaxial anesthesia is used in patients with *spina bifida occulta*. Recently, ultrasound imaging of the lumbar spine has been shown to facilitate the identification of the landmarks necessary for neuroaxial anesthesia. We have studied whether ultrasound guidance for neuroaxial anesthesia accurately enables to diagnose “the hidden” cases of *spina bifida occulta*.

METHODS: The spine images were visualized from the normal individual as well as the patient with *spina bifida occulta* by placing the linear high-resolution high frequency transducer probe perpendicular to the long axis of the spine (transverse view).

RESULTS: The vertebral body and its associated transverse processes as well as spinous process were clearly visualized from the normal individual. The spinous process was identified as a small hyperechoic signal just underneath the skin. Beneath the spinous process, the hypoechoic triangular shadow can be visible, which corresponds to the vertebral body (Fig.1). Contrarily, the spinous process can be hardly visible in the patient with *spina bifida occulta* in where the disease is located. More prominently, within the vertebral body, it was split by the aniso- hyperechoic region, which reflects the connective tissue inside the vertebral body and the deformity of the spinous processes (Fig.2).

DISCUSSION: The use of ultrasound imaging efficaciously enables to diagnose “the hidden” cases of *spina bifida occulta*. *Spina bifida occulta* may occasionally coincide with “tethered cord syndrome (TCS)” and the use of neuroaxial anesthesia in “hidden” cases may cause serious neurological complications. The possible complications can be avoided by the use of ultrasound guidance.



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