ANESTHESIA
&
ANALGESIA

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, and the Society for Technology in Anesthesia

Abstracts of Posters Presented at the International Anesthesia Research Society 80th Clinical and Scientific Congress San Francisco, California March 24-28, 2006

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IARS SCA SPA SAMBA ISAP STA

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SOCIETY OF CARDIOVASCULAR ANESTHESIOLOGISTS (SCA) is a nonprofit, educational foundation and is a recognized sub-specialty organization of the American Society of Anesthesiologists. Membership dues for 2006 are $175 which include a reduced-rate subscription to ***ANESTHESIA & ANALGESIA***. *Residents/Fellows*: see *Joint Resident/Fellow Membership* information below. All SCA membership payments and correspondence should be sent to: SCA, 2209 Dickens Road, P.O. Box 11086, Richmond, Virginia 23230-1086. Telephone (804) 282-0084; Fax (804) 282-0090; e-mail: sca@societyhq.com; Web site: www.scahq.org

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SOCIETY FOR TECHNOLOGY IN ANESTHESIA (STA) The Society for Technology in Anesthesia is an international organization of physicians, engineers, students, and others with an interest in anesthesia-related technologies. Membership is open to all who are interested. The Society's mission is to improve the quality of patient care by improving technology and its application. The Society promotes education and research, collaborates with local, national, and international organizations, sponsors meetings and exhibitions, awards grants, and recognizes achievement. Membership dues for 2006, Regular Membership is $100 annually; Student/Resident membership is free. Add *Anesthesia and Analgesia* for only $85. All STA correspondence should be sent to: STA, Attn: Jackie Dzurilla-Cencer, 2 Summit Park Drive, Suite 140, Cleveland, OH 44131. Telephone (216) 447-7864; Fax (216) 642-1127; e-mail: STAhq@AnesTech.org; Web site: www.AnesTech.org

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Abstracts of Posters Presented at the International Anesthesia Research Society 80th Clinical and Scientific Congress San Francisco, California March 24-28, 2006

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Cardiothoracic and Vascular - Basic Science	S-16 – S-47
Cardiothoracic and Vascular - Clinical	S-48 – S-71
Critical Care Medicine and Trauma	S-72 – S-94
Economics, Education and Patient Safety	S-95 – S-134
Equipment/Monitoring	S-135 – S-180
Neuroanesthesia	S-181 – S-196
Obstetric Anesthesia	S-197 – S-204
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Pediatric Anesthesia	S-244 – S-259
Pharmacology - Basic Science	S-260 – S-275
Pharmacology - Clinical	S-276 – S-307
Regional	S-308 – S-330
Author Index:	S-331 – S-341

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IARS 80th Clinical and Scientific Congress
Abstract Presenter Presentation Schedule

Ambulatory Anesthesia

(S-1) Patteson, S.K., Saturday 3:00
(S-2) Montes, F.R., Saturday 3:00
(S-3) Alhashemi, J.A., Saturday 3:00
(S-4) Khafagy, H.F., Saturday 3:00
(S-5) Kawai, M., Saturday 3:00
(S-6) Grinberg, A., Saturday 3:00
(S-7) Seif, M., Saturday 3:00
(S-8) Aikins, N., Saturday 3:00
(S-9) Ahmad, S., Saturday 3:00
(S-10) Moitra, V.K., Saturday 3:00
(S-11) Greenberg, J., Saturday 3:00
(S-12) Lewis, B., Saturday 3:00
(S-13) Zarate, E., Saturday 3:00
(S-14) Tang, J., Saturday 3:00
(S-15) Brunson, C.D., Saturday 3:00

Cardiothoracic & Vascular - Basic Science

(S-16) Raphael, J., Sunday 8:00
(S-17) Niemann, C.U., Sunday 8:00
(S-18) Behrends, M., Sunday 8:00
(S-19) Kitagawa, H., Sunday 8:00
(S-20) Weihrauch, D., Sunday 8:00
(S-21) Niemann, C., Sunday 8:00
(S-22) Hirsch, J., Sunday 8:00
(S-23) Weihrauch, D., Sunday 8:00
(S-24) Wang, C., Sunday 8:00
(S-25) Theilmeier, G., Sunday 8:00
(S-26) Frenzel, T., Sunday 8:00
(S-27) Zhou, Q., Sunday 8:00
(S-28) Tsutsumi, Y.M., Sunday 8:00
(S-29) Kaneda, K., Sunday 8:00
(S-30) Komaki, F., Sunday 8:00
(S-31) Komaki, F., Sunday 8:00
(S-32) Lombardi, M., Sunday 8:00
(S-33) Aizawa, K., Sunday 8:00
(S-34) Larmann, J., Sunday 8:00
(S-35) Ding, X., Sunday 8:00
(S-36) Gerhardt, M., Sunday 8:00
(S-37) Tampo, A., Sunday 8:00
(S-38) Zuurbier, C., Sunday 8:00
(S-39) Weihrauch, D., Sunday 8:00
(S-40) Kitagawa, H., Sunday 8:00
(S-41) Kurahashi, K., Sunday 8:00
(S-42) Machado, S.B., Sunday 8:00
(S-43) Deal, D.D., Sunday 8:00
(S-44) Ding, X., Sunday 8:00
(S-45) Duggan, E., Sunday 8:00
(S-46) Maybauer, D.M., Sunday 8:00
(S-47) von Heymann, C., Sunday 8:00

Cardiothoracic & Vascular - Clinical

(S-48) Suarez, T.A., Sunday 3:00
(S-49) Hemmerling, T.M., Sunday 3:00
(S-50) Delphin, E., Sunday 3:00
(S-51) Patel, K., Sunday 3:00
(S-52) Kimura, Y., Sunday 3:00
(S-53) Dejonckheere, M., Sunday 3:00
(S-54) Isetta, C.J., Sunday 3:00
(S-55) Zaugg, M., Sunday 3:00
(S-56) Higham, H.E., Sunday 3:00
(S-57) Blum, S.L., Sunday 3:00
(S-58) Xia, V.W., Sunday 3:00
(S-59) Morimoto, Y., Sunday 3:00
(S-60) Xia, V.W., Sunday 3:00
(S-61) Sander, M., Sunday 3:00
(S-62) Nishiike, S., Sunday 3:00
(S-63) Van Dijk, D., Sunday 3:00
(S-64) Kakazu, C.Z., Sunday 3:00
(S-65) Thong, A.E., Sunday 3:00
(S-66) Sugiura, S., Sunday 3:00
(S-67) Murphy, G.S., Sunday 3:00
(S-68) Radpay, B., Sunday 3:00
(S-69) Dworschak, M., Sunday 3:00
(S-70) Kanter, G., Sunday 3:00
(S-71) Wagener, G., Sunday 3:00

Critical Care Medicine & Trauma

(S-72) Gopalka, A.K., Monday 10:15
(S-73) Veelo, D.P., Monday 10:15
(S-74) Wolthuis, E.K., Monday 10:15
(S-75) Shah, N., Monday 10:15
(S-76) Hsu, S.S., Monday 10:15
(S-77) Westphal, M., Monday 10:15
(S-78) Koncelik, J., Monday 10:15
(S-79) Maybauer, M.O., Monday 10:15
(S-80) Lanigan, M.J., Monday 10:15
(S-81) Wolthuis, E.K., Monday10:15
(S-82) Pivalizza, E.G., Monday 10:15
(S-83) Planinsic, R.M., Monday 10:15
(S-84) Schumann, R., Monday 10:15
(S-85) Saner, F.H., Monday 10:15
(S-86) Mandell, M.S., Monday 10:15
(S-87) Mandell, M.S., Monday 10:15
(S-88) Planinsic, R.M., Monday 10:15
(S-89) Wu, X., Monday 10:15
(S-90) Weinger, M.B., Monday 10:15
(S-91) Mullhi, D.K., Monday 10:15
(S-92) Roy, T.K., Monday 10:15
(S-93) Chelly, J.E., Monday 10:15
(S-94) Lemaire, L., Monday 10:15

IARS 80th Clinical and Scientific Congress
Abstract Presenter Presentation Schedule

Economics, Education & Patient Safety

(S-95) Adesanya, A.O., Saturday 8:00
(S-96) Wischmeyer, P.E., Saturday 8:00
(S-97) Kim, J.T., Saturday 8:00
(S-98) Ehrenfeld, J.M., Saturday 8:00
(S-99) Choi, J.S., Saturday 8:00
(S-100) Glick, D.B., Saturday 8:00
(S-101) Pivalizza, E.G., Saturday 8:00
(S-102) Davidson, M., Saturday 8:00
(S-103) Kanter, G.J., Saturday 8:00
(S-104) Mullhi, D., Saturday 8:00
(S-105) Weinger, M.B., Saturday 8:00
(S-106) Jankowski, C.J., Saturday 8:00
(S-107) Barach, P., Saturday 8:00
(S-108) Estanol, L., Saturday 8:00
(S-109) Barach, P., Saturday 8:00
(S-110) Singbartl, G., Saturday 8:00
(S-111) Gan, T.J., Saturday 8:00
(S-112) Hudson, M.E., Saturday 8:00
(S-113) Salomone, M.M., Saturday 8:00
(S-114) Orkin, F.K., Saturday 8:00
(S-115) Doshi, A., Saturday 8:00
(S-116) Roskoph, J., Saturday 8:00
(S-117) Gratz, I., Saturday 8:00
(S-118) Sandberg, W.S., Saturday 8:00
(S-119) Shah, S.M., Saturday 8:00
(S-120) Kranner, P., Saturday 8:00
(S-121) Nafiu, O.O., Saturday 8:00
(S-122) Fukada, T., Saturday 8:00
(S-123) Fukada, T., Saturday 8:00
(S-124) Li, H., Saturday 8:00
(S-125) White, P.F., Saturday 8:00
(S-126) Kovac, A., Saturday 8:00
(S-127) Braun, E.B., Saturday 10:15
(S-128) Singbartl, G., Saturday 10:15
(S-129) Spielman, F.J., Saturday 10:15
(S-130) Moric, M., Saturday 10:15
(S-131) Mittal, M.K., Saturday 10:15
(S-132) Fanelli, A., Saturday 10:15
(S-133) Kranke, P., Saturday 10:15
(S-134) Kato, M., Saturday 10:15

Equipment /Monitoring

(S-135) Liu, E.H., Saturday 10:15
(S-136) Dupanovic, M., Saturday 10:15
(S-137) Zimmermann, P., Saturday 10:15
(S-138) Wei, H., Saturday 10:15
(S-139) Sato, N., Saturday 10:15
(S-140) Cattano, D., Saturday 10:15
(S-141) Uraoka, M., Saturday 10:15
(S-142) MacLeod, D.B., Saturday 10:15
(S-143) Rosenbaum, A., Saturday 10:15
(S-144) Rosenbaum, A., Saturday 10:15
(S-145) Tsujimoto, Y., Saturday 10:15
(S-146) Mizushima, A., Saturday 10:15
(S-147) Redford, D.T., Saturday 10:15
(S-148) Shah, N., Saturday 10:15
(S-149) Dupanovic, M., Saturday 10:15
(S-150) De Valdenebro, M., Saturday 10:15
(S-151) Nakagaki, T., Saturday 10:15
(S-152) Ikeda, K., Saturday 10:15
(S-153) Behrends, M., Saturday 10:15
(S-154) Marcus, R.L., Saturday 10:15
(S-155) Watanabe, H., Saturday 10:15
(S-156) Tan, K., Saturday 10:15
(S-157) Tsujimoto, Y., Saturday 10:150
(S-158) Toleikis, J.R., Saturday 1:00
(S-159) Nishiyama, T., Saturday 1:00
(S-160) Enlund, M., Saturday 1:00
(S-161) Xue, Q., Saturday 1:00
(S-162) MacLeod, D.B., Saturday 1:00
(S-163) Cassingham, S.F., Saturday 1:00
(S-164) Jensen, E.W., Saturday 1:00
(S-165) Jensen, E.W., Saturday 1:00
(S-166) Trojan, C.I., Saturday 1:00
(S-167) McNeer, R.R., Saturday 1:00
(S-168) Tokumine, J., Saturday 1:00
(S-169) Redford, D.T., Saturday 1:00
(S-170) Knauer, S., Saturday 1:00
(S-171) Shah, N., Saturday 1:00
(S-172) Lin, B.J., Saturday 1:00
(S-173) Kato, R., Saturday 1:00
(S-174) Hemmerling, T.M., Saturday 1:00
(S-175) Schmidt, A., Saturday 1:00
(S-176) Kainuma, M., Saturday 1:00
(S-177) Gan, T.J., Saturday 1:00
(S-178) Koitabashi, T., Saturday 1:00
(S-179) Brunson, C.D., Saturday 1:00
(S-180) Sakata, D., Saturday 1:00

Neuroanesthesia

(S-181) Sakai, H., Saturday 1:00
(S-182) Elkassabany, N.M., Saturday 1:00
(S-183) Withdrawn
(S-184) Bekker, A., Saturday 1:00
(S-185) Devadoss, U., Saturday 1:00
(S-186) Grant, G., Saturday 1:00
(S-187) Gatto, R., Saturday 1:00
(S-188) Al-Jahdari, W.S., Saturday 1:00
(S-189) Kramer, D.C., Saturday 3:00
(S-190) Farag, E., Saturday 3:00
(S-191) Bekker, A., Saturday 3:00
(S-192) Srivastava, S., Saturday 3:00
(S-193) Hoffman, W.E., Saturday 3:00
(S-194) Lobo, F.A., Saturday 3:00

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Abstract Presenter Presentation Schedule

(S-195) Hoffman, W.E., Saturday 3:00
(S-196) Durieux, M.E., Saturday 3:00

Obstetric Anesthesia

(S-197) Adachi, T., Monday 10:15
(S-198) Teymourain, H., Monday 10:15
(S-199) Blanchfield, P., Monday 10:15
(S-200) Ptaszynski, A.E., Monday 10:15
(S-201) Ozaki, M., Monday 10:15
(S-202) Nitsun, M., Monday 10:15
(S-203) Wittwer, E.D., Monday 10:15
(S-204) Mahon, P., Monday 10:15

Pain - Basic Science

(S-205) Enggaard, T.P., Monday 8:00
(S-206) Jensen, E.W., Monday 8:00
(S-207) Ahmad, S., Monday 8:00
(S-208) Kim, D., Monday 8:00
(S-209) Yamaguchi, K., Monday 8:00
(S-210) Hatakeyama, N., Monday 8:00
(S-211) Kracke, G.R., Monday 8:00
(S-212) Zhou, Q., Monday 8:00
(S-213) Kroin, J.S., Monday 8:00
(S-214) Kroin, J.S., Monday 8:00
(S-215) Wang, l., Monday 8:00
(S-216) Kroin, J.S., Monday 8:00
(S-217) Kroin, J.S., Monday 8:00
(S-218) Kroin, J.S., Monday 8:00
(S-219) Schumacher, M.A., Sunday 3:00
(S-220) Kroin, J.S., Monday 8:00
(S-221) Wu, R.S., Monday 8:00
(S-222) Nishiyama, T., Monday 8:00
(S-223) Vranken, J.H., Monday 8:00
(S-224) Holtman, J.R., Monday 8:00
(S-225) liu, H., Monday 8:00
(S-226) Huang, Z.H., Monday 8:00
(S-227) Kroin, J.S., Monday 8:00

Pain - Clinical - Acute

(S-228) Reuben, S.S., Monday 8:00
(S-229) Urban, M.K., Monday 8:00
(S-230) Weinstein, M., Monday 8:00
(S-231) Nasir, D., Monday 8:00
(S-232) Alhashemi, J.A., Monday 8:00
(S-233) Kontrimaviciute, E., Monday 8:00
(S-234) Yamashita, K., Monday 8:00
(S-235) Dabir, S., Monday 8:00

Pain - Clinical - Chronic

(S-236) Yokoyama, M., Monday 3:00
(S-237) Withdrawn
(S-238) McCeney, M.H., Monday 3:00
(S-239) Schley, M.T., Monday 3:00
(S-240) Zhuang, M., Monday 3:00
(S-241) Han, J.H., Monday 3:00
(S-242) Nakamura, S., Monday 3:00
(S-243) Sandin, M., Monday 3:00

Pediatric Anesthesia

(S-244) Berkowitz, D., Monday 1:00
(S-245) Taghon, T., Monday 1:00
(S-246) Whyte, S.D., Monday 1:00
(S-247) Hummer, K., Monday 1:00
(S-248) Murto, K., Monday 1:00
(S-249) Tontisirin, N., Monday 1:00
(S-250) Ito, H., Monday 1:00
(S-251) Murto, K., Monday 1:00
(S-252) Nafiu, O.O., Monday 1:00
(S-253) Loepke, A.W., Monday 1:00
(S-254) Bernardi, J.P., Monday 1:00
(S-255) Verghese, S.T., Monday 1:00
(S-256) Abdallah, C., Monday 1:00
(S-257) Quezado, Z., Monday 1:00
(S-258) Horikawa, Y., Monday 1:00
(S-259) Sun, L.S., Monday 1:00

Pharmacology - Basic Science

(S-260) Tsuchiya, H., Sunday 10:15
(S-261) Enomoto, A., Sunday 10:15
(S-262) Asakura, Y., Sunday 10:15
(S-263) Nishioka, K., Sunday 10:15
(S-264) Shang, Y., Sunday 10:15
(S-265) Shibuta, S., Sunday 10:15
(S-266) Tomoyoshi, S., Sunday 10:15
(S-267) Tose, R., Sunday 10:15
(S-268) Hanazaki, M., Sunday 10:15
(S-269) Chon, J., Sunday 10:15
(S-270) Bom, A., Sunday 10:15
(S-271) Radke, R., Sunday 10:15
(S-272) Shang, Y., Sunday 10:15
(S-273) Rabito, S.F., Sunday 10:15
(S-274) Glassenberg, R., Sunday 10:15
(S-275) Lee, C., Sunday 10:15

IARS 80th Clinical and Scientific Congress
Abstract Presenter Presentation Schedule

Pharmacology - Clinical

(S-276) Habib, A.S., Sunday 10:15
(S-277) Yilmazlar, A., Sunday 10:15
(S-278) White, P.F., Sunday 10:15
(S-279) Vila, H., Sunday 10:15
(S-280) Shibata, Y., Sunday 10:15
(S-281) Penenberg, D.N., Sunday 10:15
(S-282) Dhiraaj, S., Sunday 10:15
(S-283) Sah, N., Sunday 10:15
(S-284) Nigrovic, V., Sunday 10:15
(S-285) Steinberg, D., Sunday 810:15
(S-286) Steinberg, D., Sunday 10:15
(S-287) Liao, C., Sunday 10:15
(S-288) Steinberg, D., Sunday 10:15
(S-289) Steinberg, D., Sunday 10:15
(S-290) Groudine, S.B., Sunday 10:150
(S-291) Mathews, D.M., Monday 3:00
(S-292) Gupta, D.K., Monday 3:00
(S-293) Nigrovic, V., Monday 3:00
(S-294) Steinberg, D., Monday 3:00
(S-295) Win, N.N., Monday 3:00
(S-296) Freye, E., Monday 3:00
(S-297) Egan, T.D., Monday 3:00
(S-298) Kaper, J.B., Monday 3:00
(S-299) Buvanendran, A., Monday 3:00
(S-300) Ma, H., Monday 3:00
(S-301) Kaevel, K., Monday 3:00
(S-302) Maroof, M., Monday 3:00
(S-303) Laudie, M.A., Monday 3:00
(S-304) Ng, S.Y., Monday 3:00
(S-305) Ioannidou, D., Monday 3:00
(S-306) Ansley, D., Sunday 3:00
(S-307) Svensen, C., Sunday 3:00

Regional

(S-308) Cheng, G.S., Tuesday 8:00
(S-309) Dhir, S., Tuesday 8:00
(S-310) Sandhu, N.S., Tuesday 8:00
(S-311) Kumagai, K., Tuesday 8:00
(S-312) Morimoto, M., Tuesday 8:00
(S-313) Soong, J., Tuesday 8:00
(S-314) Merman, R., Tuesday 8:00
(S-315) Fanelli, A., Tuesday 8:00
(S-316) Groban, L., Tuesday 8:00
(S-317) Fujiwara, Y., Tuesday 8:00
(S-318) Reuben, S.S., Tuesday 8:00
(S-319) Garg, S., Tuesday 8:00
(S-320) Yamaguchi, S., Tuesday 8:00
(S-321) D'souza, G., Tuesday 8:00
(S-322) DeStephano, C., Tuesday 8:00
(S-323) Salomone, M.M., Tuesday 8:00
(S-324) Beebe, P.E., Tuesday 8:00
(S-325) Rhee, K., Tuesday 8:00
(S-326) Iyer, C.P., Tuesday 8:00
(S-327) Diarra, D.P., Tuesday 8:00
(S-328) Ghisi, D., Tuesday 8:00
(S-329) Soong, J., Tuesday 8:00
(S-330) Bahk, J., Tuesday 8:00

Ambulatory Anesthesia

S-1.

A COMPARISON OF ACUPOINT ELECTRICAL STIMULATION RELIEFBAND VERSUS LOW DOSE GRANISETRON OR DOLASETRON FOR PREVENTING POSTOPERATIVE NAUSEA AND VOMITING IN WOMEN UNDERGOING LAPAROSCOPIC SURGERY

AUTHORS: **S. K. Patteson**, C. C. Snider, D. S. Meyer, E. Fronczek, J. Scott, R. C. Carroll;
AFFILIATION: University of Tennessee Knoxville, Knoxville, TN.

Introduction - Postoperative nausea and vomiting (PONV) remains a significant problem in laparoscopic surgery. Pharmacologic regimens are effective but have side effects and increased costs. Non-pharmacologic treatment with acupoint electrical stimulation has been suggested to be effective in preventing PONV. ReliefBand® may be as effective in preventing PONV as lower dose, low cost pharmacologic treatment. Decreased dosages of antiemetics may provide effective relief while providing institutional cost savings.
Methods - After IRB approval, 176 women undergoing laparoscopic surgery were randomized to 4 regimens; dolasetron (A), granisetron (K), active ReliefBand® (ARB), or inactive ReliefBand (IRB). Exclusion criteria included antiemetic therapy within 24 hours, pregnancy, allergy to treatment medication or history of PONV. All patients (ARB/IRB groups) were educated that they may or may not feel stimulation. ARB intensity was set preoperatively per manufacturer's protocol and then removed. IRB patients (electrode disconnected by cutting the small connections to the battery, dial active, appearing functional) had the IRB placed preoperatively, set to a sham level of 4/5, and then removed. General endotracheal anesthesia was induced with atracurium 2.5mg, midazolam 2mg, fentanyl 100ug, propofol 2.5mg / kg and succinylcholine 1.5 mg/kg. Anesthesia was maintained with nitrous oxide 65% in oxygen and isoflurane. Study medications, granisetron 0.1mg or dolasetron 12.5mg, were administered per protocol 15 minutes prior to surgical closure. ARB or IRB were immediately replaced in the recovery room. PONV rescue medication was administered after breaking the code per anesthesiologist's discretion.
Results - PONV was assessed 24 hour postoperatively by observation and reporting of nausea and vomiting. ANOVA analysis (Figure 1) indicated treatments A, K, & ARB were equally effective in lowering PONV and granisetron and the active ReliefBand® were significantly ($P<0.05$) more effective than the IRB group. The trend was seen for vomiting but did not reach significance ($P>0.18$). The average time from entering recovery until hospital discharge was longer for drug treatments (215 minutes) than ARB or IRB (135 minutes) but was not significant ($P>0.19$). Utilization of rescue medication for PONV was not significantly different between the groups.
Discussion - The use of acupoint electrical stimulation was as effective as low dose granisetron and was associated with a shorter time from recovery until discharge. Either ARB or low dose granisetron may represent a substantial institutional cost saving.

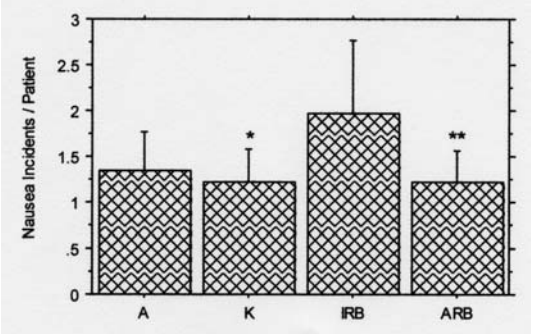


Figure 1. ANOVA for Incidents of Nausea Per Patient Versus Treatment.
Means with error bars = 95% Confidence Interval.
Fisher's Protected Least Squares P values;
* K versus IRB P = 0.038, ** ARB versus IRB P = 0.04

S-2.

COMPARISON OF SPINAL ANESTHESIA VERSUS COMBINED SCIATIC-FEMORAL NERVE BLOCK FOR OUTPATIENT KNEE ARTHROSCOPY

AUTHORS: **F. R. Montes[1]**, E. Zarate[2], J. C. Giraldo[1], R. Grueso[2], J. D. Rincon[1], M. P. Vanegas[2];
AFFILIATION: [1]Fundación Cardio Infantil, Bogota, Colombia, [2]Hospital Universitario San Ignacio, Bogota, Colombia.

Introduction: Knee arthroscopy is one of the most commonly performed orthopedic procedures in the world. Several types of anesthesia, including local, nerve blocks, neuroaxial blockade, and general anesthesia, have been successfully used. It has been suggested that use of regional anesthesia may have some potential benefits in the outpatient setting and result in decreased resource utilization, superior patient satisfaction, and better analgesia (1). The aim of this study was to compare the clinical properties of two widely used regional anesthetic techniques with regard to preparation and recovery from anesthesia in a standardized outpatient population.
Methods: Following IRB approval and informed consent, 50 ASA I-II adult outpatients undergoing arthroscopic knee surgery were enrolled in this randomized, prospective study. Study subjects were equally divided (n=25 each) into spinal (S) and sciatic-femoral (SF) groups. Midazolam (0.03 mg/kg) and Fentanyl (1 mcg/kg) were applied to all patients. S patients received spinal anesthesia with 7.5 mg of 0.5% hyperbaric bupivacaine. SF patients received combined sciatic-femoral nerve block with 100 mg of Bupivacaine and 200 mg of Lidocaine in a multiple injection technique. Times lasting from arrival in the operating room to the readiness for surgery, as well as duration of surgery, recovery times and patient satisfaction were recorded. Analgesia and occurrence of adverse events were also registered. Data was evaluated by ANOVA, t-test and Chi-square test. A $P < 0.05$ was considered significant.
Results: Demographic data were similar between groups. There were no significant differences between the two groups in any of the study measurements of recovery (Table 1). No serious adverse effects were observed. After discharge home, 74% of patients in the S group versus 40% of patients in the SF group reported having moderate pain at 24 hours postoperatively ($P<0.05$). Patient satisfaction was high (> 90%) with both techniques.
Discussion: Our preliminary results show that for outpatient arthroscopic knee surgery the use of a combined sciatic-femoral nerve block offer satisfactory anesthesia with a clinical profile similar to the obtained with low-dose spinal anesthesia. However, sciatic-femoral nerve block is associated with significantly lower pain scores during the first 24 hours.
References:
1.) Jankowski CJ et al. Anesth Analg 2003;97:1003-9

Table 1

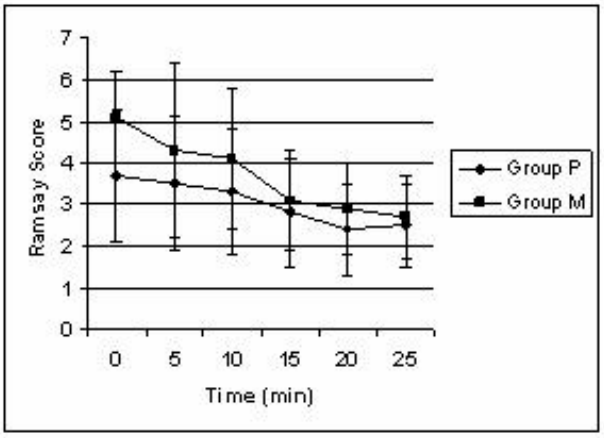
	S Group	SF Group	P
Anesthesia preparation time (min)	17.0 ± 8.4	22.6 ± 10.3	0.06
Surgery preparation time (min)	22.6 ± 8.3	24.7 ± 8.6	0.40
Duration of Surgery (min)	44.3 ± 16	44.2 ± 27	0.97
Operating room exit (min)	6.2 ± 3	6.5 ± 3	0.78
Total operating room time (min)	91.6 ± 26	95.8 ± 36	0.64
Time to home readiness (min)	101 ± 63	101 ± 47	0.98
Time to actual discharge (min)	224 ± 52	207 ± 57	0.44

S-3.

EFFECTS OF INTRAVENOUS PARACETAMOL VS INTRAMUSCULAR MEPERDINE ON POSTOPERATIVE SEDATION AND READINESS FOR DISCHARGE AFTER TONSILLECTOMY

AUTHORS: **J. A. Alhashemi**[1], M. F. Daghistani[2];
AFFILIATION: [1]King Abdulaziz University Hospital, Jeddah, Saudi Arabia, [2]King Khalid National Guard Hospital, Jeddah, Saudi Arabia.

Introduction: Although meperidine is commonly used for postoperative analgesia after tonsillectomy, it could potentially delay hospital discharge given its sedative properties. In contrast, intravenous paracetamol is a non-opioid analgesic that is devoid of sedative effects and thus could be associated with earlier discharge from hospital. This study compared the effects of intravenous paracetamol administration with those of intramuscular meperidine on postoperative sedation and readiness for discharge in children undergoing tonsillectomy.
Methods: Thirty American Society of Anesthesiologists' class I-II patients, aged 5-15 yrs, and scheduled for tonsillectomy were enrolled in this double-blind trial. All patients received midazolam 0.5 mg/kg PO 30 min before surgery and fentanyl 1 μg/kg IV on induction of anesthesia. Patients were randomized to receive either paracetamol 15 mg/kg IV (group P) or meperidine 1 mg/kg IM (group M) on induction of anesthesia. Sevoflurane was used for induction and maintenance of anesthesia, and no other analgesics were administered throughout the case. Postoperatively, Ramsay sedation score (1) and Aldrete score (2) were determined every 5 min until discharge from recovery room. Patients were discharged from recovery room when their Aldrete score was ≥10. Repeated measures analysis of variance and Mann-Whitney tests were used to analyze Ramsay scores and times to achieve an Aldrete score of ≥10, respectively. Data are presented as mean ± SD unless otherwise indicated, and statistical significance was defined as $p < 0.05$.
Results: On admission to recovery room, group M patients had deeper levels of sedation, based on Ramsay scores, compared with group P patients (5.2 ± 1.2 vs. 3.6 ± 1.2, respectively) ($p = 0.1$). This trend was observed up to 15 min into recovery (Figure). The median (25^{th},75^{th} centiles) times to an Aldrete score 10 were 15 (5,15) and 25 (15,35) min for groups P and M, respectively ($p = 0.03$).
Discussion: Intravenous paracetamol administration was associated with a lesser degree of sedation and an earlier readiness for discharge compared with intramuscular meperidine in children undergoing tonsillectomy.
References:
(1) J Clin Anesth 1995;7:89-91.
(2) Br Med J 1974;2:656-9.



S-4.

COMPARISON OF SINGLE-SHOT CAUDAL ROPIVACAINE 0.1%, 0.2% AND 0.3% WITH BUPIVACAINE 0.25% FOR AMBULATORY ANAL SURGERY IN ADULTS

AUTHORS: **H. F. Khafagy**;
AFFILIATION: Theodor, Cairo, Egypt.

Introduction: Ropivacaine has been reported to have a wider safety margin with regard to both central nervous and cardiac toxicity in adults[(1)] and causes less interference with motor function when compared with bupivacaine [(2)]. The aim of this double blind randomized study was to compare the duration of postoperative analgesia and incidence of motor block after single shot caudal block using three different concentrations of ropivacaine with bupivacaine 0.25% for ambulatory anal surgery in adults.
Methods: Sixty adult patients ASA I, II scheduled for anal surgeries under general anesthesia were randomly allocated to one of four groups of fifteen patients each to receive caudal 0.5 ml.kg-1 of either concentrations of ropivacaine 0.1%, 0.2%, 0.3% or bupivacaine 0.25% (group I, II, III and IV respectively). Intraoperative and postoperative haemodynamic data were monitored. Postoperative Bromage score for motor assessment, visual analogue pain score (VAS) for postoperative analgesia and sedation score were assessed. Adverse effects like blurring of vision, nausea or vomiting were also recorded.
Results: The four groups were comparable concerning age, weight and duration of surgery. There was intraoperative decrease in heart rate and blood pressure in the four groups but within acceptable clinical range. No motor affection was observed in group I. However, it was significantly affected in group IV compared to other groups when the patient was awake, 5, 15 and 30 minutes postoperatively. All patients were pain free for two hours postoperatively. Duration of analgesia was minimally prolonged in group III (4.02 ± 0.29 hr) while it was comparable between group II and group IV (3.89 ± 0.44 and 3.71 ± 0.36 hr respectively). Yet, it was significantly the least in group I as compared to the other groups (3.09 ± 0.12 hr). No adverse events were recorded in the four groups.
Discussion: This study demonstrated that 0.5 $ml.kg^{-1}$ of ropivacaine 0.2% for caudal block provided satisfactory postoperative pain relief after anal surgery in adults. This concentration was as effective as bupivacaine 0.25% with lower incidence of motor block which is important for ambulatory surgery. This finding goes in accordance with Ivani et al [(3)] but they didn't find motor affection in both groups. Ropivacaine 0.1% showed less analgesic efficacy while the use of ropivacaine 0.3% was associated with minimal improvement in postoperative pain relief when compared to ropivacaine 0.2% and bupivacaine 0.25%. Meanwhile ropivacaine 0.3% recorded the highest incidence of motor block among the three concentrations of ropivacaine but still less than bupivacaine 0.25%.
References:
(1) Knudsen K et al. Br J Anaesth 97; 78: 507-514.
(2) Zaric D et al. Reg Anesth 1996; 21: 14-25.
(3) Ivani G et al. Br J Anaesth 1998; 81: 247-248.

S-5.

THE USEFULLNESS OF NON-INTUBATED TIVA ON DAY STAY ANESTHESIA IN DENTISTRY

AUTHORS: **M. Kawai**[1], M. Mizuno[1], T. Yamashita[1], T. Kamada[1], Y. Tanaka[2], J. Kotani[3];
AFFILIATION: [1]Kobe Dental Center, Kobe City, Japan, [2]Kobe City General Hospital, Kobe City, Japan, [3]Osaka Dental Universitiy, Osaka City, Japan.

Introduction: We studied the usefulness of outpatient non-intubated total intravenous anesthesia (TIVA) for dental procedures provided by dentist anesthesiologist in Japan.
Methods: Subjects were consisted of 400 outpatients that were provided dental treatments under non-intubated TIVA during March 2005 from April 2004 in Kobe Dental Center. The medical histories of the patient was the mentally disabled, uncooperative child, gagging reflex and phobia. Non-intubated TIVA: The case of profound uncooperative patient required presedation such as oral midazolam or slow induction with inhalation anesthetic agents such as sevoflurane. Monitors are placed, and intravenous access is obtained. For non-intubated TIVA, the most frequently used sedative drug is benzodiazepine such as midazolam, opioid like fentanyl, and general anesthetic agent such as propofol. Airway maintenance is facilitated by placing an oropharyngeal partition and one or two nasopharyngeal airways. The head can be taped to the dental chair headrest in a manner that raises the chin and nose, thereby lifting the tongue and providing a patient airway. A nasal cannula is placed for additional oxygenation. During dental procedures, the dentist and dental assistant take extra precautions to help keep the oropharynx clear and maintain a patient airway. After dental procedures, the patient recovers with the parent or caregiver usually present. We investigated the intra and postoperative complications from medical and anesthesia records.
Results: In all case, we could perform dental treatment on schedule. Cases that were need laryngeal mask with respiratory tract difficulty were 9 cases. The complication during dental procedures was none. All patients were able to come home after the dental treatment within several hours. In postoperative complication, fever (more than 37.5 degrees) was recognized in 7 cases, and vomiting in only 3 cases.
Discussion: With endotracheal intubation, the airway is protected and the practitioner is able to positive pressure ventilate the patient while the dentist continues working itraorally. However, intubation increases the risk of injury to airway structures and laryngeal mask obstruct to facilitate dental procedures. Intra and postoperative complication was few in non-intubated TIVA.
Summary: Non-intubated TIVA was thought to be useful anesthesia method for a dental treatment on day stay anesthesia.
Reference: General Dentistry September-October 464-469, 2003

S-6.

TEE SEDATION: A UNIQUE APPROACH

AUTHORS: **A. Grinberg**, F. E. Shapiro, W. J. Manning, K. Pond;
AFFILIATION: Beth Israel Deaconess Medical Center, Boston, MA.

Introduction: Transesophageal echocardiography (TEE) has become a routine diagnostic procedure in the ambulatory setting. Most sedation for TEE is done by nurses trained in conscious sedation with Midazolam, Fentanyl, and occasionally Propofol being the most commonly administered sedatives. Administration of these sedatives may improve patients' tolerance; however it increases the risk of complications. We undertook this project to demonstrate a unique approach of sedation for TEE in an obese patient with complicated medical history.
Method: Several weeks ago, our colleagues from cardiology requested a consult for the administration of sedation for an elective, ambulatory TEE outside of the operating room. We used Monitored Anesthetic Care (MAC) to facilitate the TEE exam. The sedation of choice for this case was midazolam and dexmedetomidine (an alpha-2 agonist.) Since this is an unusual approach for sedation for TEE, we videotaped the procedure for teaching purposes.
Results: The administration of dexmedetomodine was easy, the patient maintained spontaneous ventilation without airway obstruction and conditions for the TEE were optimal. The patient expressed satisfaction from the sedation. She was safely discharged home without delay two hours after the procedure.
Discussion: This unique approach is preferable over the standard of care in its minimal effect on ventilation with preservation of PaO_2 and minimal increase of PCO_2 especially when the airway is shared with the cardiologist or endoscopist. These qualities are especially beneficial in obese patients, patients with sleep apnea and those with compromised airways. Dexmedetomidine is an alpha-adrenergic agonist with a higher selectivity for the alpha-2 receptor than clonidine (on the order of 1620:1 versus clonidine's 300:1), which accounts for its linear dose response curve[1]. Dexmedetomidine has been shown to have sedative, amnestic, and analgesic properties, and because its selectivity for the alpha-2 receptor is so high, it can be used in patients in whom cardiorespiratory stability must be maintained. A loading dose of 1 microgram per kilogram followed by an intravenous infusion of 0.2-0.7 micrograms per kilogram per hour produces safe and reliable sedation[2]. Within the usual range of plasma concentrations it does not affect the smooth muscle in peripheral resistance vessels, so autonomic responses are blunted[3]. In summary, dexmedetomidine is unique among sedatives for its ability to provide sedation, anxiolysis, and analgesia without causing significant concomitant respiratory depression while maintaining cardiovascular stability.
References:
1. Alpha-2 adrenergic agonists: A new role in outpatient anesthesia. Dannemiller Memorial Educational Foundation, Vol. XVIII, Ch. 21.
2. Pharmacokinetics of dexmedetomidine infusions for sedation of postoperative patients requiring intensive care. British Journal of Anesthesia. 2002; 88: 669-75.
3. Dual alpha-2 adrenergic agonist and alpha-1 adrenergic antagonist actions of dexmedetomidine on human isolated endothelium-denuded gastroepiploic arteries. Anesthesia and Analgesia 2002; 94: 1434-40.

S-7.

IS THERE A ROLE FOR VISCOUS LIDOCAINE IN UPPER ENDOSCOPY?

AUTHORS: R. Spatz, W. Saweris, **M. Seif**, A. Weiss, R. Michael, A. R. Abadir;
AFFILIATION: The Brookdale University Hospital Medical Center, Brooklyn, NY.

Introduction:
The usefulness of topical pharyngeal anesthesia for endoscopic procedures is not well established. Although topical pharyngeal anesthesia has been shown to improve patient tolerance to endoscopy in the absence of conscious sedation, the existing literature is conflicting regarding additional benefits of pharyngeal anesthesia in patients receiving deep sedation (1-4).
The aim of the present study was to determine the role of viscous lidocaine gel with deep sedation in obese patients undergoing upper gastrointestinal endoscopy in relation to the incidence of apnea, total propofol dosage, oxygen % saturation and procedure performance.
Material and Methods:
Nine hundred obese patients undergoing upper endoscopy were enrolled in this study. Patients were randomized into four groups to receive: propofol alone (Group I), propofol and viscous lidocaine gel (GroupII), midazolam and propofol (Group III), and midazolam, propofol and viscous lidocaine gel (Group IV). Propofol was given intravenously to induce deep sedation by increasing target concentration in a dose from 0.9 -1.3 mg/kg. Pharyngeal anesthesia was given using 15 ml of 2% viscous lidocaine gel to the pharynx. The patient was encouraged to gargle the solution for 15 seconds before swallowing it. After 4-6 minutes propofol was given and the endoscopic procedure was performed. The sedative was intravenous midazolam 2 mg/ml in a bolus dose of either 3 mg or 5 mg, depending grossly on the size and age of the patient. Monitoring with capnography and end tidal CO_2 were done for every patient to allow for rapid titration of propofol at the earliest signs of respiratory depression.
Results:
The use of either VLG or midazolam resulted in decrease of the mean dosage of propofol used to 60.04% and 66.1% respectively. When VLG and midazolam used additively, the mean total dosage of propofol used decreased to 27.68%. One patient (0.4%) in group IV (propofol + midazolam + viscous lidocaine gel) suffered mild apnea with a highly significant decrease in the average doses of propofol used (P=0.0001).
Disscusion and conclusion:
Our results indicated that the use of the viscous lidocaine gel in the practice of diagnostic upper endoscopy in deeply sedated patients dose not only help in decreasing the total dosage of propofol needed to induce deep sedation but also decreased the incidence of occurrence of apnea, especially in obese patients and has no effect on the oxygen % saturation or the duration of performing the endoscopic procedure.
References:
1. Vargo JJ, Zuccaro G, DumOt JA. et. Al. *Gastroenterology 2002; 23:8-16*
2. Vargo JJ. Propofol: *Gastrointest Endosc Clin N Am 2004;14:313-23*
3. Lee YS. *J Int Med Res 2004;32:19-24*
4. Radaelli F, Terruzzi V, Minoli G. *Gastroentest Endosc Clin N Am 2004;14:335-52*

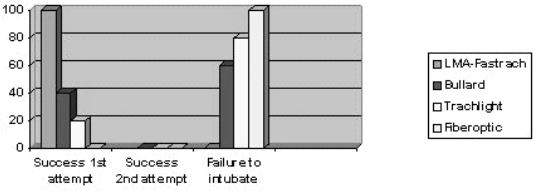
S-8.

DIFFICULT AIRWAY MANAGEMENT AND THE NOVICE PHYSICIAN

AUTHORS: **N. Aikins**, R. Ganesh, K. E. Springmann, J. J. Lunn, S. Mydur, J. Solis-Keus;
AFFILIATION: Texas Tech University Health Sciences Center, El Paso, TX.

Background: Selection of the ideal airway device in patients with difficult airways or potentially difficult airways (DA) remains contentious especially for a novice anesthesia physician (NP) who must deviate from conventional direct laryngoscopy with a rigid laryngoscope following a failed intubation and employ one of several alternative devices. In this prospective randomized study, the author reports the reliability, rapidity and safety for a novice physician using four alternative airway devices to intubate 20 obese (BMI>27.5) patients who may be more difficult to intubate than normal weight patients.
Methods: The author investigates a novice physician's use of the Bullard™, Fiberoptic™, Fastrach™ and Trachlight™ comparing reliability, rapidity and safety of orotracheal intubations in obese patients. Following induction of anesthesia the NP was allowed up to a maximum of two attempts at oral intubation per device. Mean intubation times+/- SD, % success rates and postoperative complications are evaluated for each group.
Results: The Fastrach™ was successful 100% of the time on the first attempt requiring a mean time of 55 seconds +/-6.6. All intubations were unsuccessful following two attempts with the Fiberoptic™. A success rate of 20% (1 of 5) was recorded for the Trachlight™ achieved on first attempt after 95 seconds. The Bullard™ was successful in 40% (2 of 5) of the patients after a mean time 60 seconds +/-5, but was the only device to result in mild oral discomfort one day post operatively.

Table 1



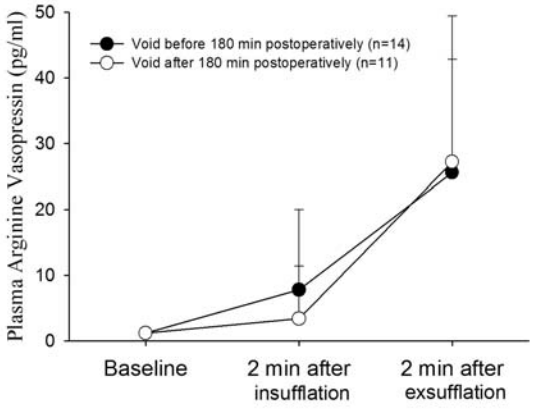
Discussion: In the hands of a novice physician, managing a difficult or a potentially difficult airway, such as obese patients, the LMA-Fastrach™ may be the most reliable device.

S-9.

ASSOCIATION OF PLASMA ARGININE VASOPRESSIN LEVELS WITH FAILURE TO VOID FOLLOWING OUTPATIENT LAPROSCOPIC GYNECOLOGIC SURGERY

AUTHORS: **S. Ahmad**, P. C. Fitzgerald, R. J. McCarthy;
AFFILIATION: Northwestern University Feinberg School of Medicine, Chicago, IL.

Introduction: Patients undergoing gynecologic laparoscopy are required to void prior to hospital discharge. Laparoscopy is associated with a marked increase in plasma arginine vasopressin (pAVP) shortly after insufflation of the abdomen(1). Patients who do not void shortly after surgery generally do not have urinary retention, but generally have reduced urine volume in the bladder (2). The purpose of this study was to compare pAVP levls following laparoscopy in patients who voided shortly after surgery with those that did not.
Methods: After IRB approval and written consent, 25 elective gynecologic laparoscopy patients were studied. Subjects received standardized anesthetic regimen consisting of sevoflurane, sufentanil and rocuronium. pAVP levels were obtained before anesthesia, 2 min post insufflation and 2 min after exsufflation. Patient characteristics, insufflation pressure, duration of surgery, and intraoperative fluids were recorded. In the recovery area, VAS for pain on admission and discharge, the frequency of nausea,vomiting and use of analgesics and antiemetics were noted. Subjects were stratified into groups based on their ability to void within 180 minutes postoperatively. pAVP levels were analyzed using 2 way ANOVA for repeated measures in one-variable. Data were analyzed using the Mann-Whitney U-test and the Fishers exact test. A $P < 0.05$ was required to reject the null hypothesis.
Results: Fourteen subjects voided within 180 min postoperatively. Subject characteristics and intraoperative parameters did not differ between those that voided and those that did not void. The median (range) duration of surgery was 105 (60-190) min, last oral intake 10 (7-12) hours, intraoperative iv fluids 1300 (600-3860) ml, intraoperative urine output 100ml, and insufflation pressure 13 (10-15) mmHg. The concentration of pAVP was significantly increased compared to baseline at insufflation and further increased following exsufflation in both subjects that voided with 180 min and those that did not (fig). The change in pAVP concentrations did not differ between groups. Recovery room admission and discharge pain scores as well as the frequency of nausea, vomiting and need for analgesics and antiemetics was similar between groups.
Discussion: This study showed that abdominal distention due to insufflation and exsufflation during laparoscopic gynecologic procedures increased pAVP levels 25 fold. The change in pAVP levels however was not associated with delayed time of urination postoperatively.
References: 1. Lancet: 1;175-176, 1982. 2. Anesth Analg 89: 90-97, 1999



S-10.

HOW SWEET IT CAN BE: PREDICTING POSTOPERATIVE GLUCOSE CONTROL

AUTHORS: **V. K. Moitra**, J. Greenberg, B. Sweitzer, M. Drum;
AFFILIATION: University of Chicago Hospitals, Chicago, IL.

Introduction: Glycemic control during the perioperative period is challenging. To our knowledge, there are no data on the use of HbA1c or other factors to predict glucose control in fasting patients during the postoperative period. Our study examined the predictive value of HbA1c and other variables for postoperative glucose values.
Methods: After IRB approval, 241 patients were analyzed in a prospective observational study. HbA1c values were drawn before surgery followed by a postoperative test of blood glucose. The relationship between fasting glucose levels and HbA1c was evaluated using multivariable linear regression with glucose level as the dependent variable and HbA1c as the primary explanatory variable, controlling for age, sex, race, BMI, NPO duration, surgery risk class[1], type of anesthesia, and time of day as potential covariates. The analysis excluded patients who had taken morning insulin, steroids or hypoglycemic agents on the day of surgery.

Dependent Variable: Postoperative Fasting Blood Glucose (N = 223)

Model 1:

Covariate	Coefficient	Standard Error	P-value
HbA1c (%)	15.8	2.49	< 0.001
Time of day of preoperative glucose	- 3.0	1.38	0.031
Hours since preoperative glucose	3.7	1.49	0.015
Hopkins Surgery Risk Class 3 vs. 1-2	26.0	7.12	< 0.001
4-5 vs. 1-2	34.5	10.60	0.001

Model 2:

Covariate	Coefficient	Standard Error	P-value
HbA1c (%)	15.5	2.51	< 0.001
Time of day of preoperative glucose	- 3.72	1.38	0.008
Hours since preoperative glucose	4.25	1.48	0.005
Anesthesia: General/Combo vs. MAC/Regional	23.1	7.78	0.003

Results: HbA1c was a highly significant predictor of postoperative glucose levels. In the multivariable model, time of day, elapsed time since the preoperative measure, and surgical risk class also significantly predicted postoperative glucose levels. Postoperative glucose was significantly lower later in the day. In contrast, postoperative glucose levels increased significantly with elapsed time from the preoperative measure. Postoperative glucose was also significantly higher among patients undergoing riskier surgeries. While surgical risk class was the stronger predictor, type of anesthesia was a significant alternative. Variation in postoperative glucose was considerable, as exhibited by the range (60 - 324) and standard deviation, and only 26% of the variability could be explained by the best fitting model (Adj $R^2 = 0.2580$).
Discussion: Glucose normalization in diabetic patients undergoing surgery lowers the risk of complications such as infection and wound healing.[2] HbA1c, time of day, surgical risk category, and anesthesia type may be used to determine which patients are at higher risk for poor glucose control in the postoperative period. As anesthesiologists adjust perioperative diabetic management, we believe these data may be useful in stratifying therapies and preventing episodes of hyperglycemia.
[1] A Consensus Approach to Preoperative Evaluation Using the Johns Hopkins Risk Classification System
[2] Diabetes Care 1999; 22: 1408-14.

S-11.

PREDICTING A SWEET CHANGE IN PERIOPERATIVE GLUCOSE CONTROL

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Introduction
Glycemic control during the perioperative period is challenging because multiple factors affect blood sugar, including the stress of surgery, acute illness, anorexia, and NPO status. Our study examined the predictive value of HbA1c and other variables for glucose change during the perioperative period.

Methods
After IRB approval, 241 patients were analyzed in a prospective observational study. The relationship between preoperative and postoperative glucose levels and HbA1c was evaluated using multivariable linear regression with glucose level as the dependent variable and HbA1c as the primary explanatory variable, controlling for age, sex, race, BMI, NPO duration, surgery risk class[1], type of anesthesia, and time of day as potential covariates. Models were fit for pre- to postoperative change in glucose levels. The analysis excluded patients who had taken morning insulin, steroids or hypoglycemic agents on the day of surgery.

Dependent Variable: Pre to Postoperative Change in Fasting Blood Glucose			(N = 233)
Covariate	Coefficient	Standard Error	P-value
Body Mass Index	0.84	0.29	0.004
Anesthesia: General/Combo vs. MAC/Regional	22.4	7.87	0.005
Hopkins Surgery Risk Class 3 vs 1-2	31.6	7.37	< 0.001
4-5 vs 1-2	44.8	9.79	< 0.001

Results
Glucose levels increased on average 20.0 ml/dL (s.d. = 48.7) from the pre- to postoperative measurement. In multivariable regression, body mass index (BMI), type of anesthesia and surgery risk class was significantly associated with change from pre- to postoperative glucose levels. Greater change occurred among heavier patients. Change was also greater among patients undergoing riskier surgeries. Change in glucose level was 22.4 ml/dL higher among patients who received general anesthesia, alone or in combination with other modalities, than in patients receiving regional anesthesia or monitored anesthesia care. Change from pre- to postoperative glucose exhibited considerable variability, ranging from a decrease of 288 ml/dL to an increase of 177 ml/dL, and only 26% of the variability could be explained by the best fitting model (Adj R^2 = 0.2647). HbA1c was a marginally significant predictor of change in glucose levels when controlling for age. However, this association was attenuated and no longer approached significance when controlling for any of the other covariates.

Conclusions
The anesthetic management of diabetic patients requires a clear understanding of glucose metabolism and physiology, interpretation of laboratory test results, and an awareness of the potential for hypoglycemia and hyperglycemia. Our data suggest that we may be able to predict changes in glucose control during the perioperative period based on BMI, anesthesia type, and surgical risk class.

[1] A Consensus Approach to Preoperative Evaluation Using the Johns Hopkins Risk Classification System

S-12.

CAN REUSABLE LARYNGEAL MASK AIRWAYS (LMAS) BE USED MORE THAN FORTY TIMES?

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Introduction: The manufacturer of the classic reusable LMA recommends that their product not be used more than 40 times because of decreases in the tear strength, tensile strength and elongation and increased stiffness of the polymer it contains.[1] We attempted to replicate their results to verify their conclusions.

Methods: After IRB approval was obtained, the number of uses of recently purchased LMAs was tabulated. When it was verified that at least 100 uses had taken place, the LMAs were taken for analysis. Samples were taken of the cuffs and tested for elongation, tensile strength, stiffness and tear strength. The cuff from an unused LMA was analyzed in the same way for comparison. Where possible, the tests conformed to ASTM standard protocols. The data obtained were compared to results reported by the manufacturer for devices that had been used 100 times.

Results: Three LMAs that had been used over 100 times and an unused one (for comparison) were analyzed. The tensile strength was found to increase by approximately 25%, while the LMA manufacturer reported a 30% decrease in tensile strength after 100 uses. We found increased stiffness and decreased tear strength of the samples, as the manufacturer reported. However, the tear strength was decreased by only half as much as the manufacturer found while the stiffness of the silicone increased three times more than that of the manufacturer's samples. The decrease in elongation of the material by 30% agreed with the manufacturer's literature.

Conclusion: The silicone in reusable LMAs does not lose its tensile or tear strength after 100 uses to the extent that the company claims. On the other hand, it may become stiffer than the manufacturer predicts. This decrease in flexibility may not have any bearing on the longevity of the device. We conclude that 100 uses- and perhaps more- may be considered safe for this device.

Reference: 1. LMA North America product literature.

S-13.

METOCLOPRAMIDE DOES NOT INCREASE THE ANTIEMETIC EFECTIVENESS OF DEXAMETHASONE IN OUTPATIENTS UNDERGOING ENT PROCEDURES

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In theory, the combination of two antiemetic medications with different sites of activity should be more effective than one drug alone in outpatients undergoing ENT procedures, with an inhalation-based anesthetic technique[1]. Therefore, a prospective, randomized, placebo-controlled, double-blind study was designed to compare the antiemetic efectiveness of the combination metoclopramide-dexamethasone and each one of these drugs administered alone.
202 consenting adult ASA I and II outpatients undergoing a variety of ENT procedures utilizing a standardized general anesthetic technique were randomly assigned to one of four treatment groups (n=52 each), according to an IRB-approved protocol. The study groups consisted of: Group A (dexamethasone, 8mg + metoclopramide, 10 mg), Group B (dexamethasone, 8 mg + saline), Group C (saline + metoclopramide, 10 mg) and Group D (saline + saline). The study medications (5 ml) were administered intravenously 3 min before the anesthesia induction (dexamethasone or saline) and 30 min prior to the end of surgery (metoclopramide or saline). The times from discontinuation of isoflurane to awakening, orientation and home-readiness were recorded. Failed response to the prophylactic treatment was defined as the occurrence of emetic episodes, persistent nausea for 15 min or requirement for rescue antiemetic medications. Data were analyzed using ANOVA for continuous variables and Chi-square test for discrete variables, with p-values <0.05 considered statistically significant.The four groups were similar with respect to their demographic characteristics anesthesia and surgery times, recovery profiles and postoperative analgesic requirements. During the PACU stay and at 24 hours, the number of patients who experienced a failed response was significantly higher in the Groups C and D than Groups A and B. The incidence of failed response was similar in the Groups A and B and in the Groups C and D (Table). Dexamethasone and metoclopramide-dexamethasone groups had the shortest times to home readiness (Table).

	Group A (n = 52) n (%) (95% CI)	Group B (n = 52) n (%) (95% CI)	Group C (n = 52) n (%) (95% CI)	Group D (n = 52) n (%) (95% CI)
Vomiting (PACU)	6 (11.5) (3 - 20) *	4 (7.69) (5 - 14) † ‡	13 (25) (13 - 37)	20 (38.5) (25 - 52)
Nausea (PACU)	4 (7.69) (4.5 - 14) †‡	2 (3.85) (1 - 9) § ‡	13 (25) (13 - 36)	21 (40.4) (27 - 54)
Rescue (PACU)	3 (5.77) (5 - 12) § ‡	2 (3.85) (1 - 9) § ‡	13 (25) (13 - 37)	19 (36.5) (23 - 49)
Failed Treatment (PACU)	7 (13.5) (4 - 23) †‡	5 (9.6) (2-17) § ‡	13 (25) (13 - 37)	23 (44.2) (22 - 49)
Failed Treatment (24 h)	2 (3.8) (-0.14 - 9) †‡	6 (12) (3 - 20) §	16 (32.7) (20 - 45)	11 (21.2) (10 -32)
Home-ready (min))	162 ± 67§*	153 ± 70‡§	230 ± 164	219 ± 120

*P < 0.05 vs Group D
†P < 0.05 vs Group C
‡P< 0.01 vs Group D
§P < 0.01 vs Group C

Prophylactic dexamethasone (8 mg IV) administered before anesthesia induction significantly reduces the incidence of PONV in outpatients undergoing ENT procedures. Metoclopramide (10 mg IV) administered prior to the end of surgery does not increase antiemetic effectiveness of dexamethasone. At this dose, metoclopramide is as effective as placebo.
(1) N Engl J Med 2004; 350:2441-51

S-14.

EVALUATION OF ELECTROENCEPHALOGRAPHIC CEREBRAL STATE INDEX (CSI) AND BISPECTRAL INDEX (BSI) VALUES DURING AMBULATORY ANESTHESIA

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INTRODUCTION: The Cerebral State Monitor (CSM) has been recently introduced into clinical practice. The cerebral state index (CSI), a new quantitative index for the level of sedation/hypnosis, is calculated by four subparameters from the spontaneous EEG. CSI has been reported to be a good measurement to detect patient's consciousness during general anesthesia. We designed this study to compare the clinical utility, as well as the sensitivity and specificity of the CSI to the bispectral index (BIS) using the XP platform. In addition, their ability to predict the level of consciousness during induction and emergence from general anesthesia were evaluated.
METHODS: 10 consenting outpatients scheduled for laparoscopic surgery were enrolled in this prospective study. After application of both the CSI and BIS electrode systems, anesthesia was induced with propofol, 2 mg/kg IV, and fentanyl 1 µg/kg IV. Desflurane 2-6% end-tidal in combination with N2O 60% was administered for maintenance of anesthesia. The times to display the values from both monitors, and the comparative CSI and BIS values at specific intervals during the induction and emergence periods were recorded (means±SD, with a= p<0.05 vs BIS value).
RESULTS: Both the BIS and CSI values were found to predict the level of consciousness. The area under the receiver operating characteristic (ROC) curve for detection of consciousness indicated a similar performance with the CSI (0.98 ± 0.07) and the BIS (0.98 ± 0.07) electrode systems. The CSI exhibited a good correlation with the BIS during both the induction (r = 0.85) and emergence (r = 0.80) periods. Interesting, the CSI responds to the induction were slower than BIS, however, the CSI showed significantly faster to baseline values than BIS during the emergence period. The CSI experienced similarly interference from the electrocautery during surgery to the BIS (5% vs 7%, respectively).
DISCUSSION: The CSI appears to possess similar sensitivity and specificity to the BIS in assessing consciousness during induction and emergence from general anesthesia. The CSI may offer an advantage with respect to assessing recovery from general anesthesia, it would appear that the CSI monitor is a viable alternative to the BIS monitor in the ambulatory setting.

	BIS	CSI
Total time to display value (sec)	99±27	75±10a
Baseline (awake)	88±7	88±6
Loss of consciousness	54±19	65±14
Intubation	39±10	51±9
Pre-incision	40±11	43±5
5 min after incision	39±11	40±7
End of anesthesia	49±12	45±4
Following comment	78±7	88±6a
Orientation	82±7	88±6

S-15.

AWARENESS, TREATMENT, AND CONTROL OF DIABETES: A SURVEY AMONG OR PATIENTS

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Introduction: The prevalence of diabetes mellitus in both adults and children has been steadily rising throughout the world for the past 20-30 yr. Better glycemic control in diabetic patients undergoing major surgery has been shown to improve perioperative mortality and morbidity. The aim of this study is to determine awareness, treatment and control of diabetes among our OR patients.
Methods: After IRB approval, patients with diabetes, age 45 or above were contacted in the Ambulatory Surgery Unit. A survey questionnaire was used to extract data in a 1- to -1 interview. The questionnaire contained information on health status, demographic characteristics, awareness of diabetes, management of diabetes, insurance status, access to care, and whether diabetes is under control. Data was collected on a survey form and input into an Excel file. Categorical data was analyzed using Fisher's exact test, and numerical data was analyzed using two-tail t-test. $P < 0.05$ was considered as statistical significance.
Results: 25 patients (56% female) were recruited for this study. Among them, 17 were African American, and the rest of them were Caucasian. Average age was 61 yr. Average diabetes history was 13 yr. 76% of patients had insurance; however, 56% of patients did not see a doctor during the past 12 months because of the cost. 84% of patients checked their blood glucose daily. 12% of patients check their HbA1c every three months. Most patients managed their diabetes by changing their life style and by taking insulin or oral medication. 68% of patients' blood glucose level was not under control. 32% of patients had retinopathy. Major variables were not statistically significant between the two ethnic groups.
Conclusion: A high percentage of patients were still concerned about the cost of their health care. Most patients regularly checked their health condition and put forth effort to control their diabetes. However, a high percentage of patients' glucose levels were not under control. Most patients did not have an HbA1c done regularly.

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S-16.

ISOFLURANE ATTENUATES APOPTOSIS AFTER REGIONAL MYOCARDIAL ISCHEMIA AND REPERFUSION IN RABBITS VIA PHOSPHATIDYLINOSITOL-3-KINASE/AKT SIGNALING

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Objective: to evaluate whether anesthetic-induced preconditioning attenuates myocardial apoptosis and whether the phosphatidylinositol-3-phosphate (PI3K)/Akt pathway is involved in the regulation of anesthetic induced cardioprotection.
Methods: Using a model of regional myocardial ischemia and reperfusion, rabbits were subjected to 40 minutes of regional myocardial ischemia followed by 180 minutes of reperfusion and were assigned to the following groups: a control group of ischemia and reperfusion (I/R), anesthetic-induced (1 minimal alveolar concentration of the volatile anesthetic isoflurane) preconditioning group and an additional group that was exposed to combination of isoflurane and the PI3K inhibitor, wortmannin (0.6 mg/kg intravenously). A sham-operated, wortmannin + I/R and wortmannin + sham groups were also included. Myocardial infarct size was assessed by 2,3,5-triphenyl tetrazolium chloride staining. Myocardial apoptosis was evaluated by terminal deoxynucleotidyl transferase-mediated dUTP nick-end labeling (TUNEL) and activated caspase 3 assays. Phosphorylation of Akt, a downstream target of PI3K was assessed by Western blotting.
Results: isoflurane preconditioning reduced infarct size compared to the control group: 22±4% vs. 41±5% ($p<0.05$). The percentage of apoptotic cells decreased in the isoflurane group (3.8 ± 1.2%) compared to control group (9.3 ± 1.6%; $P < 0.05$). These results were also confirmed by the activated caspase-3 assay. Wortmannin inhibited the cardioprotective effect of isoflurane: myocardial infarction increased to 44 ± 3% and the percentage of apoptotic cells was 8.6 ± 1.4%. Akt phosphorylation was increased after isoflurane preconditioning. Wortmannin blocked this effect as well.
Conclusions: We conclude that isoflurane protects the heart against ischemia and reperfusion by decreasing apoptosis and infarct size via activation of PI3K.

S-17.

THE EFFECT OF AGING ON WARM ISCHEMIA REPERFUSION INJURY IN THE RAT LIVER

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Introduction: To investigate the effect of aging on ischemia repefusion injury in the rat liver.
Methods: Male Lewis rats (3 and 9 months) were subjected to 75 minutes of partial hepatic warm ischemia (70% of the liver) followed by 8 hours (n=6) and 24 hours of reperfusion (n=8), respectively. Animals were kept normothermic during surgery. Blood and tissue were harvested in all groups at the end of reperfusion. Conventional liver enzymes (AST/ALT), histology, myeloperoxidase (MPO) a marker of inflammatory response, magnetic resonance spectroscopy (MRS) analysis, and animal recovery/survival were used for assessment.
Results: Hepatocellular injury was significantly greater in aged rats after 8 hr of reperfusion, as determined by hepatic enzymes and histology. ALT and AST were 31324±9147 U/L and 18687±2911 U/L in aged rats, where as 11057±4328 U/L and 10960±2861 U/L in young rats ($p<0.05$). Hepatic necrosis (greater than 75%) was signficantly higher in aged rats when compared to young rats (less than 25%), $p<0.05$. MPO activity in liver samples was significantly increased in the aged rats after 8 hr of reperfusion (157±38 mU/mg vs. 104±26 mU/mg, $p<0.05$). In the old rats, MRS analysis demonstrated severe alterations in blood metabolic profile (e.g.higher lactate, lower glucose) when compared to young rats. Interestingly, MRS also revealed impaired renal function (increased creatinine. All rats survived 8 hr of reperfusion. However, all old rats died after 24 hr of reperfusion whereas all young rats survived.
Discussion: Advanced age is associated with higher hepatocellular injury and poor survival in warm ischemia reperfusion injury of the rat liver. Inflammatory response is more pronounced in the old rat and blood chemistry signficantly altered.

S-18.

MILD HYPOTHERMIA REDUCES HEPATIC ISCHEMIA/ REPERFUSION INJURY IN OBESE RATS

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Introduction: Steatotic liver is more susceptible to the deleterious effects of ischemia/ reperfusion, resulting in impaired liver function and increased complications following hepatic surgery[1]. Mild hypothermia is known to protect against hepatic ischemia/ reperfusion injury[2]. The effects of such moderate decreases in body temperature during hepatic ischemia/ reperfusion on postischemic liver function in steatotic liver have so far not been addressed. We therefore assessed hepatic metabonomics and injury in rats undergoing partial hepatic ischemia that where either allowed to cool down to 33°C or maintained at 37°C.
Methods: In 10 isoflurane- anesthetized male obese Zucker rats (450-550 grams) vascular supply to the left and medial lobe (70% of the liver) was clamped for 75 minutes. One group of rats were allowed to cool down to 33.3±0.1°C (T33, n=5), then a heating lamp was used to maintain this temperature. The normothermic group was maintained at 36.9±0.3°C (T37, n=5). Following 8h of reperfusion, blood and liver samples were harvested. We assessed liver damage by serum transaminase concentrations and histology. ^{1}H-NMR spectra from whole blood were used to compare in detail the effects of hypothermia on cellular metabolism of steatotic livers following ischemia/ reperfusion.
Results: After 8 h of reperfusion, hypothermia reduced ALT to 7359±5169 vs. 29532±16717 U/L and AST to 8857±6053 vs. 39234±16825 U/L when compared with normothermia ($p<0.05$ vs. T37). Histological assessment confirmed more than 75% necrotic hepatocytes with T37, but less than 25% necrosis in the hypothermic group. Blood from normothermic animals obtained after 8 hrs of reperfusion contained significantly higher concentrations of lactate ($p=0.001$) and lower concentrations of glucose ($p=0.01$) than hypothermic animals; the (liver) osmolyte betaine was also markedly increased ($p=0.0002$) in blood from the normothermic group. In addition, normothermic rats had elevated circulating fatty acids ($p=0.002$), triglycerides ($p=0.0005$), glutamate ($p=0.003$), succinate ($p=0.03$), and acetate ($p=0.03$) compared to the hypothermic group.
Discussion: We established a reproducible ischemia-induced fulminant necrosis model in obese rats which resulted in metabolic profiles similar to acute liver failure. We also demonstrated that mild hypothermia prevents massive liver injury. NMR blood profiles indicate that hypothermia protects cellular metabolism and identifies betaine as a putative marker of liver injury. Mild normothermia appears to be a feasible procedure to compensate for the increased sensitivity of steatotic livers for hepatic ischemia/ reperfusion injury.
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S-19.

DUAL EXPOSURE TO ISOFLURANE SUPPRESSES MYOGLOBIN RELEASE EVOKED BY MYOCARDIAL ISCHEMIA AND REPERFUSION IN RABBITS

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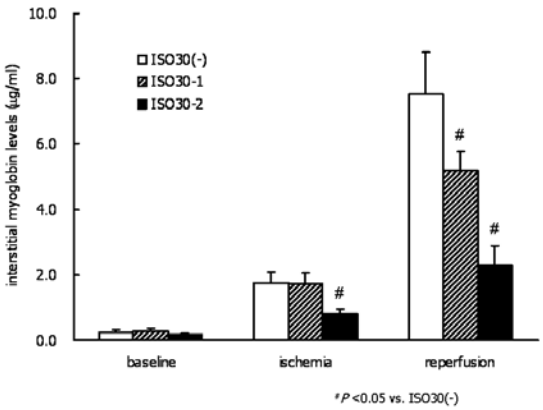
Introduction: Although repeated brief ischemia attenuates myocardial ischemia-reperfusion injury, the effect of repeated exposure to volatile anesthesia on myocardial injury remains unclear. We tested whether two brief exposures to isoflurane would lead to a better preconditioning state than would a single exposure and whether dual exposure to isoflurane would achieve beneficial effect on myocardial ischemic or reperfusion injury.
Methods: A dialysis probe was implanted into the left ventricle free wall in the pentobarbital-anesthetized rabbits. Dialysate myoglobin level was served as an index of myocardial interstitial myoglobin levels. Rabbits were randomly assigned to one of three groups: (1) Vehicle group (n=6) was without exposure to isoflurane (ISO) (ISO30(-)). (2) Rabbits were inhaled to 2% isoflurane once for 30-min (ISO30-1, n=6) and (3) twice for 30-min (ISO30-2, n=6), with a 15-min washout period interspersed. Isoflurane exposure was followed by a 15-min of washout period before ischemia, and all rabbits then underwent 30 min of coronary occlusion and 60 min of reperfusion.
Results: In all three groups myoglobin release increased during ischemia and furthermore augmented during reperfusion. ISO30-1 group only suppressed the myoglobin release during reperfusion. ISO30-2 group yielded a greater depression in myoglobin release during both ischemic and reperfusion periods.
Conclusion: Dual exposure to isoflurane suppressed the myocardial myoglobin release evoked by ischemia and reperfusion period. Similarly to ischemic preconditioning, repeated exposure to isoflurane seems to be more beneficial for myocardial protection in the clinical setting.



S-20.

CARDIOPROTECTION BY ISOFLURANE OR BRIEF, REPETITIVE ISCHEMIA DURING EARLY REPERFUSION IS ABOLISHED BY INHIBITION OF B-CELL LYMPHOMA 2 PROTEIN IN RABBITS

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Introduction: Brief exposure to isoflurane or repetitive episodes of transient ischemia during early reperfusion after coronary artery occlusion protects against myocardial infarction by activating phosphatidylinositol-3 kinase signal transduction and inhibiting mitochondrial permeability transition pore (mPTP) activity(1-3). B-cell lymphoma (Bcl-2) is an antiapoptotic protein located in the outer mitochondrial membrane (4) that inhibits mPTP during delayed ischemic preconditioning (5). Isoflurane also enhances Bcl-2 expression in isolated cardiac myocytes in vitro (6). Whether Bcl-2 plays a role in cardioprotection by isoflurane or brief, repetitive ischemia during reperfusion is unknown. We tested the hypothesis Bcl-2 mediates isoflurane- or ischemia-induced postconditioning in vivo.
Methods: Barbiturate-anesthetized rabbits (n=62) were instrumented for the measurement of systemic hemodynamics and subjected to a 30 min left anterior descending coronary artery occlusion followed by 3 h reperfusion. Rabbits were randomly assigned to receive 0.9% saline, isoflurane [0.5 or 1.0 minimum alveolar concentration (MAC)] administered for 3 min before and 2 min after reperfusion, three cycles of postconditioning ischemia (10 or 20 s each) during early reperfusion, or 0.5 MAC isoflurane plus three cycles of postconditioning ischemia (10 s) in the presence or absence of the selective Bcl-2 inhibitor HA-14 (2 mg/kg, i.p., 30 min before coronary occlusion). Postconditioning ischemia consisted of three cycles of 10 or 20 s coronary occlusions separated by 10 or 20 s reperfusions beginning 10 or 20 s after initiation of reperfusion, respectively. Myocardial infarct size was determined using triphenyltetrazolium chloride staining. Statistical analysis was performed with ANOVA followed by the Student-Newman-Keuls test (*P<0.05).
Results: Systemic hemodynamics were similar between groups. Isoflurane (1.0 but not 0.5 MAC) and postconditioning ischemia (20 but not 10 s) reduced (P<0.05) infarct size [21±4*, 43±7, 19±7*, and 39±11%, respectively, of left ventricular area at risk (mean±SD)] as compared to control (44±4%). Isoflurane (0.5 MAC) plus 10 s postconditioning ischemia also produced protection (20±7*%). HA-14 alone did not affect infarct size (42±3%), but abolished the protection produced by 1.0 MAC isoflurane (44±1%), 20s postconditioning ischemia (46±3%), and 0.5 MAC isoflurane plus 10 s postconditioning ischemia (41±4%).
Conclusions: The results indicate that Bcl-2 mediates isoflurane- or ischemia-induced cardioprotection during early reperfusion in vivo.
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S-21.

ANESTHESIA INDUCED MILD HYPOTHERMIA REDUCES HEPATIC INJURY AND INFLAMMATION FOLLOWING ISCHEMIA/ REPERFUSION IN RATS

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Introduction: Moderate to severe hypothermia has shown to protect against ischemia/reperfusion injury in the liver. Methods of cooling have included total body cooling, hypothermic perfusion, extracorporeal cooling, and topical cooling. However, the temperatures found to protect the liver are often clinically unacceptable or require in situ manipulation with selective perfusion. Whether anesthesia induced clinically relevant mild hypothermia is equally protective is not well established. We therefore assessed hepatic injury and subsequent inflammatory response in rats undergoing partial hepatic ischemia under normothermia (37°C), mild (34°C) and moderate (31°C) hypothermia.
Methods: Male Wistar rats (300-400 grams) were divided in three groups (n=6 each) and assigned to the different temperature groups. Temperature was measured by a rectal probe and controlled by heating pads and lamps. The vascular supply to the left and medial lobe (70% of the liver) was clamped for 45 minutes. Following 24h of reperfusion, blood and liver samples were harvested.
Results: After 24h of reperfusion, ALT and AST serum concentrations increased to 5101±2378 and 6409±4202 U/L in the normothermic group. Mild hypothermia (34°C) resulted in ALT and AST serum concentrations of 99±87 and 171±38 U/L (p<0.01 vs. normothermia). Moderate hypothermia (31°C) reduced hepatic injury to a similar extend as mild hypothermia (34°C). Histological assessment demonstrated more than 75% necrosis in the normothermic group and less than 25% necrosis in the hypothermic groups. MPO activity was significantly reduced in both hypothermic groups (110±73 (31°C) and 62±42 mU/min/mg protein (34°C)) when compared to the normothermic group (1889±1606 mU/min/mg protein, p<0.01).
Discussion: Mild hypothermia of 34°C resulted in distinct morphological and functional protection against hepatic I/R injury. The reduction in liver necrosis and transaminase release was associated with a profound inhibition of the neutrophil accumulation normally seen following hepatic ischemia/ reperfusion. Further decrease in body temperature had no additional protective effect. Our findings challenge the concept, that a reduction of hepatic energy requirements is responsible for hypothermia- induced protection. The protective effects of mild hypothermia are most likely the consequence of the inhibition of the inflammatory response evoked by ischemia/ reperfusion of the liver.

S-22.

ALTERATIONS IN THE PROTEOME OF PULMONARY ALVEOLAR TYPE II CELLS IN THE RAT AFTER LIVER ISCHEMIA

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Introduction: Hepatic ischemia may cause injury to the lung. Alveolar epithelial type II cells (ATII) are well known to play a key role in lung injury and repair. Therefore, we investigated the impact of liver ischemia on the proteome of these cells.
Methods: Male lean Zucker rats (250-300 g) were anesthetized with isoflurane under spontaneous ventilation. Vascular supply to the left and medial lobe (70% of the liver) was clamped for 75 min with subsequent reperfusion. Sham operated Zucker rats were used as controls. After 8 h, bronchoalveolar lavage (BAL) was performed. ATII were isolated (purity >90%) [1], lysed by sonication and fractionated. Proteins were tryptically digested into peptides. The peptides were labeled using the novel isobaric tagging reagent iTRAQ [2] and controls and samples were pooled. Subsequently, the samples were purified by cation exchange chromatography, separated by HPLC and identified using ESI-MS-MS mass spectrometry. Spectra were interrogated and quantified using ProteinProspector [3].
Results: After ischemia and reperfusion, we observed a significantly increased neutrophil percentage (47.5±25.6%) compared to sham-operated controls (5.3±3.0%) in BAL ($p<0.01$). Quantitative proteomics showed statistically differences especially in proteins of the mitochondrial energy metabolism, the oxidant antioxidant system and the cell membrane. Proteins with altered content included ATP synthase, catalase, superoxide dismutase and Na, K-ATPase.
Discussion: Liver ischemia leads to lung injury that can be detected by quantitative mass spectrometry. The identified proteins have important roles in cell metabolism, host defense and the clearance of pulmonary edema fluid. The alterations in ATII after liver ischemia may be clinically relevant and merits further investigation.

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S-23.

ISOFLURANE-INDUCED CARDIOPROTECTION DURING EARLY REPERFUSION IS ENHANCED BY INHIBITION OF GLYCOGEN SYNTHASE KINASE IN RABBITS

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Introduction: Inhibition of the beta isoform of glycogen synthase kinase (GSK-beta) protects against ischemia-reperfusion injury(1). Brief exposure to isoflurane before and during early reperfusion after coronary artery occlusion also protects against infarction(2). Whether GSK mediates this action is unknown. We tested the hypothesis that GSK inhibition enhances isoflurane-induced postconditioning.
Methods: Barbiturate-anesthetized rabbits (n=86) were instrumented for the measurement of systemic hemodynamics and subjected to a 30 min left anterior descending coronary artery occlusion followed by 3 h reperfusion. Rabbits were randomly assigned to receive 0.9% saline, isoflurane [0.5 or 1.0 minimum alveolar concentration (MAC)] administered for 3 min before and 2 min after reperfusion, the selective GSK inhibitor SB216763 (SB21; 0.2 or 0.6 mg/kg), or 0.5 MAC isoflurane plus 0.2 mg/kg SB21. Other groups of rabbits pretreated with phosphatidylinositol-3 kinase (PI3K) inhibitor wortmannin (0.6 mg/kg), 70-kDa ribosomal protein s6 kinase (p70s6K) inhibitor rapamycin (0.25 mg/kg), or mitochondrial permeability transition pore (mPTP) opener atractyloside (5 mg/kg) received 0.6 mg/kg SB21 or 0.5 MAC isoflurane plus 0.2 mg/kg SB21. Additional groups received mPTP inhibitor cyclosporin A (5 mg/kg) plus 0.2 mg/kg SB21 with or without atractyloside pretreatment. Myocardial infarct size was determined using triphenyltetrazolium chloride staining. Statistical analysis was performed with ANOVA followed by the Student-Newman-Keuls test (*$P<0.05$).
Results: Systemic hemodynamics were similar between groups. Isoflurane (1.0 but not 0.5 MAC) and SB21 (0.6 but not 0.2 mg/kg) reduced ($P<0.05$) infarct size [21±5*, 44±6, 23±4*, and 46±2%, respectively, of left ventricular area at risk (mean±SD)] as compared to control (42±5%). Isoflurane (0.5 MAC) plus 0.2 mg/kg SB21 and cyclosporin A plus 0.2 mg/kg SB21 produced similar degrees of protection (25±4* and 27±6*%, respectively). Atractyloside but not wortmannin or rapamycin abolished protection produced by 0.6 mg/kg SB21 and 0.5 MAC isoflurane plus 0.2 mg/kg SB21. Atractyloside also blocked reductions in infarct size produced by 5 mg/kg CsA plus 0.2 mg/kg SB21.
Conclusions: The results indicate that GSK inhibition enhances isoflurane-induced protection against infarction during early reperfusion via a mPTP-dependent mechanism.
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S-24.

INHIBITION OF ERK ABOLISHES ISOFLURANE-INDUCED PRECONDITIONING BY DOWNREGULATING HIF 1ALPHA AND VEGF EXPRESSION IN RATS

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Introduction: It has been shown that the hypoxia inducible factor (HIF) and vascular endothelial growth factor (VEGF) are involved in a number of intracellular processes that occur in response to hypoxia. HIF and VEGF are regulated through activation of the extracellular signal regulated kinase (Erk). The involvement of this intracellular signaling pathway in anesthetic preconditioning by isoflurane is unknown. We hypothesize that Erk is initially upregulated by isoflurane preconditioning and consequently this is followed by an upregulation of HIF and VEGF.
Methods: Rats were anesthetized with thiobutabarbital sodium and acutely instrumented for measurement of systemic hemodynamics. All rats were exposed to 30 minutes of isoflurane (1MAC) followed by 30 minute coronary occlusion and 2 hour reperfusion. In separate experimental groups, rats were randomly assigned to receive 0.9% saline (control), isoflurane (1MAC) and/or the Erk inhibitor PD 98059 (1.0 mg/kg in DMSO 0.2ml). PD98059 was administered either before or after isoflurane. Myocardial infarct size was determined using triphenyltetrazolium chloride staining. Myocardium was obtained before occlusion and snap frozen in liquid nitrogen for western blot analysis. Protein expression of Erk, HIF 1alpha and VEGF were measured and band density was evaluated using NIH image software. Statistical analysis was performed with ANOVA.
Results: Isoflurane and PD 98059 after isoflurane administration reduced infarct size from 59.3±3.7% to 40.7±8.4% and 41.8±8.6% respectively. PD 98059 administered before isoflurane prevented the reduction in infarct size (60.7±4.7%). Western analysis of tissue revealed that Erk, HIF1alpha and VEGF expression was upregulated in isoflurane treated animals compared to control. PD 98050 blunted this upregulation.
Conclusion: These results show that isoflurane preconditioning increases Erk, HIF and VEGF protein expression. In addition we were able to show that inhibition of Erk with PD 98059 abolishes the upregulation of Erk, HIF and VEGF. These data show for the first time the involvement of HIF 1alpha and VEGF in anesthetic preconditioning.

S-25.

UROKINASE-RECEPTOR (U-PAR)-PATHWAY INTERCEPTION REDUCES INFARCT SIZE AND AMELIORATES SCAR FORMATION AFTER MYOCARDIAL ISCHEMIA IN MICE

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Introduction: 5 million patients anually suffer perioiperative myocardial ischemia that can precipitate myocardial infarction. Myocardial infarction induces scarring which leads to cardiac failure and arrythmias. The extent of myocardial damage after infarction depends on the ischemic damage, reperfusion, inflammatory response and scar formation in the affected area. The inflammatory response is the key amplificator of this process. U-PAR, a partner molecule of integrins is important for leukocyte recruitment. We therefore examined its role for myocardial healing and scarring using u-PAR deficient (u-PAR$^{-/-}$) mice and soluble recombinant u-PAR to modulate myocardial wound healing after myocardial ischemia with reperfusion (MI/R). We hypothesized that pharmacological or genetic u-PAR-pathway interception will reduce infarct size, modulate inflammation and improve myocardial scar formation.
Methods: With IRB approval MI was performed in age and gender matched mice by surgical occlusion of the left anterior descending coronary artery. After 30min reperfusion was initiated. In WT mice 100µg sru-PAR was injected IV upon reperfusion. Leukocyte depletion was induced in WT mice with hydroxyurea. Infarct were morphometrically assessed in TTC-stainings. Area at risk (AAR) was assessed by coomassie blue injection after religation of the LAD. Leukocyte infiltration 24h after MI/R was quantitated in cross-over homing assays of fluophor-labelled PMN. For biochemistry hearts were harvested on days 3 and 7 and separated into ischemic and non-ischemic part for protein and RNA-extraction. ICAM-1-expression was determined by Western blotting and RT-PCR. Collagen gene expression was assessed by realtime RT-PCR at 72h. Collagen was quantified by densitometry on SDS-PAGE after limited pepsin digestion on day 7 compared to a collagen standard.
Results: Infarct/AAR in u-PAR$^{-/-}$ was significantly reduced by 42% ($n=8$, $p<0.05$) compared to WT 24h after MI/R. Sru-PAR reduced infarct size by 32% compared to controls ($n=6/4$, $p<0.05$). Leukocyte depletion reduced infarct size in WT to the level of u-PAR$^{-/-}$ but did not further protect post-ischemic myocardium in u-PAR$^{-/-}$. 24 hours after MI/R 70% less u-PAR$^{-/-}$-PMN homed to WT infarctions while 35% less WT-PMN homed to u-PAR$^{-/-}$-infarctions compared to the WT/WT-experiment ($n=5$, $p<0.05$). ICAM-1-expression was similarly induced in infarctions of both mouse strains. 72 hours after MI/R collagen mRNA was significantly stronger induced in WT compared to u-PAR$^{-/-}$ translating into significantly reduced collagen deposition 7 days post-MI ($n=7$, $p<0.05$).
Discussion: U-PAR-deficiency and the recombinant receptor protect against reperfusion injury by modulating inflammation that is conferred by PMN-recruitment during reperfusion. Modulation of inflammation translates into reduced scar formation and as we have previously shown into improved function. This effect may be due to a competitive antagonism of membrane bound u-PAR. U-PAR therefore represents a potential therapeutic target to treat post-ischemic myocardial tissue. Soluble u-PAR may be an attractive molecule to exploit this pathway therapeutically.

S-26.

IN VIVO OPTICAL TRACKING OF MACROPHAGE RECRUITMENT TO ISCHEMIC MYOCARDIUM USING FLUORESCENCE MEDIATED TOMOGRAPHY (FMT) IN MICE

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Introduction: Cardiovascular diseases (CVD) are the leading cause of death in the western world. Post-mortal histological methods demonstrated recruitment of inflammatory cells into post-ischemic myocardium occurs during reperfusion in response to ischemia. (1) Information on leukocyte recruitment in the clinical setting would significantly ease diagnosis and allow control of therapeutic efficacy in cardiovascular diseases. Means to non-invasively image inflammatory cell recruitment in vivo are not available. We utilized the emerging optical technology of fluorescence mediated tomography (FMT; 2) to demonstrate that macrophages can be stained and tracked in ischemic mouse myocardium in vivo using membrane targeted near-infrared fluophors (NIRF).
Methods: With IRB approval thioglycollate elicited peritoneal macrophages from green-fluorescent protein (GFP) transgenic mice were stained with lipophile NIRF-dye 1,1'-dioctadecyl-3,3,3',3'-tetramethylindotricarbocyanine iodide (DiR) at 20 nM for 30 min and washed. Mice were subjected to transient ligation of the left anterior descending coronary artery for 30 minutes to induce myocardial ischemia and reperfusion (MI/R). Upon reperfusion $10x10^6$ macrophages were injected intravenously. FMT was conducted 24 hours after MI/R. Organs were harvested for ex vivo planar fluorescence reflectance imaging (FRI), histology and fluorescence microscopy. FRI data were quantitated as mean peak fluorescence intensities in the infarcted and non-infarcted areas. A target-to-background ratio was calculated. Data are presented as mean ± SEM. Non-parametric tests were used for data analysis.
Results: In SHAM-animals significant macrophage homing was observed to lung, liver and spleen. No signal was observed in the heart by FMT or FRI. Microscopically, double-labelling of the cells in liver, lung and spleen with DiR and GFP confirmed a macrophage-associated DiR-signal. Injection of cell-free DiR resulted in a weak signal in liver and spleen but no signal in heart or lung. FRI demonstrated a significant increase of fluorescence target-to-background ratio associated with macrophage recruitment in the infarction. (1.83±0.17 vs. 1.14±0.06, MI/R vs. SHAM, n= 9/6, $p<0.001$). In mice with MI/R injected with macrophages FMT resolved fluorescence in the anterior mediastinum in vivo which could be localized to the heart by correlative magnetic resonance imaging and dual wavelength FMT using an additional fluophor (Cy5.5) which was injected directly in to the heart.
Discussion: Optical Imaging using FRI or FMT to track NIRF-fluophor labelled inflammatory cells is a powerful tool to specifically assess cell-trafficking in CVD in vivo. This methodology may potentially allow to measure cellular inflammatory responses not only in myocardial ischemia but in all disease-states associated with leukocyte recruitment. FMT may allow to estimate the extent of reperfusion induced tissue damage and has the potential to be an invaluable research and eventually clinical tool.
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S-27.

EFFECTS OF REPETITIVE ISCHEMIC PRECONDITIONING ON SPINAL CORD ISCHEMIA IN A RABBIT MODEL

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Objective: A completely randomized controlled study based on a rabbit model is designed to study the effect of repetitive ischemic preconditioning (IPC) on spinal cord ischemia and its mechanism.
Methods: Twenty-four Japanese white rabbits were randomly and double-blinded divided into sham-operation group, ischemia-reperfusion group and IPC group with 8 rabbits in each group. Spinal cord ischemia was induced by infra-renal aortic cross-clamp for 45 minutes in ischemia-reperfusion group. Before the 45 minutes ischemia,the rabbits in the IPC group underwent four cycles of IPC. The concentrations of calcium,magnesium,copper,zincum in spinal cord were measured in the 7th day after operation. Postoperative neurological function, EMG of rear limb, and spinal cord histopathological changes were assessed in all annimals.
Results: The concentrations of calcium and copper in spinal cord in ischemia-reperfusion group were significantly higher than those in sham-operation group ($P<0.05$ or 0.01), but magnesium and zincum significantly lower ($P<0.05$). Compared with IPC group, calcium and copper in ischemia-reperfusion group were significantly higher ($P<0.05$), but zincum significantly lower ($P<0.01$). The neurological function and histopatholohical changes in ischemia-reperfusion group were much lower than those in sham-operation group and IPC group ($P<0.05$ or 0.01). And there was significantly worse change of EMG in ischemia-reperfusion group than that in IPC group ($P<0.05$).
Conclusion: Repetitive IPC can protect rabbit spinal cord from ischemic reperfusion injury quickly, and one possible reason for the effect is to maintain the balance of calcium, magnesium, copper, zincum in the ischemic region.

S-28.

ROLE OF 12-LIPOXYGENASE IN ISOFLURANE-INDUCED DELAYED CARDIAC PROTECTION IN MICE

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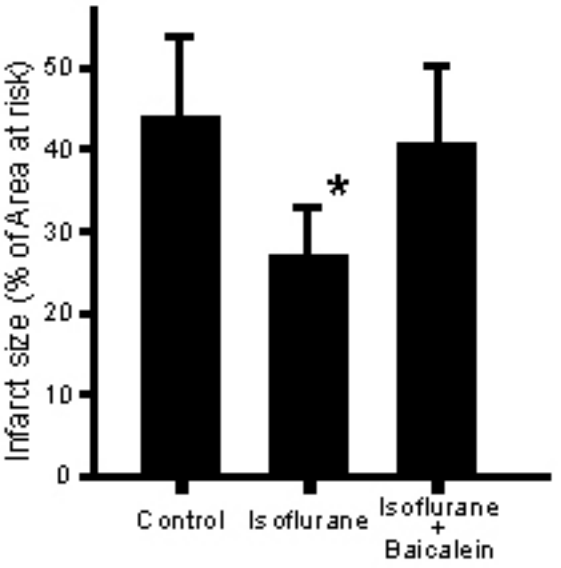
Introduction: Treatment with isoflurane exerts a protective effect against ischemia/reperfusion injury in the myocardium similar to that of ischemic preconditioning. Isoflurane-induced cardiac protection has been described to be a biphasic event: with infarct size reduction 15 min and 24 hours after isoflurane treatment. Delayed cardiac protection induced by volatile anesthetics has substantial clinical potential; however, the signaling events that lead to delayed cardiac protection via isoflurane with respect to potential downstream mediators remain largely unknown. Therefore, we examined the role of 12-lipoxygenase (12-LO) as a potential mediator of isoflurane-induced delayed cardiac protection.
Methods: Under light anesthesia (sodium pentobarbital; 40 mg/kg, ip) mice were randomly divided into groups and received 1.0 MAC isoflurane or 100% oxygen (controls) for 30 min, followed by a 24-hour recovery period. After recovery, mice were anesthetized with pentobarbital sodium (80 mg/kg, ip), mechanically ventilated, and subjected to a 30 min left anterior descending coronary artery occlusion followed by 2 hours of reperfusion. Some isoflurane- and oxygen-treated mice were also given baicalein (3 mg/kg), a 12-LO inhibitor, 20 min prior to ischemia-reperfusion. After reperfusion the coronary artery was again occluded and the area at risk (AAR) delineated by negative staining. The heart was cut into slices. Each slice of left ventricle (LV) was counterstained with 1% 2,3,5,-triphenyltetrazolium chloride to determine infarct. Slices were visualized and infarct size (IS) was determined by planimetry. The AAR was expressed as a percentage of the LV, and the IS was expressed as a percentage of AAR.
Results: The AAR as a percent of LV were similar among groups. Isoflurane (1.0 MAC) produced a delayed cardiac protective effect compared to controls (27.1 ± 6.3% [n = 8] vs 44.6 ± 10.2% [n = 8], respectively, $p<0.05$). The delayed cardiac protective effect of isoflurane was attenuated by baicalein (40.6 ± 10.1% [n = 8], $p<0.05$).
Discussion: These data demonstrate that delayed cardiac protection produced by isoflurane is associated with at least a 24-hour memory period in mice in vivo and that the delayed protective effect of isoflurane is sensitive to 12-LO inhibition. Thus 12-LO may be a potential downstream mediator of volatile anesthetic induced delayed cardiac protection.



S-29.

SEVOFLURANE ENHANCES ETHANOL-INDUCED CARDIAC PRECONDITIONING THROUGH MITOCHONDRIAL K_{ATP} CHANNELS AND PROTEIN KINASE C ACTIVATION IN GUINEA PIG

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Introduction: Volatile anesthetics and ethanol-induced cardiac preconditioning may share common signaling pathways, including protein kinase C (PKC) activation. Sevoflurane has been shown to confer additional cardioprotection on top of ischemic preconditioning (1). Recent studies have also shown that chronic moderate ethanol consumption induces long-term protection against cardiac ischemia-reperfusion injury through PKC activation (2). We investigated whether sevoflurane enhances low dose ethanol-induced preconditioning, and the potential role of mitochondrial K_{ATP} channels and PKC.
Methods: Isolated perfused guinea pig hearts were subjected to 30 min global ischemia and 120 min reperfusion (I/R) in all groups. Controls (CTL) were neither ethanol nor sevoflurane-treated. Ethanol-treated group (EtOH) received 2.5% ethanol in their drinking water for 6 weeks. Anesthetic preconditioning was elicited by administration of 10 min of sevoflurane (1 MAC; 2%) with 10 min washout before ischemia in hearts from ethanol-treated (EtOH+SEVO) or non-ethanol-treated (SEVO) animals. To investigate the involvement of mitochondrial K_{ATP} channels and PKC, 5-hydroxydecanoate (5-HD, 200) and chelerythrine (CHE, 10) respectively, were administered for 20 min, starting 10 min before sevoflurane (EtOH+SEVO+5-HD, EtOH+SEVO+CHE) or vehicle (CTL+5-HD, CTL+CHE) administration. Contractile recovery was monitored by left ventricular developed (LVDP) and end-diastolic (LVEDP) pressures. Infarct size (IS) was determined by triphenyltetrazolium chloride (TTC) stain.
Results: After I/R, SEVO, EtOH, and EtOH+SEVO had higher LVDP (49±3, 47±3, 50±3 vs 26±2, respectively, $p<0.05$), and lower LVEDP (27±2, 27±6, 25±3 vs 60±5, respectively, $p<0.05$) compared to CTL. Infarct size was significantly reduced in SEVO and EtOH compared to CTL (24±2%, 27±2% vs 45±5%, $p<0.05$). Administration of sevoflurane to EtOH (EtOH+SEVO) led to further reduction of infarct size to 17±1%. Blockade of mitochondrial K_{ATP} channels by 5-HD and PKC by CHE abolished this additional cardioprotective effect of sevoflurane. Coronary flow (CF) was similar among all groups throughout the experiment.
Discussion: Sevoflurane enhances cardiac preconditioning induced by chronic moderate ethanol consumption through mitochondrial K_{ATP} channel and PKC activation.
References:
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2) Proc Natl Acad Sci USA 1998;95:8262-8267

	baseline				120min Reperfusion			
	n	LVDP(mmHg)	LVEDP(mmHg)	CF(ml/min)	LVDP	LVEDP	CF	IS(%)
CTL	10	113±5	10±0	28±2	26±2	60±5	28±3	45±4†
EtOH	10	104±4	10±0	27±1	47±3*	27±6*	25±3	27±2*
SEVO	10	101±5	10±0	31±2	50±3*	26±2*	24±2	23±2*
EtOH+SEVO	10	110±5	10±0	26±2	50±3*	25±3*	20±1	15±2*†
CTL+CHE	10	109±5	10±0	28±2	26±4	48±7	20±2	46±3†
EtOH+SEVO+CHE	10	100±3	10±0	28±2	29±3	49±8	19±3	44±3†
CTL+5HD	10	107±5	10±0	29±2	36±3	55±3	27±2	42±2†
EtOH+SEVO+5HD	10	111±2	10±0	27±1	32±3	57±7	21±2	45±3†

mean±SEM; *P<0.05 *vs.* CTL
†P<0.05 *vs.* EtOH and SEVO in IS

S-30.

REGIONAL DIFFERENCE IN ISCHEMIA-INDUCED MYOCARDIAL NOREPINEPHRINE RELEASE FROM CAT'S SYMPATHETIC NERVE ENDINGS

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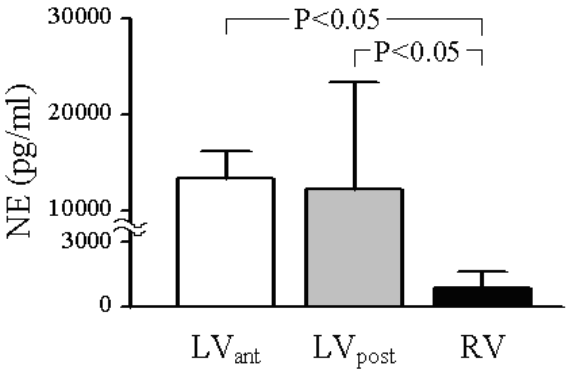
Introduction: Acute myocardial ischemia causes local norepinephrine (NE) release in the ischemic region, which aggravates the myocardium. The presence of high NE levels in the ischemic region may be involved in the progression of myocardial cell injury and a high incidence of malignant arrhythmia. The distribution of sympathetic nerve differs in the left and right ventricle, but whether regional ischemia affects neural regulation at different regions remains unknown. This study was designed to elucidate regional difference in the local sympathetic regulation. We examined the effects of regional myocardial ischemia on myocardial interstitial NE levels at left ventricular anterior, posterior and right ventricle. **Methods:** In anesthetized cats, using cardiac microdialysis, we measured myocardial interstitial NE levels in three regions: the left anterior descending coronary artery (LV_{ant}, n=8) and the left circumflex artery (LV_{post}, n=6) perfusion areas and the right coronary artery perfusion area (RV, n=6). Acute myocardial ischemia was evoked by ligating respective coronary arteries for 60 min. Dialysate NE levels were measured using liquid chromatogram with electrochemical detection and served as index of myocardial interstitial NE levels. Further, to examine the distribution of sympathetic nerve endings in three different regions (n=6-6-6), we administered ouabain (100μM) via the dialysis probe and measured the amount of NE release evoked by ouabain. **Results and Discussion:** Myocardial ischemia progressively increased the myocardial interstitial NE levels in LV_{ant}, LV_{pos}, and RV regions. As shown in the figure, ischemia-induced increase in NE was less than one-tenth in RV compared with that in LV_{ant} and LV_{post}. Locally applied ouabain induced increases in the myocardial interstitial NE levels. There was no significant difference in ouabain-induced NE release among three regions. These data suggest that regional difference in ischemia-induced myocardial NE release was attributable to degree of the ischemia rather than degree of sympathetic innervation. **Conclusion:** Myocardial ischemia induces regional difference in NE release between LV and RV area. Lower energy consumption in RV may spare longer time before the local NE release occurs due to energy depletion.



S-31.

DIFFERENTIAL NOREPINEPHRINE RELEASE MECHANISMS OF SKELETAL MUSCLE AND MYOCARDIAL ISCHEMIA IN ANESTHETIZED RABBITS AND CATS

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Introduction: Acute ischemia has been reported to deteriorate sympathetic outflow distal to the ischemic area. Although such deterioration has been well documented in the myocardium, relatively little is known about this phenomenon in skeletal muscle. We investigated how acute skeletal muscle ischemia affects norepinephrine (NE) releasing function from skeletal muscle sympathetic nerve endings and compared the mechanism of skeletal muscle sympathetic deterioration with that of myocardial ischemia-induced sympathetic deterioration. **Methods:** We compared NE release mechanisms between ischemic skeletal muscle and myocardium. We implanted a microdialysis probe into the adductor muscle and left ventricle in anesthetized rabbits and cats. Regional ischemia was introduced by microsphere injection and ligation of the common iliac artery, or by occlusion of the main coronary artery. The time courses of dialysate NE concentrations were examined with local administration of desipramine (DMI, membrane NE transport inhibitor), ω-conotoxin GVIA (CTX, N-type Ca^{2+} channel blocker), and TMB-8 (intracellular Ca^{2+} antagonist). **Results and Discussion:** Skeletal muscle ischemia temporally decreased the dialysate NE levels during 60min of ischemia. During this period, baroreflex and high potassium induced dialysate NE responses were suppressed to compare with those responses before ischemia. Initial reduction of NE release may be mediated by an impairment of axonal conduction and/or NE exocytosis. Then, a progressive increase in dialysate NE level occurred after initial fall of dialysate NE. At 4hr-skeletal muscle ischemia, dialysate NE levels (vehicle 141 ± 36 pg/ml, n=6) were suppressed by TMB-8 (25 ± 5 pg/ml, n=6) but not by DMI (n=6) or CTX (n=6). These results suggest that Ca^{2+} release from intracellular Ca^{2+} store is partly involve in the skeletal muscle-induced NE release. Myocardial ischemia progressively increased dialysate NE levels. At 0-15 min myocardial ischemia, dialysate NE levels (vehicle 711 ± 111 pg/ml, n=6) were suppressed by CTX (116±23 pg/ml, n=6). At 45-60 min myocardial ischemia, dialysate NE levels (vehicle 28176 ± 5973 pg/ml) were suppressed by DMI (4938 ± 1254 pg/ml, n=6), but not by CTX or TMB-8 (n=6). Therefore, in early phase of myocardial ischemia, NE release was evoked by Ca^{2+} dependent exocytosis and subsequently by Ca^{2+} independent, outward NE transport mechanism via Na^{+} reduced gradient between extra and intraneuronal space. **Conclusion:** Ischemia induced differential NE release mechanisms in the skeletal muscle and myocardium. The skeletal muscle ischemia induced biphasic effect in NE release. Initial reduction of NE release may be mediated by regional impairment of axonal conduction and/or NE exocytosis. The later ischemia-induced NE release was partly attributable to exocytosis via intracellular Ca^{2+} overload, while the myocardial ischemia-induced NE release was attributable to exocytosis in the early phase or carrier mediated outward NE transport in the subsequent phase.

S-32.

AGING AND THE INOTROPIC RESPONSE TO DOBUTAMINE IN SWINE

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Introduction: Both experimental and clinical data indicate a decrease in cardiac β-adrenergic responsiveness with aging (1,2). Potential therapeutic implications of this observation include an age-related dampening of the dose-inotropic response for β-agonists used in the management of low cardiac output states. Clinical experience, however, is not uniformly consistent with this probability. The present study was therefore designed to test the hypothesis that aging alone will diminish the inotropic response to dobutamine.
Methods: Strain-matched female swine without biochemical or physical evidence of cardiovascular disease were used for the study. Animals were divided into two groups: sexually mature young adult (~9 months, n=8) and elderly (> 9 years, n=8). All animals were anesthetized with isoflurane, ventilated with oxygen, and instrumented for measurement of right ventricular (RV) pressure and volume (conductance catheter). Data were recorded at baseline and during infusion of 0.625 and 1.25 μg/kg min dobutamine (DOB). Contractility was quantified as peak +dP/dt normalized to end-diastolic volume (EDV) with dose-response data expressed as a ratio of the baseline value. Data were compared by repeated measures ANOVA with $p<0.05$ considered significant.
Results: There were no differences in RV peak or ED pressures among groups at baseline. As shown in figure 1 panel A, the inotropic response to DOB was greater in elderly animals (figure 1). As shown in figure 1 panels B and C, blockade of autonomic reflexes with hexamethonium and atropine (block) in 3 young and 3 elderly animals markedly accentuated the inotropic response to DOB in young animals but did not alter the response in elderly pigs.
Conclusions: Contrary to the study hypothesis, the inotropic response to DOB was more pronounced in elderly swine when compared to strain and gender-matched young adults. However, following blockade of autonomic reflex pathways, the influence of age on DOB responses was reversed (young > elderly) due to a marked potentiation of the response in young animals but no change in that of elderly pigs. These data underscore the influence of aging on cardiovascular reflex regulation and highlight the fact that the functional impact of age-related biochemical changes such as decreased β-receptor affinity in the heart can be offset by other regulators of cardiac performance.

References

1. Am J Physiol Heart Circ Physiol. 2005;288(5):H2498-503
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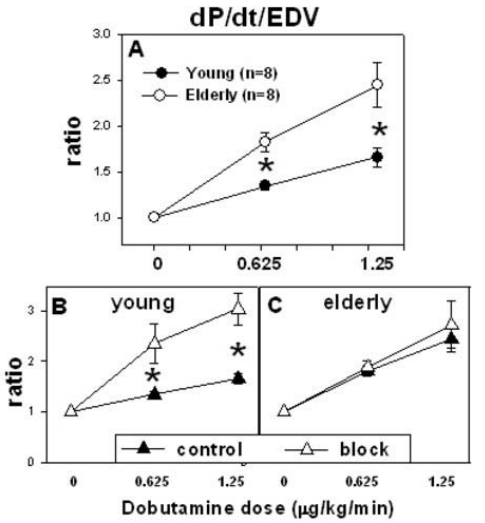

S-33.

REMODELING OF THE CARDIAC NA CHANNEL BY ISOFLURANE-INDUCED PRECONDITIONING IN RATS

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Introduction: Anesthetics-induced preconditioning (APC) has been reported to produce antiarrhythmic effects in addition to the well-established reduction in infarct size following ischemia. Although it is well documented that the mitochondrial ATP-sensitive potassium channels contribute significantly to infarct size reduction, the underlying mechanism of the antiarrhythmic effects by APC is still unclear. Previous studies have demonstrated that APC prolonged the cardiac action potential duration. To investigate APC induced changes at the ion channel level, in the present study, we investigated the effects of APC on the cardiac sodium current (INa), a major depolarizing current in the heart responsible for the initiation of the action potential.
Methods: Upon approval from the Institutional Animal Care and Use Committee, cardiac ventricular myocytes were isolated from adult Wistar rat hearts. The whole-cell configuration of the patch clamp technique was used to record INa. To mimic APC, rats were exposed to 1.4% isoflurane (1.0 minimum alveolar concentration) for 30 minutes followed by a 30-minute recovery period prior to cell isolation (APC group). For the non-APC group, rats were not exposed to isoflurane. INa was elicited during 50 ms depolarizing test pulses from a holding potential of - 90 mV, a voltage close to the resting membrane potential of cardiac ventricular myocytes. Standard voltage protocols (that utilized the -90 mV holding potential) were used to monitor the profiles of steady-state activation and inactivation, and the recovery from inactivation. Data are reported as means ± SEM. Statistical analysis was performed using unpaired Student's t-test and $p < 0.01$ was considered significant.
Results: In the APC group, both the steady-state activation and inactivation curves were shifted toward more positive membrane potentials compared with those in the non-APC group (n=9-11 / group). For the activation curve, the potentials at which channel conductance reached half- maximal values were -40.4±1.4 mV and -36.1±1.7 mV in the non-APC and APC groups, respectively. For the inactivation curve, the potentials at which half of the available channels were inactivated were -78.9±1.0 mV and -74.8±1.5 mV in the non-APC and APC groups, respectively. The rate of recovery from inactivation was not significantly different between the two groups.
Conclusion: Isoflurane-induced anesthetic preconditioning resulted in the positive shifts of the cardiac Na channel steady-state activation and inactivation curves. These changes were observed from a holding potential close to the physiological resting membrane potential. Our results demonstrated a novel consequence of APC, whereby persistent changes in the Na channel were triggered. The full impact of these changes on cell excitability and on the action potential profile will need to be determined.

S-34.

PROGESTERONE INHIBITS ENDOTHELIAL PROGENITOR CELL PROLIFERATION IN VITRO AND LEADS TO IMPAIRED NEOVASCULARIZATION IN MICE

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Introduction: Progesterone (PG) in combination with Estrogen (E2) is used for hormone replacement therapy (HRT). Recent data suggest that this combination may increase the number of cardiovascular events in postmenopausal women.[1)] While E2 is thought to exert beneficial effects on vascular processes, including enhancing the function of endothelial progenitor cells (EPC),[2)] the role of PG in this context is still ambiguous. Cardiac complications due to ischemic diseases are a major cause of morbidity and mortality after non-cardiac surgery.[3)] Therefore, we investigated the effect of PG on EPC function and neovascularization.
Methods: Serum starved bone marrow (BM) derived murine EPCs, seeded in 96-well-plates were treated with different concentrations of PG for 48h (0, 0.01, 0.1, 1 and 10µM; five wells/group). ^{3}H-thymidine was added for the last 24h. In one experiment cells were incubated in the presence of the PG receptor antagonist RU486. Ovariectomized FVB mice underwent hind limb ischemia surgery at day 7 after PG (approx. 1.7mg/d) or placebo pellet implantation. Cell culture assays were performed for EPC-quantification in the BM as well as in the peripheral blood. At day 35 after initiation of treatment limbs were harvested and immunohistology for isolectin B4 was performed to quantify capillary density. Muscle atrophy was assessed by calculating the weight ratio of ischemic and non-ischemic gastrocnemius muscle.
Results: Scintillation counting revealed a dose-dependent inhibition of in vitro EPC proliferation with a maximum inhibition by 1µM PG (939±86 vs. 1398±122counts per min., PG vs CTR, n=15/19, p=0.004). This effect was abolished by co-incubation with 1µM of the PG receptor antagonist RU486. Significantly fewer EPCs were found in the BM of mice receiving PG (day 7: 1.4±0.2 vs. 2.3±0.2; day 14: 2.0±0.1 vs. 3.5±0.3 %EPC/Mononuclear cells, PG vs. CTR, n=3/4, p<0.03). Moreover, circulating EPCs were reduced (day 21: $1.4x10^4$±$2.3\ x10^3$ vs. $2.3x10^4$±$1.5x10^3$; day 35: $2.2x10^4$±$2.0x10^3$ vs. $6.7x10^4$±$1.4\ x10^4$ EPC/ml blood, PG vs. CTR, n=4/5, p<0.03). PG treated mice displayed reduced capillary density (day 35: 1.17±0.07 vs. 1.51±0.07 capillaries/myocyte, PG vs. CTR, n=5, p<0.02). At day 14 muscle atrophy (ischemic/control) was more pronounced in the PG-group (0.55±0.05 vs. 0.69±0.06, PG vs. CTR, n=5, p<0.03).
Discussion: PG reduces EPC proliferation in vitro and impairs EPC mobilization in vivo leading to impaired neovascularization and more severe muscle atrophy. These results indicate an unfavorable role of PG in the setting of ischemic diseases and offer a novel explanation for negative effects seen under certain forms of HRT.
References: 1) JAMA 2001;288: 312-333. 2) Circulation 2003;108: 3115-3121. 3) Br J Anaesth 2004;93: 9-20.

S-35.

ALPHA-ADRENORECEPTOR ACTIVATION INCREASES MYOFILAMENT CA^{2+} SENSITIVITY AND CAUSES TRANSLOCATION OF PKC ALPHA IN CANINE PULMONARY ARTERY SMOOTH MUSCLE CELLS

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Introduction: We investigated the effect the of the α-adrenoreceptor agonist, phenylephrine (PE), on myofilament Ca^{2+} sensitivity in intact and permeabilized pulmonary arterial smooth muscle (PASM). Moreover, we assessed the effect of PE on the cellular distribution of specific PKC isoforms (alpha and delta) in pulmonary arterial smooth muscle cells.
Methods: All procedures were approved by the Institutional Animal Care and Use Committee. Endothelium denuded canine PASM strips were dissected. Tension and intracellular Ca^{2+} concentration ($[Ca^{2+}]_i$) were measured simultaneously in fura-2 loaded PASM strips. The strips were perfused in a Ca^{2+}-free buffer containing 40 mM KCl with or without PE (10^{-6}M). Extracellular Ca^{2+} was then increased from 0.125 to 2.5 mM to obtain the $[Ca^{2+}]_i$-tension relationship. In separate experiments, PASM strips were permeabilized with α-toxin, then tension and $[Ca^{2+}]_i$ were measured simultaneously during superfusion of the strips with a solution containing 10 µM free Ca^{2+} (pCa 5.0). The increase in tension in response to the pCa 5.0 solution was used to normalize all subsequent changes in tension in the same strip. Following washout, the strips were treated with a pCa 6.5 solution, and the effects of PE (10^{-4} M) on tension were assessed while maintaining $[Ca^{2+}]_i$ at a known constant value. The immunofluoresence technique and confocal microscopy were used to localize the cellular distribution of PKC isoforms (alpha and delta) in PASM cells before and after the addition of PE (10^{-6} M) or the PKC activator, phorbol 12-myristate 13 -acetate (PMA 10^{-6} M). Statistical analysis utilized Student's t-test for paired comparisons. Values are means ± SD.
Results: PE caused a leftward shift in the $[Ca^{2+}]_i$-tension relationship in intact PASM strips and caused an increase in tension (78±9%) at constant $[Ca^{2+}]_i$ in permeabilized strips; i.e. PE increased myofilament Ca^{2+} sensitivity. Immunofluoresence staining for PKC isoforms showed that in untreated cells, both PKC alpha and PKC delta were detected in the cytoplasm and nucleus. Activation with PMA and PE induced translocation of PKC alpha from the cytoplasm and nucleus to the membrane. PMA caused translocation of PKC delta to the area of the myoflilaments, whereas PE did not cause translocation of PKC delta.
Discussion: Our results suggest that the increase in myofilament Ca^{2+} sensitivity in response to alpha-adrenoreceptor activation in pulmonary arterial smooth muscle may involve the translocation of PKC alpha.

S-36.

MYOCYTE REMODELING IN AN OVINE MODEL OF CHRONIC, ISCHEMIC HEART FAILURE

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Introduction: Ventricular remodeling in chronic heart failure (CHF) is associated with morphological alterations of cardiac myocytes which include myocyte degeneration (fibrosis) and compensatory myocyte hypertrophy. Using a sheep model of CHF developed by our laboratory(1), morphometric analysis of myocardial tissue in ischemic (LV posterior wall) and non-ischemic cardiac walls (LV anterior, RV free wall, anterior septum) was performed to assess myocyte hypertrophy as CHF progresses over time and determine whether there are differences in ischemic versus non-ischemic myocardium.
Methods: CHF (LV EF <35%) was induced in sheep via coronary microembolization of the circumflex coronary artery (LCx), which selectively infarcts the LV posterior wall exclusively (1). Ventricular myocardium was obtained from control (n=9), early CHF (4 months, n=7), and late CHF (12+ months, n=5) sheep. From each heart, 12 images of each heart wall were captured from immunostained sections. Digital image analysis was performed to measure the myocyte/nuclei area ratio as an index of myocyte hypertrophy. *p<0.05 considered significant compared to controls.
Results: The myocyte/nuclei area ratio did not change significantly in any of the heart walls of the early CHF sheep compared to controls. In contrast, the myocyte/nuclei area ratio of the late CHF sheep increased 291%*, 127%*, and 724%* in the LV anterior, posterior, and anterior septum, respectively, while this ratio decreased in RV free wall (-39%*). Regional wall thickness was decreased in the LV posterior wall in the late CHF sheep compared to controls but was unchanged in the LV anterior wall. Interestingly, wall thickness was increased in both the RV free wall and anterior septum. Wall thickness inversely correlated to myocyte hypertrophy in the LV posterior wall, the region targeted by microembolization (r=-0.9736*), but not in the other walls.
Discussion: Remodeling in ischemic CHF results in alterations at both the cellular and tissue levels. In agreement with clinical findings of human CHF, our sheep model of CHF is associated with myocyte remodeling through increased myocyte/nuclei area ratio as CHF progresses over time. Intuition suggests that cellular hypertrophy would be associated with wall hypertrophy; however, this was not the case: all of the LV walls in the late CHF sheep experienced increased myocyte/nuclei area ratio, regardless of ischemic status, while the RV underwent opposite changes.
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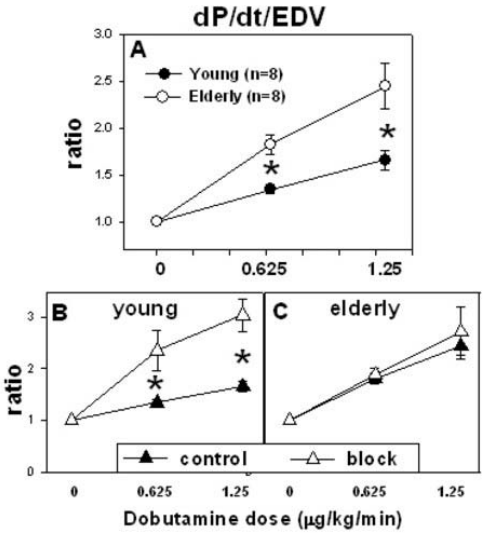

S-37.

ANESTHETIC-INDUCED PRECONDITIONING TRIGGERS CHANGES IN THE CARDIAC L-TYPE CALCIUM CHANNEL FOLLOWING ISCHEMIA IN RATS

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Introduction: Cardioprotection by volatile anesthetic-induced preconditioning (APC) confers cardioprotection by reducing infarct size and incidences of lethal arrhythmia during ischemia and reperfusion. Although the signal transduction pathways underlying infarct size reduction have been emerging, less is known about the mechanism underlying the antiarrhythmic effect. In the current study, we hypothesized that APC triggers remodeling of the cardiac sarcolemmal L-type Ca channel that is persistent beyond the ischemic period. We postulate that this contributes to the antiarrhythmic effect and the attenuation of calcium overload during reperfusion.
Methods: The study was approved by the Institutional Animal Care and Use Committee. The whole-cell configuration of patch clamp technique was used to record the L-type calcium current (ICa) from ventricular myocytes isolated from adult Wistar rat (210-240g) hearts. Rats were divided into three experimental groups prior to cell isolation: Control (CTL), Ischemia (ISC) and Anesthetic-induced preconditioning + Ischemia (APC+ISC). In the APC+ISC group, to mimic APC, rats were exposed to 1.4% isoflurane (1.0 MAC) for 30 minutes with a 30-minute recovery period prior to cell isolation. In the CTL and ISC groups, rats were not exposed to isoflurane. In all groups, hearts were initially perfused with regular crystalloid solution on a Langendorff apparatus. To simulate global ischemia in the ISC and APC+ISC groups, the perfusion was stopped for 30 minutes, and followed by perfusion with Joklik solution containing protease and collagenase to subsequently obtain isolated ventricular myocytes. ICa current-voltage relationship, steady-state inactivation and activation curves, and recovery from inactivation were obtained using standard voltage protocols.
Results: Compared with those in the CTL group, ICa recorded from the ISC group resulted in a hyperpolarizing shift in the steady-state inactivation curve where the potential at which half the available channels were inactivated were -35.2±1.9 mV in CTL and -37.1±1.2 in ISC. APC+ISC abolished this negative shift. However, the steady-state activation curves were shifted in the hyperpolarizing direction for both the ISC and APC+ISC groups (voltage at half-maximal conductance V1/2=-23.1±0.3 and -23.2±1.5 mV, respectively) compared to those in the CTL group (-20.1±0.1 mV). No differences were observed in the current density and the recovery from inactivation among the groups.
Conclusion: The results from the present study showed that there is a persistent negative shift in the L-type calcium channel steady-state inactivation curve following 30 minutes of global ischemia. The observed shift was abolished by APC, suggesting that preconditioning restores the inactivation curve to control levels. This may present a novel mechanism contributing to the cardioprotective mechanism underlying APC. In contrast, APC did not restore the observed shift in the steady-state activation curve following ischemia. This suggests that the shift in the activation curve following ischemia does not impact the efficacy of APC.

S-38.

ISOFLURANE AND SEVOFLURANE, BUT NOT PENTOBARBITAL, INDUCE HYPERGLYCEMIA IN THE RAT

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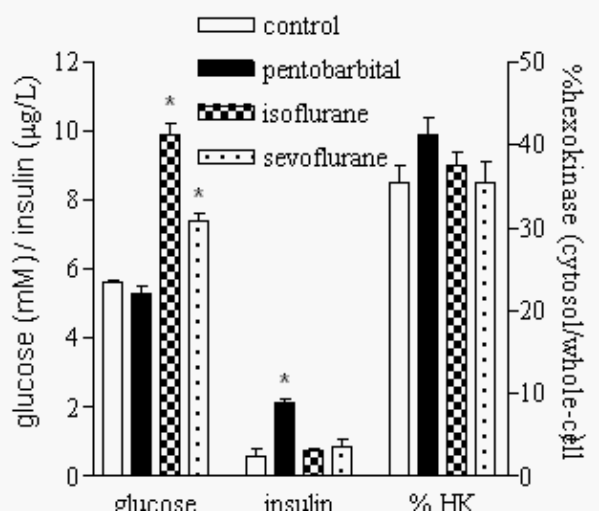
Introduction- Elevated blood glucose levels are currently viewed as a risk factor for in-hospital complications. In contrast, elevated insulin levels may be beneficial in the setting of clinical outcome. A third parameter of glucose metabolism, hexokinase, has recently been implicated in cell survival properties. Translocation of hexokinase to mitochondria preserves mitochondrial integrity and is an important mechanism by which cells can be protected against cell death. It is unclear to what extent anesthesia per se affects these important parameters of glucose metabolism. In this study we addressed the question whether anesthetic agents, at similar levels of hemodynamics, affect mitochondrial hexokinase association and blood levels of glucose and insulin in non-fasted animals.
Methods- Rats were either decapitated (control group; n=10) or anesthetized with pentobarbital (90 mg/kg; n=9), isoflurane(1.5%, n=7) or sevoflurane (2.5%, n=7). Blood pressure and heart rate were recorded in the anesthetized, pressure-controlled ventilated animals. At 30 min of the experiment, blood glucose and insulin levels were determined and the heart homogenized and partly centrifuged at 18,000 g for 10 min to obtain the cytosolic fraction. Hexokinase activity determined in the cytosolic fraction relative to the whole-cell fraction is used as reciprocal index of the amount of hexokinase associated with mitochondria. Results are given as mean ± SEM. $P<0.05$ was considered significant.
Results- No differences in blood pressure and heart rate were observed among groups, indicating similar levels of anesthesia. Isoflurane and sevoflurane significantly increased glucose levels (9.9 ± 0.8 mM and 7.4 ± 0.3 mM, respectively) without alterations in insulin (0.76 ± 0.06 µg/l and 0.87 ± 0.20 µg/l, respectively) as compared to control (6.4 ± 0.3 mM and 0.59 ± 0.22 µg/l). In contrast, pentobarbital was without effect on glucose (5.2 ± 0.2 mM) but did raise insulin (2.13 ± 0.13 µg/l). A trend ($p=0.062$) of mitochondrial detachment of hexokinase was observed with pentobarbital as compared to control (41.2 ± 2.0% versus 35.5 ± 2.1%). This trend was not observed with isoflurane (37.5 ± 1.5%) or sevoflurane (35.5 ± 2.6%).
Conclusions- At similar levels of anesthesia, isoflurane and sevoflurane induce hyperglycemia. Pentobarbital did not raise blood glucose levels, probably as a result of elevated insulin levels. Only pentobarbital anesthesia was associated with a non-significant trend of hexokinase detachment from mitochondria.



S-39.

MITOCHONDRIAL PERMEABILITY TRANSITION PORE INHIBITION POTENTIATES CARDIOPROTECTION BY ISOFLURANE DURING EARLY REPERFUSION IN RABBITS: DEPENDENCE ON MITOCHONDRIAL KATP CHANNELS

AUTHORS: J. G. Krolikowski, **D. Weihrauch**, D. C. Warltier, J. R. Kersten, P. S. Pagel;
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Introduction: Inhibition of the mitochondrial permeability transition pore (mPTP) mediates the protective effects of brief, repetitive ischemic episodes during early reperfusion after prolonged coronary artery occlusion (1). Brief exposure to isoflurane immediately before and during early reperfusion also produces cardioprotection (2), but whether mPTP is involved in this beneficial effect is unknown. We tested the hypothesis that mPTP mediates isoflurane-induced postconditioning and also examined the role of mitochondrial KATP (mKATP) channels in this process.
Methods: Rabbits (n=102) were anesthetized with sodium pentobarbital (30 mg/kg) and acutely instrumented for the measurement of systemic hemodynamics. All rabbits were subjected to a 30 min left anterior descending coronary artery occlusion followed by 3 h reperfusion. In separate experimental groups, rabbits (n=7 or 8 per group) were randomly assigned to receive 0.9% saline (control), isoflurane (0.5 or 1.0 MAC) administered for 3 min before and 2 min after reperfusion, or the mPTP inhibitor cyclosporin A (CsA, 5 or 10 mg/kg) in the presence or absence of the mPTP opener atractyloside (5 mg/kg) or the selective mKATP channel antagonist 5-hydroxydecanoate (5-HD; 10 mg/kg). Other rabbits received the combination of 0.5 MAC isoflurane and 5 mg/kg CsA in the presence and absence of atractyloside or 5-HD. Myocardial infarct size was determined using triphenyltetrazolium chloride staining. Statistical analysis was performed with ANOVA followed by the Student-Newman-Keuls test (*$P<0.05$).
Results: Isoflurane (1.0 but not 0.5 MAC) and CsA (10 but not 5 mg/kg) significantly ($P<0.05$) reduced infarct size [21±4*, 44±6, 23±3*, and 45±3%, respectively, of left ventricular area at risk (mean±SD)] as compared to control (44±6%). The combination of 0.5 MAC isoflurane and 5 mg/kg CsA also produced cardioprotection (26±1*%). Neither atractyloside nor 5-HD alone affected infarct size (47±3 and 45±3%, respectively), but abolished the protection produced by 1.0 MAC isoflurane (48±1 and 46±3%, respectively), 10 mg/kg CsA (46±3 and 47±4%, respectively), and the combination of 0.5 MAC isoflurane and 5 mg/kg CsA (45±5 and 45±3%, respectively).
Conclusions: The results indicate that mPTP inhibition enhances, whereas opening abolishes, isoflurane-induced postconditioning. This cardioprotective effect is dependent on mKATP channel activation in vivo.
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S-40.

MILD HYPOTHERMIA SUPPRESSES MEMBRANE DISRUPTION EVOKED BY MYOCARDIAL ISCHEMIA, BUT NEITHER BY CHEMICAL ANOXIA NOR CA^{2+} OVERLOAD IN RABBITS

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Introduction: Although low temperature makes the myocardial cell membrane tolerant to ischemia, whether hypothermia affects membrane disruption in various cardiac pathophysiological states remains unknown. We tested whether hypothermia would reduce myocardial cell membrane disruption in three models including myocardial ischemia, chemical anoxia and Ca^{2+} overload. **Methods:** A dialysis probe was implanted into the left ventricular myocardium of pentobarbital-anesthetized cats and myocardial interstitial myoglobin levels were measured as an index of myocardial cell membrane disruption. Under both conditions of normothermia (37°C) and hypothermia (33°C), myocardial cell membrane disruption was induced by (1) myocardial ischemia during 60-min of coronary occlusion (2) regional myocardial anoxia by local administration of cyanide (30 mM) via dialysis probe (3) regional Ca^{2+} overload by local administration of maitotoxin (2 μM) via dialysis probe. **Results:** In normothermia, myocardial interstitial myoglobin levels significantly increased during coronary occlusion (from 181 ±13 in control to 2581±520 ng/ml) and further increased during reperfusion (6700±1900 ng/ml) (n = 6). In hypothermia, increase in myocardial interstitial myoglobin levels was suppressed during both coronary occlusion (1133±179 ng/ml) and reperfusion (3266±899 ng/ml) (n =6). There was no significant difference in cyanide-induced increase in myocardial interstitial myoglobin between normothermic (930±130 ng/ml, n = 6) and hypothermic conditions (895±86 ng/ml n = 6). Increase in myocardial interstitial myoglobin evoked by maitotoxin in normothermia (2065±511 ng/ml, n = 6) was not significant different from that in hypothermia (2110±566 ng/ml, n = 6). **Conclusion:** Mild hypothermia suppressed the membrane disruption evoked by myocardial ischemia but neither by chemical anoxia nor Ca^{2+} overload. Early phase in myocardial ischemia might be involved in the beneficial effects of hypothermia on membrane disruption.

S-41.

KERATINOCYTE GROWTH FACTOR GENE TRANSFECTION AMELIORATES ACUTE LUNG INJURY AND MORTALITY IN MICE

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Introduction: Currently there is no effective pharmacological therapy known for acute lung injury. Keratinocyte growth factor, a novel treatment that promotes the repair of epithelial cells and restores lung tissue integrity in injured lungs, has the potential to improve outcomes. Gene transfection of keratinocyte growth factor has a long duration of action of the expressed protein and is cost-effective. This study investigated the efficacy of keratinocyte growth factor gene transfection in acute lung injury.
Methods: We constructed an adenovirus vector expressing mouse keratinocyte growth factor. BALB/c mice were anesthetized and $1.0x10^9$ plaque forming units of virus vector per mouse were instilled intratracheally using a microsprayer. After 3 days, the mice were placed in an airtight chamber and exposed to 90% to 92% oxygen for 72 hours. The 5-day survival rate was assessed.
Results: Keratinocyte growth factor was strongly and uniformly expressed in the lungs. Keratinocyte growth factor prevented intra-alveolar hemorrhage, fibrin exudation, and congestion of capillary vessels. There was prominent proliferation of surfactant protein-C positive cuboidal cells in the lungs. The arterial oxygen tension (Figure 1) and the survival rate (Figure 2) were significantly higher in the keratinocyte growth factor transfected group (KGF) than those in control group (1W1). As lung injury indices, the efflux of albumin from the alveolar space to blood was significantly greater (Figure 3) and the wet to dry weight ratio (QW/QD) of the lungs was significantly larger (Figure 4), in the 1W1 group than KGF group.
Discussion: To our best knowledge, this is the first paper that has demonstrated the protective effects of keratinocyte growth factor gene transfection in injured lungs in vivo. These results suggest that keratinocyte growth factor gene therapy may be clinically useful in the treatment of patients suffering from acute lung injury or acute exacerbations of chronic lung diseases.

Figure 1

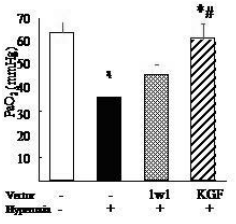


Figure 2

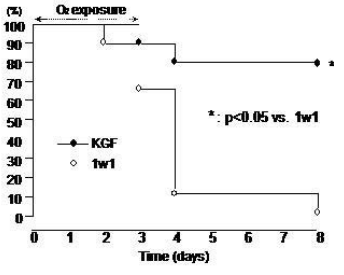


Figure 3

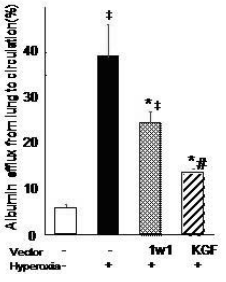
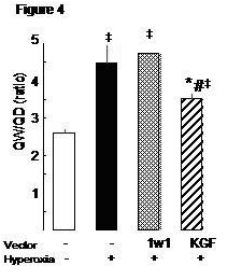


Figure 4



S-42.

INTRAVENOUS APPROACH TO SYMPATHETIC PLEXUS NEUROSTIMULATION IN THE BASE OF THE CANINE HEART

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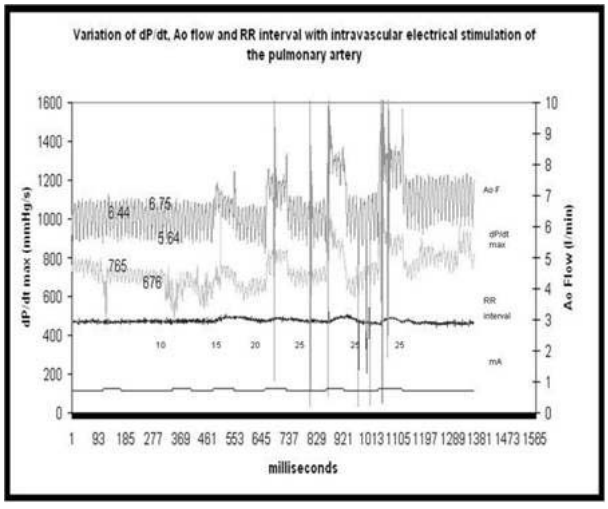
Introduction: The challenge of controlling inotropism is to achieve a positive and selective effect. Drugs have a tendency to improve inotropism at the cost of increasing chronotropism. Animal preparations have provided anatomical evidence that segregation of these functions exists at the level of the sympathetic nerve projections around the great vessels, including the dorsal and rostral area of the common pulmonary artery (1)(2).The purpose of this study was to evaluate, in a canine model, a novel strategy for neuromodulation of the cardiac autonomic fibers using an intravascular approach. This strategy is based on the discrete function of the individual nerve fibers around the pulmonary artery. A potential exists at that site to selectively control heart function and improve ventricular performance in the absence of major side effects.
Methods: Three dogs underwent a middle sternotomy under general isoflurane anesthesia. Physiological monitoring included electrocardiogram, blood pressure, left intraventricular pressure and echocardiogram. A stimulating catheter was placed inside the pulmonary artery through a direct puncture of the right ventricle. Localization was confirmed using fluoroscopy.
Electrical stimulation, comprised of charge-balanced, biphasic square-wave pulses (pulse width: 4-msec), was delivered at a rate of 20 pulses per second. Pulse amplitude was varied between 5-25mA. Stimulation was delivered for a period of 1 minute, with a minimum inter-stimulus interval of 30-seconds. RR interval, dP/dt max and aortic flow were recorded every millisecond during baseline and stimulation epochs.
Results: The maximum variation (MV) in dP/dt max during a 1-minute train of stimulation was 28% and occurred in subject 2 at a stimulus intensity of 15-mA. The maximum variation of the aortic flow in the same interval was 31% in subject 1 at 25-mA (Graph1). The average MV in dP/dt max and aortic flow across all three animals was 19.5% and 19.7%, respectively. All dogs showed a 6% decrease in heart rate during stimulation. At higher thresholds, arrhythmias could be induced, at which point stimulation was immediately terminated.
Discussion: Electrical stimulation through a catheter carefully-positioned within the pulmonary artery can produce positive inotropic effect with a concomitant decrease in heart rate. The current study demonstrates the feasibility of this novel, intravascular approach to neuromodulation of the heart.
References: (1)Ann Thorac Surg 1992; 54:502-506. (2)Am J Physiol 1988; 255(5 Pt 2): H1050-9.



S-43.

EMBOLIC EVENTS ASSOCIATED WITH CARDIOPULMONARY BYPASS DISRUPT THE BLOOD BRAIN BARRIER IN DOGS

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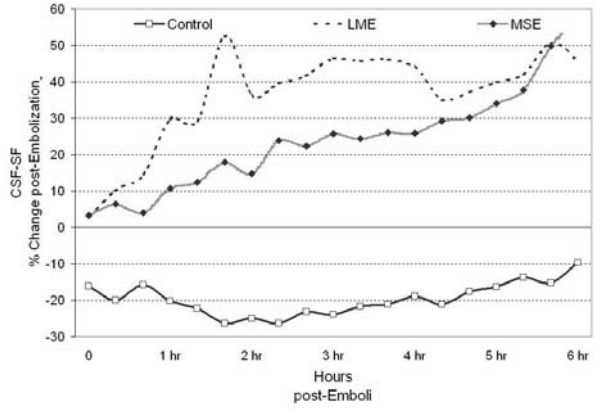
Introduction: Patients undergoing cardiopulmonary bypass (CPB) receive a variety of microemboli (gaseous, lipid, particulate atheroma) to the cerebral circulation. Post operative neurobehavioral dysfunction has been linked to embolic events.[1] Microemboli distributed to the brain during CPB also result in a diffuse neurologic injury manifested as a disruption of the blood-brain barrier (BBB). Breakdown of the BBB possibly explains brain swelling observed by MRI after CPB.[2] We examined the effect of the passage of non-occlusive lipid emboli and occlusive particulate emboli on the BBB.
Methods: Anesthetized dogs (≥30kg) received 0.8% sodium fluorescein (SF) IV over a 10-hour period as serum (jugular) and CSF samples (cisterna magna) were collected at 20-minute intervals. The Control group (n=6) had no further intervention. After 3 hours of SF infusion, embolic events associated with CPB were simulated by the infusion of lipid or non-deformable particulate emboli via a cannula placed from the femoral artery into the left ventricle of the heart. The LME group (n=6) received lipid-laden blood (18cc triolein + 350cc blood, well-agitated with air) simulating the return of cardiotomy-suctioned blood. The MSE group (n=4) received 2.5 x10^6 15um-diameter microspheres simulating particulate emboli such as friable atheroma. SF levels of all samples were determined using a fluorescent spectrophotometer. Because parametric assumptions could not be satisfied by the CSF-SF values, non-parametric testes were conducted (Friedman test for repeated measures and Kruskal-Wallis One-way ANOVA).
Results: Serum-SF levels were similar in all groups, trending to a steady state within 3 hours. Following embolization, CSF-SF levels rose 36-46% in the LME group and 15-57% in MSE group. Both LME and MSE were higher vs. Control at 0-4 hours ($p < 0.025$), but were not statistically different at 6 hours post-embolization due to the variance within groups.
Discussion: Animals receiving emboli showed acute changes in BBB permeability following embolic injury. The length of anesthesia (>10 hrs) and the cumulative CSF sampling (21 mls) may have caused some subjects in the Control group to become unstable after 4 hours post-embolization. These data suggest that embolic events during CPB may contribute to brain edema post-CPB and subsequent decline in neurobehavioral function both acutely and in the long term.
References: 1) Semin Cardiothorac Vasc Anesth. 2005; 9(2):151-2.
2) Anesthesiology. 1998; 88(2):340-345.
Supported by NIH NS 20618-11



S-44.

PROPOFOL INCREASES MYOFILAMENT CA^{2+} SENSITIVITY IN PERMEABILIZED CANINE PULMONARY ARTERIAL SMOOTH MUSCLE AND CAUSES TRANSLOCATION OF PKCα

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Introduction: We have previously reported that propofol increases myofilament Ca^{2+} sensitivity in intact pulmonary arterial smooth muscle via the protein kinase C (PKC) pathway.[1] In the present study, we investigated the effect of propofol on myofilament Ca^{2+} sensitivity in permeabilized pulmonary arterial smooth muscle. Moreover, we assessed the effect of propofol on the cellular distribution of specific PKC isoforms (alpha and delta) in pulmonary arterial smooth muscle cells.
Methods: All procedures were approved by the Institutional Animal Care and Use Committee. Endothelium denuded canine pulmonary arterial smooth muscle strips were dissected and loaded with fura-2 to measure intracellular Ca^{2+} concentration ($[Ca^{2+}]_i$). After being permeabilized with α-toxin, tension and $[Ca^{2+}]_i$ were measured simultaneously during superfusion of the strips with a solution containing 10 μM free Ca^{2+} (pCa 5.0). The increase in tension in response to the pCa 5.0 solution was used to normalize all subsequent changes in tension in the same strip. Following washout, the strips were treated with a pCa 6.0 solution, and the effects of propofol (10^{-5}-10^{-3} M) on tension were assessed while maintaining $[Ca^{2+}]_i$ at a known constant value. The immunofluoresence technique and confocal microscopy were used to localize the cellular distribution of PKC isoforms before and after the addition of the PKC activator (phorbol 12-myristate 13 - acetate: PMA 10^{-6} M) or propofol (10^{-4} M). Statistical analysis utilized Student's t-test for paired comparisons. Values are means ± SD.
Results: Treatment with the pCa 6.0 solution increased tension by 96 ± 5%. Propofol caused a dose-dependent increase in tension (peak increase of 20±2%) at constant $[Ca^{2+}]_i$(i.e. propofol increased myofilment Ca^{2+} sensitivity). Immunofluoresence staining for PKC isoforms showed that in untreated cells, both PKC alpha and PKC delta were detected in the cytoplasm and nucleus. Activation with PMA and propofol induced translocation of PKC alpha from the cytoplasm and nucleus to the membrane. PMA caused translocation of PKC delta from the cytoplasm and nucleus to the area of the myoflilaments, whereas propofol had no effect on PKC delta.
Discussion: Activation of PKC increases myofilament Ca^{2+} sensitivity by inhibiting myosin light chain phosphatase. Our results showed that propofol caused translocation of PKC alpha, which suggests that propofol activated PKC. Propofol also increased myofilament Ca^{2+} sensitivity in permeabilized pulmonary arterial smooth muscle. Thus, it is possible that the propofol-induced increase in myofilament Ca^{2+} sensitivity in pulmonary arterial smooth muscle may involve the translocation of PKC alpha.
Reference: 1.Tanaka S, Kanaya N, Homma Y, Damron DS, Murray PA: Propofol increases pulmonary artery smooth muscle myofilament calcium sensitivity: role of protein kinase C. Anesthesiology 2002; 97: 1557-66

S-45.

PLASMINOGEN ACTIVATOR INHIBITOR GENE EXPRESSION AFTER CARDIAC SURGERY

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Introduction: Systemic inflammation after cardiac surgery is cytokine mediated and presents as metabolic acidosis and arterial vasodilation[1]. The action of these mediators induces an increase in plasminogen activator inhibitor type 1 (PAI-1) levels with inhibition of fibrinolysis[2]. This suggests that the inflammatory cascade is closely related to the fibrinolytic system. The aim of this study was to investigate the relationship between PAI gene expression, 4G/5G PAI polymorphism and bleeding indices post cardiac surgery.
Methods: Patients scheduled for routine cardiac surgery were recruited over a 2 year period. Post operatively the patients were randomized into two groups, those that had an uncomplicated recovery (uncomplicated group) and those that developed hypotension requiring inotropic support or hyperlactaemia with a lactate level greater than 4mmol/L (complicated group). For RNA analysis blood was obtained from eight two patients undergoing cardiac surgery at three time points a) prior to surgery, b) 1hr post cardiopulmonary pump, and c) 6hrs post cardiopulmonary pump. A 24hr sample was taken in a subgroup of patients. The relative change in tumour necrosis factor (TNF α) and PAI messenger RNA in peripheral blood mononuclear cells at each time point after cardiopulmonary bypass was compared with a baseline preoperative level. DNA was also extracted from blood and was analysed for carriage of the 4G/5G PAI polymorphism.
Results: Thirty four patients met the criteria for inclusion into the complicated group as defined by the presence of hyperlactaemia or inotrope requirement. Forty eight patients were recruited into the uncomplicated group. Cardiopulmonary bypass time was significantly longer in complicated group (p=0.034). Both PAI and TNF α gene expression decreased after cardiac surgery. PAI mRNA at 1hr was associated with TNF α mRNA at 1hr (p=0.02). The 5G allele was linked to low PAI mRNA levels 24hrs after cardiac surgery. Thirty eight percent of patients homozygous for 5G received coagulation products in comparison to five percent of the patients homozygous for 4G. Carriage of the 5G allele and suppression of inflammatory mediators after CPB may explain the increased tendency to bleed in these patients.
Conclusion: The inflammatory cascade appears to be closely linked to the fibrinolytic system[3]. Tumour necrosis factor plays a principle role in initiating the systemic inflammatory response[4]. It also appears to have a powerful antifibrinolytic action by increasing the production of PAI-1. In this study, suppression of the proinflammatory response occurs immediately after bypass, which may create a fibrinolytic environment with an increased tendency for bleeding.
References:
(1) Annals of Thoracic Surgery; 61, 1714-20, 1996
(2) Annual Review of Immunology, 7; 625-55, 1989
(3) Annual. Review of Immunology, 10, 411-52, 1992
(4) Journal of Infectious disease, 171, 1057-60, 1995

S-46.

CEFTAZIDIME ATTENUATES THE INCREASE IN OVINE TRACHEAL BLOOD FLOW RESULTING FROM SMOKE INHALATION INJURY AND SEPSIS

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Introduction: Direct inflammatory damage to the airway by smoke inhalation leads to a dramatic increase in tracheal blood flow (1). Previously, our group developed an ovine model of hyperdynamic Pseudomonas aeruginosa (PA) sepsis in association with smoke inhalation injury (2). The aim of this study was to evaluate the effects of ceftazidime (cef) on hemodynamics and regional blood flow in this model.
Methods: Twelve sheep (35-40 kg) were operatively prepared for chronic study, and randomly allocated to either the sham, control, or cef group (n=4 each). After a tracheostomy had been performed, acute respiratory distress syndrome (ARDS) was induced in the control and cef group by insufflation of 48 breaths of cotton smoke and instillation of PA into the lungs according to an established protocol (2). The sham group received only the vehicle. The sheep were studied for 24h in the awake state and were ventilated with 100% oxygen. Cef (3g, i.v.) was administered at 1 and 13 h post injury. Coloured microspheres were injected at baseline (BL), and 24h. Systemic hemodynamics were determined intermittently. Trachea samples were obtained after the experiment during necropsy.
Results: Cardiopulmonary variables were stable in sham animals. In the control group, cardiac index (CI in L/min/m^2) increased significantly after 24h vs. BL (5.2±0.3 vs. 7.9±0.5), and was associated with a significant drop in mean arterial pressure (MAP in mmHg, 97±4 vs. 66±3). Cef stabilized CI (BL: 5.6±0.3 vs. 24h: 5.5±0.5) and raised MAP (BL: 96±3 vs. 24h: 82±6; each $p<0.05$) compared to the control group. Tracheal blood flow (in mL/min/g) was significantly attenuated in the cef group compared with the significant increase in the control group (sham BL 0.05±0.02, 24h 0.05±0.01, control 0.05±0.01, 24h 0.8±0.1, cef BL 0.05±0.02, 24h 0.2±0.05, $p<0.05$).
Conclusion: Since ceftazidime improved hemodynamic variables and attenuated the increase in tracheal blood flow in this model, it might be a useful treatment of patients with smoke inhalation injury and sepsis.
References:
(1) Schenarts et al. Shock 1996, 6(3):201-205
(2) Murakami et al. Crit Care Med 2002,30(9):2083-90.

S-47.

PRONOUNCED HEMODILUTION DURING CARDIOPULMONARY BYPASS DOES NOT AFFECT GUT PERMEABILITY

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Introduction: Hemodilution frequently occurs during cardiac surgery when cardiopulmonary bypass has been instituted. During a prospective, controlled and randomized study to investigate the clinical outcome of patients who were randomly allocated to a hematocrit of 20% or 25%, respectively, during normothermic cardiopulmonary bypass (CPB) for isolated CABG surgery, we investigated the influence of hemodilution on cytokine levels and gut permeability.
Methods: After approval by the local ethical committee and informed consent 60 patients were randomized to a hematocrit of 20%+/-1% versus 25%+/-1% during normothermic CPB. Prior to CPB patients were subjected to isovolemic hemodilution using HES130/0.4 (Voluven, Fresenius, Germany) to a hematocrit of 5+/-1% above the targeted hematocrit. Immunological and gastrointestinal outcome measures were: TNF-alpha, IL-10 and the excretion mannitol, lactulose/ mannitol index (L/M index) as well as sucralose in urine samples. Postoperative intensive care therapy followed an internal standardized protocol. Statistical analysis was performed using the Mann-Whitney-U-test and the Friedman. A $p<0.05$ was considered statistically significant. Results are given as median and interquartile range.
Results: Baseline parameters did not differ between study groups. TNF-alpha and IL-10 as well as the excretion of mannitol and the L/M index increased significantly in both groups after surgery ($p<0.05$ for all parameters). However, there were no significant differences regarding any of these parameters between both groups.

	Hct 25%	Hct 20%	p
L/M index baseline	0.021 (0.024-0.043)	0.022 (0.022-0.033)	0.46
L/M index 6hrs after surgery	0.203 (0.112-0.372)	0.371 (0.071-0.640)	0.29
Sucralose 6hrs after surgery	2.891 (2.231-3.653)	3.464 (2.503-4.941)	0.24
TNF alpha baseline [pg/ml]	7.6 (6.8-8.4)	7.7 (6.9-8.2)	0.99
TNF alpha during CPB [pg/ml]	8.3 (7.5-9.3)	8.1 (7.3-9.1)	0.60
TNF alpha 6hrs after surgery [pg/ml]	7.3 (6.6-8.0)	7.4 (6.4-9.3)	0.23
IL-10 baseline [pg/ml]	4.4 (4.0-5.2)	4.3 (3.8-4.9)	0.41
IL-10 alpha during CPB [pg/ml]	6.2 (5.0-9.1)	6.3 (5.2-6.9)	0.78
IL-10 alpha 6hrs after surgery [pg/ml]	18.0 (11.3-42.9)	20.3 (14.2-35.2)	0.61

Discussion: The results of our study showed significant differences in immunological response and gut permeability after isolated normothermic CPB for CABG-surgery. These results were not dependent on the hematocrit during CPB. This indicates that a hematocrit of 20% per se during normothermic CPB does not impair immunological response and gut permeability. Prospective and sufficiently powered studies are required to further evaluate the impact of the cardiopulmonary bypass on these parameters.

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S-48.

ASCENDING AORTIC DISSECTION (TYPE A) WITH HEMODYNAMICALLY SIGNIFICANT CARDIAC TAMPONADE IN A PREVIOUSLY HYPERTENSIVE PREGNANT WOMAN AFTER ACUTE COCAINE USE: A CASE REPORT AND DISCUSSION

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Introduction: Acute ascending aortic dissections are considered surgical emergencies, particularly when there is associated cardiac tamponade. Although this disease process tends to affect those in their fifth decade, 50% of aortic dissections in women less than 40 years old occur in association with pregnancy.[1] The cardiovascular changes that take place during pregnancy may be a contributing factor to this process.[2] The complication of acute cocaine use and the differing hemodynamic needs of the mother and baby make this an important case for presentation.
Case Report: A 37 year old woman (G_3P_2) 30 weeks pregnant presented to the emergency room with severe chest pain and shortness of breath. Three weeks previous, she had an elevated systolic blood pressure of 150 mmHg(preeclampsia ruled out). A 2-dimensional transthoracic echo revealed cardiac tamponade with restricted right and left ventricular filling. The patient was emergently transported to the operating room where a TEE was preformed that also demonstrated an aortic dissection 1.75 cm distal to the sinuses of valsalva, 3+ aortic insufficiency, and compression of the right atrium. No flow was seen in the false aortic lumen. After induction of general anesthesia, a c-section was preformed. We opted for moderate dose fentanyl (35 micrograms/kg) and labetalol (total 1mg/kg) for hemodynamic control with a mean blood pressure goal of 50 mmHg. After open drainage of 550ml of blood from the pericardium, a St. Jude 23 mm mechanical aortic valve and an ascending aortic root replacement was preformed. After placement on cardiopulmonary bypass, excessive reservoir blood (3100ml) was noted, despite previous retrograde aortic priming. An inline hemoconcentrator was used and 2050ml of ultrafiltrate was removed. The mother and baby tolerated the procedures well and were extubated on post-op days two and four, respectively.
Discussion: Three take-home points can be gleaned from this case. First, successful management of the partuant and child under these circumstances requires a balance between the desire to decrease the dp/dt while maintaining uterine perfusion. Although our OB/GYN colleagues suggested the use of hydralazine, we opted for labetalol so that we would not have unopposed Beta agonism given the presence of cocaine. Additionally, labetalol has been used successfully with few effects on the neonate. Secondly, greater increase in blood volume (35%) versues red cell volume (20%) necessitated the use of ultrafiltration to facilitate separation from bypass with an acceptable intravascular volume may also be necessary in similar third trimester.[3] Lastly, ongoing TEE monitoring was beneficial given the post delivery increase in cardiac output in addition to interrogating the new valve and ascending root.
References:
1) Journal Vascular Surgery 8:470-475, 1988
2) Diseases of the aorta in Braunwald's Heart Disease, p.1546 (5th ed.1997)
3) Anesthesiology 26:393-399, 1965

S-49.

DESFLURANE CAUSES MORE ATRIAL FIBRILLATION AND TACHYCARDIA AFTER OFF-PUMP AORTO-CORONARY BYPASS GRAFTING (OPCAB) THAN SEVOFLURANE

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INTRODUCTION: All volatile anesthetics provide protection against myocardial ischemia by pharmacologic preconditioning. Desflurane and sevoflurane seem ideal to fast-track patients after cardiac surgery. This study compares their arrythmogenic potential in patients after off-pump cardiac surgery (OPCAB).
METHODS: Forty patients undergoing OPCAB with TEA and ultra-fast-track anesthesia were randomized in this pilot study in two groups of 20 patients. Anesthesia was maintained with either 1 MAC of sevoflurane or 1 MAC of desflurane. Continuous ECG-monitoring for the detection of arrhythmias was performed during and up to 72 h after surgery, Troponine-T, CK-MB, regional wall motion abnormalities and ejection fraction, time to extubation, respiratory functions and hemodynamic stability were compared using t-test or Chi-square test. $P < 0.05$.
RESULTS: All patients were successfully extubated in the operating room with minimal post-operative pain up to 72h after surgery. Troponine-T and CK-MB levels, immediately after surgery, 3, 12, 24, 48 and 72h after surgery, were not statistically different between the two volatile agents. Hemodynamic stability during surgery and preservation of ejection fraction were equally not different between the two groups. Time to extubation was equally short with sevoflurane at 12 min (4) and desflurane at 11 min (5). There were significantly more patients with atrial fibrillation and tachycardia in the desflurane group than in the sevoflurane group. Before being discharged from the hospital, the atrial fibrillation was converted either spontaneously or pharmacologically or by electro conversion to sinus rhythm. In addition, 6 patients in the desflurane group against 1 patient in the sevoflurane group showed an agitated state immediately after surgery which settled spontaneously within 2 h.

DISCUSSION: Our pilot study shows that desflurane causes more arrythmias than sevoflurane after OPCAB. The findings of our prospective study are consistent with a recent retrospective analysis of patients after on-pump cardiac surgery. (1) They do not differ in providing hemodynamic stability or myocardial protection during or after aortocoronary grafts. Recovery from anesthesia was equally fast after both volatile anesthetics as was respiratory function.
CONCLUSION: Sevoflurane is superior to desflurane for anesthesia for OPCAB since it provides significantly less atrial fibrillation and supraventricular tachycardia whilst providing equally fast extubation times.

	Sevoflurane (N=20)	Desflurane (N=20)
Atrial fibrillation	1	5*
Atrial flutter	0	0
Supraventricular Tachycardia	0	5*
Ventricular tachycardia or fibrillation	0	0
Bradycardia	4	3

*Values are presented as actual number of patients.
1 Acta Anaesthesiol Belg. 2005;56(2):147-54.

S-50.

SEVOFLURANE FOR OPCABG PERMITS EARLIER EXTUBATION AND RETURN OF COGNITIVE FUNCTION WITH HIGHER PAIN LEVELS THAN ISOFLURANE

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Introduction: Off-pump CABG (opCABG) has caused a reevaluation of traditional narcotic-based anesthetic techniques developed for on-pump CABG. We compared the efficacy of sevoflurane (S) versus isoflurane (I) as the primary anesthetic for opCABG on time to extubation and functional outcomes.
Methods: Following IRB approval and written informed consent, 107 opCABG pts were enrolled at two university centers. They were randomized to receive either S or I for maintenance of anesthesia without nitrous oxide. Patients in both groups were anesthetized with etomidate and an intermediate acting muscle relaxant was used to facilitate intubation and maintain intraoperative neuromuscular blockade. Intraoperative fentanyl was limited to 5g/kg. Mini-Mental State Examination (MMSE) and Memory Recall Test (MRT) were administered pre-operatively and post operatively a few minutes following extubation and 90 minutes later. Pain scores were obtained after extubation every 15 minutes for 90 minutes. Sixteen patients were excluded due to incomplete data sets. Data of 91 patients were analyzed by ANOVA or Mann-Whitney U test, as appropriate.
Results: The two groups were comparable with respect to demographics and duration of administration of inhalational agents. S patients were extubated earlier than I patients (hr:min [st dev]: S: 2:48 [3:04]; I: 4:27 [4:46] (p=0.05). MMSE, MRT and pain scores following end of anesthesia are shown in Table 1. Pain scores <5 at 90 min following extubation were less frequent for S than I patients (χ^2= 6.8, df=2, p=0.03). Female patients did not return to baseline Mini Mental Status levels as fast as males.
Discussion: Sevoflurane and isoflurane both provide a means of delivering hemodynamically stable anesthesia in opCABG cases without the use of high dose narcotics. Females may have delayed cognitive recovery from opCABG. Sevoflurane permitted significantly shorter time to extubation than isoflurane with equivalent cognitive profiles 90 minutes following extubation. Our findings indicate the need for meticulous pain control in patients extubated early after opCABG surgery.
Table 1: Main findings of anesthetic agent and functional recovery following opCABG: Cognitive changes from preoperative baseline (* = sig diff).

	Time from end of anesthesia	90 min following extubation
SEVOFLURANE	2:49*	4:19
- MMSE (0-30)	- 7.6	- 4.7
- MRT (0-8)	- 1.7	- 1.9
- PAIN (0-10)	6.8	5.4*
ISOFLURANE	4:40*	6:10
- MMSE (0-30)	- 8.7	- 6.3
- MRT (0-8)	- 1.6	- 1.5
- PAIN (0-10)	6.5	3.8*

S-51.

EFFECT OF ROUTINE INTRAOPERATIVE TEE ON SURGICAL MANAGEMENT IN PATIENTS UNDERGOING CARDIAC SURGERY

AUTHORS: **K. Patel**, D. Muzic, M. Minhaj, P. Gramling-Babb, A. Tung, M. Chaney;
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Introduction: While not routine, TEE is widely used because it is perceived to provide information that substantially influences clinical management and likely improves patient outcome. However, there is limited scientific evidence to substantiate such perception. This prospective observational study investigates the effect of routine intraoperative TEE on surgical management in patients undergoing cardiac surgery.
Methods: Following IRB approval and informed consent, all patients scheduled for and undergoing cardiac surgery (CABG, valve, thoracic aortic, etc.) at our institution received intraoperative TEE following induction of general anesthesia. After a complete TEE exam, appropriate surgical management was determined jointly by the cardiac surgeon and cardiac anesthesiologist. Data collected included original scheduled surgery, new intraoperative TEE findings (not detected preoperatively), whether or not new TEE findings affected surgical management, and performed surgery.
Results: 132 consecutive patients scheduled for cardiac surgery were prospectively studied (87 male, 45 female, mean age 62.8 years). 43 patients (32.6%) were found to have new (not detected preoperatively) cardiac pathology via intraoperative TEE examination. 35 patients (26.5%) had their surgical plan altered because of these new findings (Table). 4 patients (3.0%) were converted from on-pump surgery to off-pump surgery and 2 patients (1.5%) were converted from off-pump surgery to on-pump surgery.
Discussion: At the present time, TEE is used in only approximately 60% of patients undergoing cardiac surgery[1]. Previous studies investigating use of routine TEE have been small in number, poorly designed, and have not involved patients undergoing off-pump CABG[2]. This clinical investigation reveals that routine use of intraoperative TEE substantially affects (one in four cases) surgical management and likely improves patient outcome. Most surgical alterations involved the mitral valve (15/35 patients) and 6 surgical alterations involved decisions regarding use/non-use of cardiopulmonary bypass. These findings support the view that all patients undergoing cardiac surgery (on-pump or off-pump) should receive the benefits of a complete intraoperative TEE examination.
References: 1. Anesthesiology 95:1507-1512, 2001.
2. Ann Thorac Surg 78: 1579-1585, 2004.

Surgical Plan Alterations	
Reason	# Of Patients
Tricuspid Valve Disease	10
Mitral Valve Disease	7
Absence Of Mitral Regurgitation	5
Mitral Valve Replacement Instead Of Repair	3
Aortic Valve Disease	2
Atrial Septal Defect	2
On-Pump CABG Instead Of Off-Pump CABG	2
Post-CPB Perivalvular Leak	1
Other	3

S-52.

LANDIOLOL ATTENUATES THE HEMODYNAMIC RESPONSE TO TRACHEAL INTUBATION, BUT DELAYS THE ONSET TIME OF VECURONIUM

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Introduction: Landiolol, an ultra-short- acting beta-adrenergic receptor antagonist, is sometimes administered to prevent the hemodynamic response to tracheal intubation. However, it may delay the onset time of neuromuscular blockades because of the decrease in cardiac output. The purpose of the present study was to clarify the onset time of vecuronium after the administration of landiolol for attenuation of the hemodynamic response to tracheal intubation.
Methods: After obtaining the approval of the hospital ethics committee and informed consent, fifty patients with ASA status I were allocated to the groups L and C. Patients in the group L received the administration of landiolol before induction (1 min of 0.125 mg/kg/min and then 4 min of 0.04mg/kg/min). Patients in the group C received the administration of physiological saline solution (PSS), alternative to landiolol. Five min after administration of landiolol or PSS, 2 mg/kg propofol and 0.1 mg/kg vecuronium were administed for induction. Tracheal intubation was performed when the train of four (TOF) reached at 0% (T0). Values of heart rate (HR) and mean arterial pressure (MAP) were recorded before and after intubation. Furthermore, the onset time from the initial administration of vecuronium to maximal block (T0).
Results: There were no differences in demographic data between two groups. MAP increased after tracheal intubation in both groups. There was no significant difference in MAP after tracheal intubation between both groups. HR significantly increased after tracheal intubation in the group C, but not in the group L. Onset time of vecuronium was significantly increased in the group L compared with the group C.
Discussion: Although administration of landiolol before anesthetic induction is very useful to prevent tachycardia by tracheal intubation, we should pay attention to the prolongation of the onset time of neuromuscular blockade.

S-53.

INTRAVENOUS ANESTHESIA WITH TARGET CONCENTRATIONS OF REMIFENTANIL AND PROPOFOL IN CARDIAC SURGERY: CO-INDUCTION WITH ETOMIDATE

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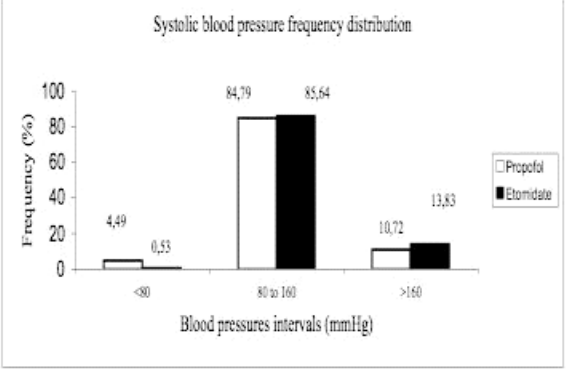
Introduction: Despite slow increases in drug concentrations, hypotension still occurs during induction with Remifentanil and Propofol in elderly patients with cardiovascular disease. The aim of this study was to verify whether a co-induction with Etomidate would provide a faster loss of consciousness (LOC= absence of response to verbal stimulation) with a lower incidence of hypotension (systolic blood pressure <80 mmHg) and lower doses of Propofol during maintenance.
Method: 20 patients, ASA class III or IV, >70 years old, scheduled for cardiac surgery, were following written informed consent randomly allocated to two groups. Patients with preoperative arterial systolic blood pressure >160 or <100 mmHg, a BMI >30, a serum creatine >1.5 $mg.dl^{-1}$ and GPT or GOT levels higher than 1.5 times the normal levels were excluded from the study. Propofol and Remifentanil effect concentrations were controlled according to Schnider and Minto pharmacokinetic models. Blood pressures, heart rate, BIS™ values and drug concentrations were automatically recorded every 10 seconds during the 90 minutes study period.
Propofol group (P): Induction started with a 2 $ng.ml^{-1}$ Remifentanil and a 0.5 $mcg.ml^{-1}$ Propofol effect concentration, the latter being gradually increased by 0.2 $ng.ml^{-1}$ increments until LOC. Ventilation was then manually controlled, and patients were given a bolus of Cisatracurium while Remifentanil was increased to 6 $ng.ml^{-1}$ until tracheal intubation. Propofol and Remifentanil concentrations were adapted according to the level of surgical stimulation, BIS values (between 40 and 60) and hemodynamics.
Etomidate group (E): Induction started with the same 2 $ng.ml^{-1}$ Remifentanil and 0.5 $mcg.ml^{-1}$ Propofol effect concentration. At that point Etomidate 0.2 $mg.kg^{-1}$ was injected. Anesthesia was further managed as in group P.
Results: Co-induction in group E (180 ± 14 sec) was faster than in group P (517 ± 210 sec) ($p<0.001$). Hypotension occurred less frequently in Group E than in group P (chi square test $p<0.001$). Total Propofol and Remifentanil consumptions during 90 minutes study period were the same.
Conclusions: Etomidate reduces the incidence of hypotension and shortens the induction time of target controlled infusions of Remifentanil and propofol in ASA III and IV elderly patients undergoing cardiac surgery. Etomidate has no sparing effect on Propofol and Remifentanil consumption before bypass.
References: 1.Acta Anesthesiol Scand; 48: 1010, 2002\



S-54.

HYPERTONIC SALINE SOLUTION ENHANCES THE PAO_2 AND THE CREATININEMIA AFTER ON PUMP MYOCARDIAL REVASCULARIZATION

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Introduction: The hypertonic saline solution (HSS) is a plasma expander that acts by removing water from intersticial and intra vascular sector. HSS increases the left ventricule filling, has an inotropic effect and deacreases the systemic vascular resistances. These effects have been observed in cardiac surgery (1). The aim of this study was to relate biological and hemodynamical changes after myocardial revascularization with and without HSS perfusion.
Methods: After ethic committee agreement and informed written consent, 47 patients scheduled for CABG surgery with CPB were randomly assigned to 2 groups: the HSS group (n=25) received 4 mL/kg of 7,5% HSS perfused during 20 minute, the Control group (n= 22) did not received HSS. Arterial blood gas, ionograms, creatininemia, proteinemia, white and red cells counts, platelets count were performed, pre (D-1) and post operatively: at the arrival in the intensive unit (D0) and on the morning of the post operative day (D1). The X chests ray on D-1, D0 and D1 were compared. Arterial hypotension and hypertension episodes, ventricular arrhythmia were recorded. The X chests ray were classified in 3 groups: normal, with intersticial oedema, with alveolar oedema. Statistical analysis employed the χ^2 and Student T tests, as appropried. A p value less than 0.05 was considered significant.
Results: The 2 groups were similar for anthropometric and CPB data. There was no difference between the left ventricule ejection fractions in the Control group (60 ± 11%) and the HSS group (60 ± 14%). The data are presented in the table, mean (standart deviation)

Table

	Control 22	HSS 25
Na preop (mMol/L)	139 (4)	139 (3)
Na arrival ICU (mMol/L)	139 (5)	147 (5)*
Na D1 (mMol/L)	138 (5)	143 (2)
PaO_2 preop (mmHg)	88 (28)	88 (16)
PaO_2extubated (mmHg)[1]	108 (34)	107 (24)
PaO_2 D1 (mmHg)	73 (16)	82 (32)*
Creatinine preop (µmol/L)	101 (27)	110 (66)
Creatinine D1 (µmol/L)	120 (52)	113 (75)
Protein D1 (g/L)	51 (9)	51 (7)

[1] O_2 3 L/min
* $p < 0.05$

On D1, there were observed more intersticial pulmonary oedema in Control group.The hemodynamics data did not significantly differ in the 2 groups.
Discussion: After on pump cardiac revascularization with CABG, the PaO_2 on the first post operative day was 11% higher in the HSS group than in the Control group. With a similar hemodilution, as showed by an identical proteinemia in the 2 groups, the plasmatic creatinine level were stable in the HSS group, when a 20% increase was observed in the Control group. Largest studies are necessary to confirm the pulmonary and renal protective effects of HSS in cardiac surgery with CPB.
Reference: 1 J Cardiothorac Vasc Anesth.15;210-5;2001.

S-55.

FUNCTIONAL GENOMICS OF ANESTHETIC PROTECTION IN HUMAN MYOCARDIUM

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Introduction: We have shown in the first placebo-controlled multicenter study of anesthetic preconditioning that administration of sevoflurane significantly ameliorates postoperative function (1) and improves cardiovascular long-term outcome in patients undergoing on-pump coronary artery bypass grafting (CABG) (2). In these studies, we provide evidence that sevoflurane preconditioning alters gene expression (PECAM-1, catalase), which may be linked to the observed decreased incidence of late adverse cardiac events in patients receiving sevoflurane. The following study should now evaluate the genome-wide responses to sevoflurane in the myocardium of patients undergoing off-pump CABG and relate these changes to functional and biochemical markers ("functional genomics").
Methods: With written informed consent, twenty male patients with 3-vessel coronary artery disease undergoing off-pump CABG were randomized to sevoflurane (VIMA) (N=10) or propofol (TCI) (N=10) anesthesia. Patients with unstable angina or myocardial infarction less than 8 weeks ago were excluded from the study. Right atrial tissue samples were taken at the beginning and at the end of the operation from all patients and used for gene chip analysis (Affymetrix HG-U133 Plus 2.0). Additional outcome parameters included serial measurements of cardiac troponin T, CK-MB, brain natriuretic peptide (NTproBNP), cystatin-C, and pregnancy-associated plasma protein-A (PAPP-A). Myocardial velocity mapping using tissue Doppler transesophageal echocardiography was performed intraoperatively, and cardiac output was determined intra- and postoperatively by the thermodilution technique with the pulmonary artery catheter.
Results: Patient characteristics were comparable between the sevoflurane and propofol group. In contrast to propofol patients, sevoflurane patients exhibited a marked increase in cardiac output at the end of CABG (sevoflurane 7.3±2.1 l/min (mean±SD) vs. propofol 5.7±1.1 l/min, $p<0.05$). Also, peak systolic and peak early diastolic velocities (mitral annulus) were significantly increased after CABG in sevoflurane patients (peak systolic: sevoflurane 4.2±1.5 cm/s vs. propofol 2.9±1.1 cm/s, $p<0.05$; peak diastolic: sevoflurane 3.9±1.6 cm/s vs. propofol 2.1±1.4 cm/s, $p<0.05$). Consistent with this observation, NTproBNP, a biochemical marker for impaired myocardial contractility, was increased in propofol patients. PAPP-A, a marker for coronary plaque instability and inflammation, was increased in propofol patients but unchanged in sevoflurane patients. Genomic analysis revealed a high number of transcripts related to signalling, inflammation, cell death, which were upregulated in response to surgery. Genomic footprints of the two anesthetics sevoflurane and propofol were discernable.
Discussion: The physiological responses to off-pump CABG without cardiopulmonary bypass are close to those observed in noncardiac surgical patients. Using transesophageal echocardiography and biochemical markers, we were able to confirm the superior cardiac protection by sevoflurane versus propofol in these patients. For the first time, we obtained the genome-wide responses of two different anesthetics in the human myocardium. Additional analysis should test the interplay between gene expression, biochemical and functional parameters.
References:
(1) Anesthesiology 98; 1315-27, 2003
(2) Br J Anaesth 94; 159-65, 2005

S-56.

IMPORTANCE OF THE 12-LEAD ECG IN RISK ASSESSMENT FOR VASCULAR SURGICAL PATIENTS

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Introduction: The 12-lead ECG is a routine and cheap method of investigating cardiac function in vascular surgical patients prior to surgery however its use as a predictor of adverse cardiac outcome has been underinvestigated in this high risk population12. We examined a cohort of 216 patients undergoing aortic and peripheral vascular surgery in our institution to assess its value as a tool for risk assessment.
Methods: After ethics committee approval and obtaining informed consent we recruited 216 patients (aged 45-92 years, 169 male) undergoing vascular surgery under general anesthesia. In all patients the presence or absence of cardiovascular risk factors was determined by history and clinical examination. Preoperative ECGs were obtained and examined by a single blinded observer for the presence of Q waves, ST segment depression, T wave inversion, rhythm other than sinus, >5 premature ventricular beats per minute, left axis deviation and left ventricular hypertrophy (according to Sokolow-Lyon criteria). All patients were followed-up for one year to identify cardiac deaths and episodes of cardiac morbidity.
Odds ratios were calculated to determine the association between preoperative ECG abnormality and early (up to 30 days after surgery) adverse outcome as well any relationship between ECG abnormality and in-hospital perioperative MI or cardiac death.
Results: The incidence of comorbidity in this group of patients was high: past history of ischaemic heart disease 38%, hypertension (defined as blood pressure ≥ 140/80) 55%, diabetes mellitus 9%, past history of CVA 34%.
There were 55 adverse cardiac outcomes of which 39 occurred in the first thirty days after surgery and another 16 at up to the end of the first postoperative year. These outcomes included 16 cardiac deaths and 15 perioperative MIs. The relationships between ECG abnormalities and adverse outcome are summarised in the table below.
Discussion: We have demonstrated the power of some features of the preoperative 12-lead ECG in predicting perioperative adverse cardiac events in vascular surgical patients. Further studies should examine the relative merits of risk assessments based on clinical history and examination of the perioperative ECG.
References: 1) New England Journal of Medicine 297: 845-50 1977; 2) Journal of Vascular Surgery 26: 570-8 1997

p-values of risk factors for adverse cardiac outcome (NS - not significant)

ECG abnormality	Early outcome	Overall outcome	Cardiac death	Perioperative MI
ST segment depression	0.03	0.02	0.05	0.05
T wave inversion	NS	0.01	0.009	0.0002
LVH	0.03	0.03	NS	NS
Abnormal rhythm	0.02	0.006	NS	0.02
>5 VPBs	0.006	0.02	NS	0.0003
Q waves	NS	NS	NS	NS
LAD	NS	NS	NS	NS

S-57.

FACTORS THAT PREDICT POST-OPERATIVE TRANSFUSION NEED IN PATIENTS UNDERGOING TOTAL HIP REPLACEMENT

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Introduction: The ability to predict pre-operatively which surgical patients will need transfusion has long been a goal of surgeons and anesthesiologists (J Bone Joint Surg Br 2004;86:970; J Bone Joint Surg Am 2004;86A:57). This investigation was undertaken to identify peri-operative markers that would predict the need for transfusion.
Methods: We reviewed the charts of 499 consecutive patients undergoing single primary hip arthroplasty performed by one surgeon (WMG) at one institution (RNSMC) from March, 2003 until June, 2005. All patients received general anesthesia. Variables including weight, age, ASA status, sex, history of hypertension or coronary artery disease, estimated blood loss, and the intra-operative use of pressors or anti-hypertensives were evaluated utilizing stepwise logistical regression.
Results: 256 of the patients required transfusion. Age, weight, and hypertension were significant predictors. Being hypertensive approximately doubled (2.05) the transfusion rate. Older patients (>66 years old) were 1.8 times as likely to have transfusions as younger ones. Patients weighing less than 183 lbs were 2.2 times as likely to need a transfusion.
Discussion: In patients of both sexes undergoing single primary total hip arthroplasty, having hypertension, weighing less, or being older significantly increased the need for transfusion. Further clarifying these data might identify a group of patients for whom no pre-operative procedures for anticipated blood loss replacement need be performed.

S-58.

PREREPERFUSION HYPERKALEMIA AND RISK FACTOR ANALYSIS IN 1134 CASES OF ADULT LIVER TRANSPLANTATION

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Background: While serum hyperkalemia before reperfusion of the liver graft is associated with severe postreperfusion hyperkalemia, which can cause cardiac arrest and other serious intraoperative complications, its incidence and risk factors during adult liver transplant surgery are not well characterized. Aims: To determine the incidence and risk factors for prereperfusion hyperkalemia during adult liver transplant surgery. **Methods:** After institutional approval, the medical records at our medical center between January 1, 1998 and December 30, 2004 were reviewed. During the study period 1,134 adult (age =/> 18) patients underwent liver transplantation. There were 3,322 prereperfusion potassium (K^+) samples averaging 2.9 per surgery. The patients were divided into 2 groups according to their prereperfusion K^+ values: group 1 (n=999), K^+ <5.5 mmol/L at all times; and group 2 (n=135), one or more K^+ values =/>5.5. A total of 16 variables including age, sex, UNOS status, prior surgery, the use of piggyback technique, the baseline prothrombin time (PT), international normalization ratio for PT (INR), blood urea nitrogen (BUN), creatine (Cr), base excess (BE), K^+, urine output (OU) and intraoperative transfusion of red blood cells (RBC), fresh frozen plasma (FFP), platelets (PLT) and cryoprecipitate (CRYO) were analysed. The prereperfusion K^+ values were plotted at an hourly interval before reperfusion. **Results:** There was no difference between the 2 groups with respect to age, sex, baseline PT, INR, OU, prior surgery, or the use of piggyback technique. The range of K^+ values was from 1.8 to 7.6 (mmol/L). The incidence of prereperfusion hyperkalemia was 16.8%. The mean baseline K^+ and K^+ values in all time intervals in group 2 were significantly higher than those in group 1 (data not shown). Preliminary analysis (Student t test and x^2 test) showed that patients in group 2 had higher baseline BUN (M+/-SD) (35.0+/-22.9 vs 30.3±24.0, p=0.039), higher baseline Cr (2.2+/-2.2 vs 1.8±1.8, p=0.02) and a lower baseline BE (-3.4+/-4.1 vs -2.0+/-4.1, p=0.0003) than patients in group 1. Compared with patients in group 1, patients in group 2 required greater amounts (in units) of blood transfusion including RBC (17.8+/-14.3 vs 11.5+/-9.9, p<0.0001), FFP (22.4+/-15.4 vs 15.9+/-11.4, p<0.0001), PLT (14.3+/-11.4 vs 11.6+/-10.5, p=0.006), and CRYO (10.5+/-9.9 vs 7.5+/-8.9, p<0.0001). **Conclusions:** In this large retrospective study we showed that prereperfusion hyperkalemia was associated with higher baseline K^+, more severe baseline metabolic acidosis, worse kidney dysfunction, and an increased intraoperative transfusion requirement during adult liver transplant surgery.

S-59.

CAN BE THE POSITION OF INTERNAL JUGULAR VEIN ESTIMATED IN THE PEDIATRIC PATIENTS WITH CONGENITAL HEART SURGERY? COMPARISON BETWEEN CYANOTIC AND NON-CYANOTIC PATIENTS

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Introduction: It has been established that ultrasound-guided cannulation of the internal jugular vein (IJV) is useful in infants (1). However, ultrasound transducers with high frequencies for pediatric superficial vessels are expensive and not yet widely available. When the three-dimensional position of the IJV from the carotid artery (CA) is estimated, the success rate may increase even without ultrasonography. In this study, we measured the distance between the IJV and the CA (Dis), the width of the IJV (W) and depth of it from the skin (Dep) with an ultrasound scanner and evaluated whether they could be estimated by age, height and body weight (BW). And we compared the results between cyanotic and non-cyanotic patients.
Methods: After obtaining institutional approval and parental informed consent, 100 pediatric patients (0-34 months, 43-94 cm, 2.5-12 kg) undergoing congenital heart surgery were prospectively studied. The number of cyanotic and non-cyanotic patients was 62 and 38. After the trachea was intubated, the lungs were ventilated with pressure control (15 ± 1mmHg). Dis, W and Dep in the right IJV were measured using a 12MHz transducer with a SONOS 5500 ultrasound system (Philips Medical Systems, Andover, MA, USA). The measurement was performed at the end-inspiratory period at the level of the cricoid ring. We evaluated the Pearson coefficient correlation of these variables with age, height and BW in each patient group. Statistical significance was considered to be $P < 0.05$.
Results (Table): W and Dis were significantly correlated with age, height and BW in the non-cyanotic patients and more correlated in the cyanotic patients. Dep was not correlated with them in each patient group
Discussion: The two-dimensional position of the IJV from the CA (the distance between the IJV and the CA and the width of the IJV) could be estimated by age, height and BW in the pediatric cardiac patients. Correlation was better in the cyanotic patients.
Reference:
1) Verghese, ST. Anesthesiology 1999:91:71-7

Correlation coefficient in the cyanotic and non-cyanotic patients

Cyanotic patients	Dis	W	Dep
Age	0.75	0.78	0.05
Height	0.78	0.80	0.12
BW	0.77	0.83	0.10
Non-cyanotic patients			
Age	0.68	0.66	0.20
Height	0.73	0.63	0.36
BW	0.74	0.58	0.38

S-60.

DO PATIENTS WITH HIGHER MELD SCORE HAVE HIGHER INTRAOPERATIVE RISKS DURING LIVER TRANSPLANT SURGERY?

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Background: The current organ allocation policy for liver transplantation in the United States is based on disease severity determined by the model for end-stage liver disease (MELD); and the impact of the MELD on the intraoperative risks has not been completely assessed. Aims: To determine if patients with higher MELD scores have higher intraoperative risks during liver transplant surgery. **Methods:** A total of 183 patients underwent liver transplantation in 2004 at our medical center and 53 patients (age <18, retransplant, combined transplant or UNOS status 1) were excluded. After institutional approval, the remaining 124 patients were included in the study. The patients were divided into 2 groups according to their pretransplant MELD scores: low MELD group had MELD scores of 30 or less (mean±SD 21.78±6.56, n=73) and high MELD group with MELD scores of >30 (36.57±3.02, n=51). **Results:** There was no difference between the two groups with respect to age and sex. The following intraoperative risks were compared between the two groups. The incidences of hyperkalemia (K+>5.0 mmol/L) in periods either before or after reperfusion of the graft and duration of operations were comparable between the two groups. The patients in the high MELD group required more blood transfusion in both the pre- and postreperfusion periods than the patients in low MELD group: requirement for red blood cells transfusion was significantly greater in the high MELD group than in the low MELD group in the prereperfusion period (9.85±6.21 vs 6.85±5.94 units, p=0.009, Student T test) and in the postreperfusion period (5.83±6.19 vs 3.55±3.55 units, p=0.012); requirement for fresh frozen plasma was also increased in the high MELD group compared to the low MELD group in the prereperfusion period (14.10±8.34 vs 9.93±7.28 units, p=0.005) and in the postreperfusion period (7.85±8.28 vs 4.89±4.24 units, p=0.012). Administration of vasoactive medicines (phenylephrine, epinephrine, or norepinephrine) for intraoperative hypotension was more frequently required in the high MELD group than in the low MELD group in either large amount (phenylephrine >2 mg, epinephrine >50 mcg, norepinephrine > 40 mcg) of bolus (27/51 or 52.9% vs 14/73 or 19.2%, p<0.001, Pearson x^2 test) or continuous infusion (21/51 or 41.2% vs 12/73 or 16.4%, p=0.007). **Conclusions:** The patients with higher MELD scores have higher intraoperative requirements for transfusion and vasoactive medicines during liver transplant surgery. Further characterization of the relationship between MELD and intraoperative risks may provide guidance in the management of the patients during liver transplant surgery under the current MELD system.

S-61.

PERIOPERATIVE INDOCYANIN GREEN CLEARANCE AFTER CORONARY ARTERY BYPASS GRAFTING IS PREDICTIVE FOR PROLONGED INTENSIVE CARE UNIT STAY

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Introduction: Splanchnic ischemia and hepatic dysfunction are severe complications after coronary artery bypass grafting leading to increased morbidity and mortality. Hemodilution occurring during cardiopulmonary bypass (CPB) may lead to transient splanchnic ischemia which might cause postoperative complications and affect outcome. The indocyanine green plasma disappearance rate (PDR-ICG) is a sensitive marker of liver perfusion as ICG is only metabolized in the liver. In a prospective, controlled and randomized study we investigated the PDR-ICG by a non-invasive method using pulse densitometry in patients who were randomly allocated to a hematocrit of 20% or 25%, respectively, during normothermic CPB for isolated CABG surgery. The aim of the study was to evaluate the effect of hemodilution on PDR-ICG.
Methods: After approval by the local ethical committee and informed consent 60 patients were randomized to a hematocrit of 20%+/-1% versus 25%+/-1% during normothermic CPB. Prior to CPB patients were subjected to isovolemic hemodilution using HES130/0.4 (Voluven, Fresenius, Germany). Measurements of the PDR-ICG, ASAT and alphaGST were performed immediately after induction of anesthesia, on admission to the ICU and 18hrs after surgery. For each measurement 0.5 mg/kg body weight ICG was injected into a central vein. The densitometric dye decay was analyzed with a commercially available monitor (Limon, Pulsion AG, Munich). Statistical analysis: Mann-Whitney-U-test and Spearman correlation analysis.
Results: Baseline parameters did not differ between study groups. PDR-ICG as well as ASAT and alphaGST did not differ between groups.

	Hct 25% (n=31)	Hct 20% (n=29)	p
PDR ICG alpha baseline [%/min]	17.2 (13.7-22.6)	18.3 (15.4-21.3)	0.85
PDR ICG admission ICU [%/min]	23.3 (18.1-25.4)	22.5 (16.8-27.3)	0.86
PDR ICG 18hrs after surgery [%/min]	22.5 (19.6-25.8)	22.3 (20.1-25.1)	0.93
Alpha GST baseline [U/l]	5.3 (3.7-6.6)	5.7 (4.2-7.8)	0.40
Alpha GST admission ICU [U/l]	15.6 (9.8-36.8)	22.1 (12.6-29.3)	0.46
Alpha GST 18hrs after surgery [U/l]	3.9 (2.5-4.5)	3.7 (2.9-4.1)	0.61
ASAT baseline [U/l]	22 (18-27)	22 (19-24)	0.94
ASAT admission ICU [U/l]	39 (30-48)	35 (26-44)	0.41
ASAT 18hrs after surgery [U/l]	49 (36-63)	61 (31-87)	0.40

However, PDR-ICG levels on admission to the ICU and 18h after surgery correlated with the length of ICU stay and were predictive for a prolonged ICU treatment after surgery (ROC analysis: admission ICU AUC 0.93 CI95%:0.80-0.99; 18h after surgery AUC 0.95 CI95%:0.87-0.99).
Discussion: The results of our study show that hepatic perfusion und liver cell integrity quantified by PDR-ICG, ASAT and alphaGST after isolated CABG-surgery was not impaired by a hematocrit of 20% during normothermic CPB. However, depressed PDR-ICG after cardiac surgery correlated with and was predictive for increased length of ICU stay.

S-62.

FACTORS INFLUENCING INDUCTION TIME WITH 2.5 MAC SEVOFLURANE INHALATION

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Introduction: Inhalation of a high concentration of sevoflurane via a mask allows a rapid and smooth induction of general anesthesia with only minimum effects on systemic hemodynamics (1). This technique is useful for ambulatory anesthesia of short duration. However, the induction time may vary from patient to patient depending on his/her age, vital capacity, and cardiac output. In this study, we tried to identify how preoperative respiratory and cardiac functions influenced the sevoflurane induction time.
Methods: After obtaining a written informed consent from each patient, 27 patients 28 to 77 years of age, scheduled to undergo elective surgery under general anesthesia were included in the study. Spirometry and body plethysmography were performed using a constant-volume body plethysmograph several days before the operation. The values of VC and FRC were contrasted with age- and sex-predicted reference values and were expressed as a percentage of predictive values (i.e., %VC and %FRC). In addition to routine anesthesia monitoring, cardiac output was measured continuously by impedance cardiography (BioZ, GE Medical). The bispectral index (BIS) was also displayed (A2000, Aspect Medical Systems). Patients were instructed through an earphone connected to a voice recorder to inhale, grasp a rubber ball connected to a pressure transducer, exhale, and grasp the ball again. These instructions were repeated every 12 seconds. Anesthesia was then induced with age-corrected 2.5 MAC sevoflurane and oxygen as the carrier gas at a flow rate of 10 L/min. The time from the beginning of sevoflurane inhalation to loss of eyelash reflex and to inability to grasp the ball, as well as to when the BIS value decreased to 60, were measured. The correlations of these time variables with age, height, body weight, cardiac index, %VC, %FRC, and the ratio of residual volume to total lung capacity (RV/TLC), were assessed by single regression analysis. Data were expressed as mean ± SD.
Results: Loss of eyelash reflex, inability to grasp the ball, and BIS value of 60 occurred at 42±11 sec, 66±17 sec, and 99±50 sec after the beginning of sevoflurane inhalation, respectively. There was no correlation between any preoperative characteristic and the time to loss of the eyelash reflex. The time to inability to grasp the ball showed a positive correlation with age ($r=0.44$, $P=0.02$) and a negative correlation with %RV ($r=-0.47$, $P=0.015$) and %FRC ($r=-0.39$, $P=0.042$). Only age showed a positive correlation with the time to reach the BIS value of 60 ($r=0.54$, $P=0.004$).
Discussion: Our results suggested that age was the most important predictor of induction time with 2.5 MAC sevoflurane. From the clinical standpoint, either %RV, %FRC, or preoperative cardiac index was a very unlikely cause of prolongation of the induction time.
Reference: 1. Anesth Analg 2001;93:1185-7

S-63.

LONG-TERM COGNITIVE DECLINE AFTER CORONARY ARTERY BYPASS GRAFTING: IS OFF-PUMP SURGERY BENEFICIAL? PRELIMINARY RESULTS FROM A RANDOMIZED STUDY

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Introduction: Coronary artery bypass surgery is associated with cognitive decline, which has been attributed to the use of cardiopulmonary bypass. However, one year after coronary artery bypass surgery without cardiopulmonary bypass (off-pump CABG), cognitive outcome was not better than after conventional bypass surgery with cardiopulmonary bypass (on-pump CABG) (1). The long-term effects of CABG with and without cardiopulmonary bypass are unknown. A study by Newman et al. in on-pump CABG patients claimed that the incidence of cognitive decline was 24% at six months after surgery, but increased to 42% at five years (2). This suggested that the subtle damage caused by CPB may accelerate cerebral aging, and that the harmful effects of CPB may become more apparent in the long term. The aim of the present study was to compare long-term cognitive outcome after off-pump and on-pump CABG.
Methods: Between 1998 and 2000, 281 patients were randomized to off-pump or on-pump CABG in the multicenter Octopus Study (1). Five year after their surgery, the patients were invited for a follow-up assessment. A psychologist, blinded for treatment allocation, re-administered a battery of 10 neuropsychological tests including 11 main variables to the patients. Cognitive performance of each patient at 5 years was compared to his or her baseline performance one day before surgery. Cognitive decline was defined as a decrease in performance of at least 20%, in at least 20% of the main variables (1).
Results: By July 2005, the 5 year follow-up of the first 246 patients had been completed. Twelve off-pump and 8 on-pump patients had died. The surviving 226 patients were contacted by telephone. The mean time between their coronary surgery and follow-up was 5.2 years (SD 0.2 y) in both groups. Five patients suffered from severe dementia or stroke. These patients were considered to have cognitive decline. Nineteen patients (8.4%) refused cognitive testing or were physically unable to undergo testing. Cognitive outcome could therefore be determined in 84% of the first 246 patients (106 patients in the off-pump group and 101 in the on-pump group). Mean age at the time of follow-up was 66 years (SD 9 y) in both groups. In the present patient sample, the incidence of cognitive decline was 48.1% after off-pump CABG and 47.5% after on-pump CABG (relative risk 1.01; 95% confidence interval 0.76 - 1.35; p=1.00).
Discussion: It was hypothesized that the use of cardiopulmonary bypass during CABG may accelerate cerebral aging. However, in the present sample of low-risk CABG patients, avoiding cardiopulmonary bypass did not improve cognitive outcome five years after the procedure.
References: (1) JAMA 287:1405-12, 2002. (2) N Engl J Med 344:395-402, 2001.

S-64.

ADENOSINE-INDUCED TRANSIENT CARDIAC ASYSTOLE IN THE AWAKE ELDERLY PATIENT FOR ENDOVASCULAR THORACIC AORTIC ANEURYSM REPAIR

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Introduction Adenosine, a natural purine nucleoside, is primarily used at low doses (6-12mg) as an antiarrhythmic agent to slow supraventricular tachycardias. Although not FDA approved for the purpose of inducing transient cardiac asystole, which tend to occur at higher doses (15-36mg), adenosine has been used to facilitate precise endovascular stent-graft deployment in the thoracic aorta(1). The optimal dose sufficient to provide a 20sec duration asystole is difficult to predict. Thus, we determined the dose-response relationship of adenosine's asystole duration.
Methods After IRB approval and informed consent, a prospective study on a series of 20 consecutive patients undergoing thoracic aorta endovascular aneurysm repair was performed. Using a MAC technique (monitored anesthesia care) with local inflitration (0.5% lidocaine) and sedation, patients were awake and conversant throughout the procedure. Prior to stent deployment, adenosine 18-36mg was rapidly administered via a large bore peripheral IV followed by saline flush. Standard monitors and an arterial line were used. External transcutaneous defibrillator/ cardiac pacing pads were placed as a precautionary measure. Duration of asystole was recorded by a stop watch and/or printed EKG rhythm strip analysis.

Results 12 male and 8 female, were studied. Mean age was 69yrs (range 57-78). ASA classification were III's=5 and IV's=15. Asystole duration according to adenosine dose is summarized in the table below.
(1) includes one subject at 22mg
(*) 3 pts received a second dose

Dose	N=23 (*)	Asystole Duration Mean ± SD (sec)
18mg	6 (1)	12.1 ± 5.9
36mg	17	19.5 ± 9.1
p-value		< 0.03

Discussion Transient cardiac asystole aids endovascular stent-graft deployment by causing a brief cessation in the cardiac propulsive force; thus preventing distal device migration within the thoracic aorta. Once the endovascular device is in proper position and confirmed by fluoroscopy, optimal adenosine dose for deployment, which usually takes less than 20sec, may be achieved by an18mg to 36mg dose. This translates into a weight-based dose range of 0.2-0.5mg/kg administered through a peripheral IV. Although rapidly metabolized, larger adenosine doses (0.5mg/kg or greater) produce a statistically significant longer asystole duration. Constant communication with the surgeon maximizes the window of opportunity for stent deployment during asystole; with the goal of minimizing the adenosine dose. While the common side effects are self-limiting, no patient required external defibrillation and/ or pacing.
Reference
1. Dorros G, Cohn JM: Adenosine-induced transient cardiac asystole enhances precise deployment of stent-grafts in the thoracic or abdominal aorta. J Endovasc Surg 1996; 3:270-2

S-65.

FACILITATING PERIOPERATIVE BETA BLOCKADE: TITRATION OF ANESTHETIC TO PROCESSED ELECTROENCEPHALOGRAM PARAMETERS

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Introduction: Despite evidence from randomized trials (1,2) and revisions to professional guidelines (3), beta blockade remains underutilized in the perioperative setting; perhaps because clinicians fear hemodynamic instability which could result from the concurrent administration of beta blockers and volatile anesthetics. Processed EEG monitors may help facilitate perioperative beta blockade by allowing the use of lower volatile anesthetic concentrations, possibly avoiding hypotension.
Methods: After Institutional Review Board approval and obtaining written patient consent, 18 patients undergoing vascular or total joint arthroplasty surgery were randomized to have an EEG-guided (n=8) desflurane anesthetic titrated to a Patient State Index (PSI; Patient State Analyzer 4000, Physiometrix; North Billerica, MA) value of 25-50 or a control EEG-blinded (n=10) desflurane anesthetic titrated by conventional means (heart rate, blood pressure, reflex response, movement, and minimum alveolar concentration of anesthetic). For analgesia and adrenergic stress blockade, all patients received alternating intravenous doses of fentanyl (50mcg) and metoprolol (2.5mg) to maintain heart rate below 80bpm. EEG-guided cases were compared against EEG-blinded cases using the primary endpoints of Patient State Index values and metoprolol administered perioperatively. Initial regression analysis indicated significant associations for further modeling with two sided t-tests, chi-squared analyses, and analyses of covariance.
Results: EEG-guided patients spent significantly less time over-anesthetized (4.2% vs. 8.6%, p<0.0001) as measured by the Patient State Index, a processed EEG parameter. Though this allowed for a clinically significant increase in beta blockade (3.4mg/hr vs. 1.4mg/hr,) this difference was not statistically significant (p=0.1452).

Discussion: Compliance with evidence-based guidelines for perioperative beta blockade remains poor with less than half of highest risk patients receiving such treatment (5). Like perioperative beta blockade, processed EEG monitoring has had limited acceptance and implementation. Intraoperatively, patients with EEG-guided anesthetics spent significantly less time in the over-anesthetized state. EEG guidance has been shown to decrease volatile anesthetic administration (6). In this series of patients, the shallower depth of anesthesia achieved via processed EEG titration of volatile anesthetic was associated with a trend towards increased perioperative beta blockade. Further refinements in processed EEG technology and awareness of its potential applications may help facilitate increased perioperative beta blockade.
References:
1. N Engl J Med. 1996;335:1713-20.
2. N Engl J Med. 1999;341:1789-94.
3. Anesth Analg. 2002;94:1052-64.
4. N Engl J Med. 2005;353:349-61.
5. Anesthesiology. 2002;97:82-9.
6. Circulation. 1999;100:1043-9.

	Anesthetic Administration		
	EEG-guided (n=8)	Hemodynamically Guided (n=10)	p-value
Propofol (mg)	205	235	0.5371
Fentanyl (mcg/hr)	87.3	56.6	0.2770
Metoprolol (mg/hr)	3.4	1.4	0.1452
Over-anesthetized Patient State Index <25 (sec)	4876 (4%)	10970 (9%)	<0.0001
In-range Patient State Index >25 and <50 (sec)	78219 (67%)	104422 (82%)	<0.0001
Under-anesthetized Patient State Index >50 (sec)	34505 (29%)	12168 (10%)	<0.0001
Average Weighted Patient State Index	48.0	37.8	0.1611
Average Intraoperative Time (sec)	16335	14436	0.4461
Emergence Time (sec)	369	420	0.7017

S-66.

HEMODYNAMIC EFFECTS OF LANDIOLOL, AN ULTRA-SHORT ACTING $ß_1$-SELECTIVE BLOCKER, ON ENDOTRACHEAL INTUBATION IN HYPERTENSIVE PATIENTS

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Introduction: The ultra-short acting $ß_1$-selective blocker, landiolol, is widely used in Japan. Its effect on intubation-induced tachycardia in normotensive patients has been reported (1). In this study, we compared the effects of landiolol with fentanyl on intubation-induced hyperdynamic circulation in hypertensive patients.
Methods: After obtaining an informed consent from each patient, 40 hypertensive patients, 40 to 65 years of age, undergoing elective surgery under general anesthesia participated in this study. Antihypertensive drugs administered before the operation were continued until the day of the operation except for angiotensin converting enzyme inhibitors and angiotensin II receptor blockers, which were not administered on the day of the operation. In addition to routine anesthesia monitoring such as cuffed blood pressure, ECG, and pulse oxymetry, bispectral index was continuously displayed. After preoxygenation with 100% oxygen, general anesthesia was induced and maintained with propofol using a target-controlled infusion device (TE-371, Terumo) set at 5 $\mu g \cdot mL^{-1}$. Manual ventilation with 100% oxygen was started when the patient lost consciousness. Muscle relaxation was then obtained with 0.1 $mg \cdot kg^{-1}$ vecuronium, and endotracheal intubation was carried out four min after vecuronium injection. Patients were divided into four groups of 10 patients each. In the control group, neither fentanyl nor landiolol was injected during the induction period. In the low and high landiolol groups, 0.1 $mg \cdot kg^{-1}$ and 0.2 $mg \cdot kg^{-1}$ landiolol was administered immediately after vecuronium injection, respectively. In the fentanyl group, 2 $\mu g \cdot kg^{-1}$ fentanyl was injected 1 min before infusion of propofol. Endotracheal intubation was performed within 30 sec.
Results: As compared to the control group, landiolol at 0.2 $mg \cdot kg^{-1}$ was the most efficacious to prevent intubation-induced tachycardia. Landiolol at both doses had no significant effects on blood pressure or bispectral index throughout the study period, and did not influence heart rate before intubation. In contrast, 2 $\mu g \cdot kg^{-1}$ fentanyl frequently induced hypotension just before and 5 min after intubation.
Conclusion: Landiolol could effectively prevent tachycardia after intubation in the hypertensive patients without significant effects on blood pressure.
Reference: 1. Anesthesiology 2004;101:A210.

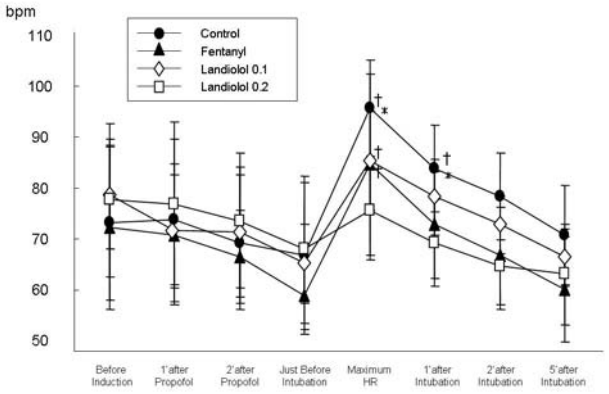

Fig.1. Changes in heart rate in the four groups. *P<0.05 vs. the control group; †P<0.05 vs. the respective baseline value.

S-67.

RETROGRADE BLOOD FLOW IN THE BRACHIAL AND AXILLARY ARTERY DURING FLUSHING OF RADIAL ARTERY CATHETERS

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Introduction: The use of invasive radial arterial catheters has been associated with a number of serious complications, which include cerebral embolization of air or particulate matter. In order for air to reach the central circulation, enough pressure must be generated during the flushing process to reverse the direction of blood flow in arterial vessels of the arm. The aim of this investigation was to examine the brachial and axillary arteries using vascular ultrasound for evidence of retrograde blood flow during flushing of radial artery catheters.
Methods: High-resolution B-mode and pulsed Doppler ultrasound examinations were performed on 50 subjects undergoing cardiac, vascular, or general surgical procedures. The proximal axillary artery was identified using B-mode and color Doppler imaging techniques, and the direction and velocity of blood flow quantified by placing the Doppler sample volume within the vessel. Clinicians were instructed to withdraw 10 cc of blood into a syringe and manually compress the plunger on the syringe to flush the radial arterial catheter at a rate reflecting standard, usual practices. The rate of manual flushing was recorded by an independent observer. Next, the flush valve on the arterial flushing-sampling pressure system (pressurized to 300 mmHg) was opened for 20 seconds to flush the system of remaining blood (automatic flushing). Ultrasound images were recorded on videotape during manual and automatic flushings, and analyzed offline. The flushing process (at the same rate) was repeated again while performing ultrasound examinations of the brachial artery.
Results: Manual flushing was conducted in ≤7 seconds in 27 subjects and in ≥8 seconds in 23 subjects (range 3-14 seconds). Doppler studies of the proximal axillary artery revealed no evidence of reversal of blood flow when manual flushing was performed over 8 seconds or longer. Retrograde blood flow was observed in 2/2 patients during a 3 second flush, 4/5 patients during a 4 second flush, 3/5 patients during a 5 second flush, 6/9 patients during a 6 second flush, and 1/6 patients during a 7 second flush. Doppler studies of the brachial artery revealed evidence of retrograde blood flow during manual flushing in 24/27 patients when flushed in ≤7 seconds, 4/20 patients when flushed in 8-12 seconds, and in 0/3 patients when flushed in 13-14 seconds. Reversal of blood flow during automatic flushing was observed in 0/50 axillary exams and 6/50 brachial exams.
Conclusion: Manual flushing of radial artery catheters in ≤7 seconds generates enough pressure within the arterial vessels of the arm to reverse the direction of blood flow in the proximal axillary artery. Our findings suggest that the risk of retrograde embolization of air or particulate matter is increased if radial artery catheters are manually flushed in less than 8 seconds.

S-68.

WHOLE LUNG LAVAGE FOR TREATMENT OF PULMONARY ALVEOLAR PROTEINOSIS - REPORT OF 21 CASES -EVALUATION IN A 5 YEAR PERIOD

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Introduction: pulmonary alveolar protenosis (PAP) is a rare disease charachterized by excessive accumulation of surfactant in the alveolar space causing recurrent pneumonia and may lead to pulmonary fibrosis. Although there are various therapeutic methods for treatment of PAP, the only known treatment which can influence the course of the disease is whole lung lavage (WLL) under general Anesthesia. After a five year experience in our center, it seems necessary to review the effectivness and out come of patients undergoing WLL.
Materials & methods: 21 patients were reffered to our center (as referal center for WLL in IRAN) during 1999 - 2004 with symptoms & signs of PAP. In all cases clinical evaluations and Examinations suspect PAP. CT Scanning of the lung and open lung biopsy which consistent with PAP confirmwd the diagnosis. All patients undergone WLL, Data were collected and analgsed. 21 patients were scheduled for WLL after proper preparation for anesthesia. General Anesthesia and one lung ventilation using double lumen tube or univent bronchial blocker tubes was done for all patients. After confirming of correct position of tube using fiberoptic bronchoscopy WLL of one lung began with normothermic normal saline solution and continoued until returend soulution became clear and particle free. Patients were observed in ICU for 24 hrs. and then discharged and folowed of an 6 month period.
Results: 47 lavages were done for 21 patient durring 5 year period. Average age of patients were 37 yr. With a predominancy for male. (1.7 ÷ 1). Each patient had at least 2 WLL (once for right & once for left lung) and a maximum of 5 lavages for one case. 3 pedaitric cases undergone cardio pulmonary By- Pass for WLL becouse severity of disease whereas in other cases one lung ventilation under general anesthesia used as method of choice. 17 cases (76.19%) were symptom free after 6 month follow up. 4 cases (19%) of cases need for repeated lavages and in one case (4.7%) pulmonary fibrosis result despite repeated WLL.
Conclusion: WLL is treatment of choice for controlling of PAP despite which mentioned in some previous articles we found that about two third of patients with PAP became symptom free 6 months after WLL. WLL using both general anesthesia with one lung ventilation or cardiopulmonary By - Pass are effective in treatment of PAP and Authors strongly recommend this.
Reference: Ssolik RC,et al. Pulmonary alveolar proteinosis. A report of two cases with diagnostic features in bronchoalveolar lavage secimens. Acta Cytol 1998; 42(2):377 - 83

S-69.

DELAYED RECOVERY OF CARDIAC OUTPUT AFTER CARDIAC ARREST IN PATIENTS WITH DIMINISHED LEFT VENTRICULAR PUMP FUNCTION

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Introduction: Implantation of cardiovertor/defibrillators (ICD) necessitates repeated inductions of ventricular fibrillation with concomitant periods of global cerebral ischemia. Previous research indicated that patients with low left ventricular ejection fraction (LVEF) suffer from a more severe brain injury after insertion evident as increased levels of serum neuron specific enolase (NSE) as compared to patients with normal pump function (1). We therefore investigated whether recovery of cardiac output (CO) after cardiac arrest is impaired in this particular group of patients.
Methods: After institutional approval and having obtained informed consent we studied 27 patients scheduled for elective ICD implantation because of drug-refractory ventricular fibrillation. CO was determined perioperatively with the help of a minimally invasive pulse contour technique (LiDCO; LiDCO Ltd. Cambridge, UK). Hereby, CO assessed immediately after defibrillation was compared to pre-arrest values. LVEF was evaluated semiquantitatively before surgery with LVEF ≥30% depicting normal or moderately reduced and LVEF < 30% severely reduced left ventricular pump function.
Results: In 9 patients preoperative LVEF was quantified as being < 30%. It was ≥30% in the remaining 18 patients. Median baseline CO was 3.5 and 4.4 l/min in the two groups, respectively. The number of heart beats (median, min, max) after the first defibrillation until baseline CO was reached again was 3 (1, 166) in patients with severely impaired and 7 (1, 16) in those with normal or near normal LVEF. Complete recovery of CO was found to occur within 9 heartbeats after cardiac arrest in all patients with normal pump function (LVEF > 50%, n = 3). In contrast, baseline CO was reached within 9 heartbeats after defibrillation in only 5/9 (56%) patients with LVEF < 30% as compared to 16/18 (89%) patients with LVEF ≥30% ($P < 0.05$).
Discussion: These results indicate that the initial recovery of CO after brief cardiac arrests appears to be related to the systolic left ventricular pump function with patients whose LVEF is < 30% demonstrating the most pronounced delay. This prolonged restoration of an already diminished cerebral perfusion could explain why patients with severely reduced LVEF show the greatest postoperative release of NSE (1). Furthermore, it is also this group of patients that seems to be more vulnerable as far as deterioration of neurocognitive function is concerned (2,3).
References: 1) Dworschak M, et al. Crit Care Med 31:2085-9,2003; 2) Grimm M, et al. Circulation 94:1339-45,1996; 3) Putzke JD, et al. J Card Fail 4:295-303,1998.

S-70.

INTRA-OPERATIVE HYPERGLYCEMIA COMMONLY OCCURS IN CARDIAC BYPASS PATIENTS

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Introduction: Hyperglycemia and Diabetes Mellitus are increasingly recognized as risk factors for post operative complications[1]. These include wound infection[2], inhibition of ischemic and anesthetic preconditioning[3], increased mortality after myocardial infarction [4] and increased mortality in the intensive care unit[5]. As part of The Collaborative Experience Project: Surgical Infection Prevention, our hospital, among other initiatives, implemented a protocol to aggressively manage intra and post operative hyperglycemia for patients undergoing cardiac surgery. This protocol specified that patients with a diagnosis of diabetes mellitus were intraoperatively started on an insulin infusion (unless fasting blood sugar was < 75gm/dl). All cardiac patients had intraoperative blood sugars checked every hour. Non-diabetic patients received an insulin infusion if any glucose level exceeded 150mg/dl. This infusion was continued into the post-operative period for 36 hours.
Methods: IRB approved retrospective chart review of 80 patients undergoing coronary artery bypass grafting and/or valve repair/replacement from September 02 - October 04.
Results: Patients who were diagnosed with diabetes mellitus (Type I or II) constituted 30% of the patients. Of the remaining (non-diabetic) patients, 78% had at least one blood glucose pre- or intra- operatively that was greater than 150mg/dl and were thus started on an insulin infusion. 90% of these elevated glucose levels occurred following the initiation of CBP despite the fact that the cardioplegia solution did not contain glucose. Finally, intraoperatively hypoglycemia (blood sugar 70mg/dl) occurred in one patient who received an insulin infusion which was treated with 12.5gm of glucose.
Discussion: Hyperglycemia occurs at a high rate in patients undergoing cardiac surgery. This may be due to undiagnosed diabetes mellitus, stress response to surgery and the bypass circuit, or dextrose containing solutions. As more evidence points to hyperglycemia and not just a diagnosis of diabetes mellitus as a risk factor for post-operative complications, aggressive treatment is needed. The impact of strict intraoperative regulation of blood glucose levels in all patients undergoing CPB remains to be determined. There is a high incidence of intraoperative hyperglycemia in patients undergoing cardiac bypass surgery in both diabetics and non-diabetics.
References:1. Anesthesiology 2003; 98:774-9 2. Ann Thorac Surg 1999;67:352-60 3. Anesthesiology 2002; 96:183-9 4. Circulation 1999; 99:2626-2632 5. New England J of Med 2001; 345:1359-1367

S-71.

INCREASED URINARY NEUTROPHIL-ASSOCIATED GELATINASE LIPOCALIN (NGAL) AFTER CARDIOPULMONARY BYPASS DERIVES FROM KIDNEYS

AUTHORS: **G. Wagener**[1], M. Jan[1], N. Borregaard[2], R. Sladen[1], H. Lee[1];
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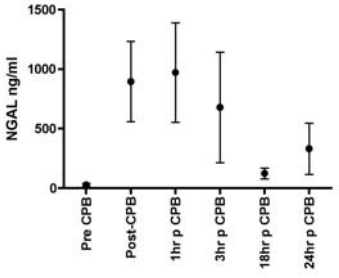
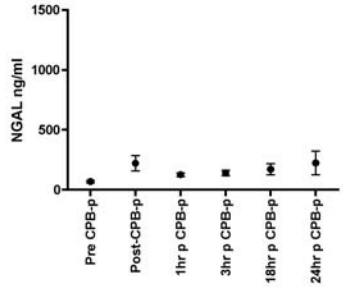
Introduction:
Neutrophil-associated Gelatinase Lipocalin (NGAL) is a protein that is up-regulated early after renal injury. It is also found in high concentrations in neutrophils
We have previously shown that urinary NGAL is elevated after cardiopulmonary bypass (CPB) and correlates with the incidence of postoperative acute renal dysfunction (ARD).
We do not know if serum NGAL also increases after CPB in adults and if the increase in urinary NGAL after CPB is due to release from blood neutrophils or a renal response to injury.
Methods:
Urinary and plasma NGAL was measured using ELISA in 20 patients undergoing cardiac surgery before, immediately after CPB and then 3, 18 and 24 hours later.
Results:
Urinary NGAL increased and peaked at 1 hour after CPB (graph 1). Plasma NGAL increased after CPB but to a much lesser degree and remained slightly elevated for 24 hours (graph 2).
Discussion:
Plasma NGAL showed only small increases after CPB compared to urinary NGAL. Urinary NGAL increased significantly immediately after CPB and peaked at 3 hours. This dramatic increase of urinary NGAL is therefore likely of renal origin and not caused by release from blood neutrophils during CPB.
Mishra et al 4 have shown that serum NGAL correlates with urinary NGAL in pediatric cardiac surgical patients and accurately predicts acute renal dysfunction (ARD). We demonstrated here that this does not hold true for adult patients: Serum NGAL increases only very moderately after CPB: Serum NGAL levels are thus not going to be useful as a predictor for ARD in adult cardiac surgical patients.
References:
1. Anesthesia Analgesia 2005; 100: S118
2. Am J Kidney Dis 19995; 26(4): 565-76
3. J Am Soc Nephrol 2003; 14(10): 2534-43
4. Lancet 2005; 365: 1231-38

Graph 1: Urinary NGAL



Graph 2: Plasma NGAL



Critical Care Medicine & Trauma

S-72.

FLASH PULMONARY EDEMA FOLLOWING ECT

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Introduction: Flash pulmonary edema after anesthesia is an infrequent but serious complication that requires timely recognition and management to avoid significant morbidity. Causes of flash pulmonary edema includes negative-pressure pulmonary edema (NPPE), cardiogenic pulmonary edema, aspiration and neurogenic edema.
Methods: A 21-yr-old man (75 kg) with the diagnosis of schizo-affective disorder presented for outpatient electroconvulsive therapy (ECT). There was no other relevant medical history. He had had multiple previous ECTs under general anesthesia without complications. Anesthesia was induced with remifentanyl (100 mcg) and propofol (80 mg), followed by succinylcholine (80 mg). The patient's lungs were easily ventilated, and ECT was given.
Results: During ECT the patient had seizures with marked motor movements including clenching of the teeth and tonic/clonic movements of all four extremities in spite of the succinylcholine. The patient resumed spontaneous respirations before the bite block could be removed. Upon emergence from anesthesia the patient was coughing and desaturated to 94-96% on oxygen by nasal canula. Crackles were noted on auscultation. The patient was started on a non-rebreather mask and a chest radiograph was performed. The oxygen saturation dropped to the low 80s and the patient became unresponsive and apneic. An oral airway was placed and pink frothy secretions were observed. Positive pressure mask ventilation with 100% oxygen was instituted, and there was an immediate improvement in oxygen saturation and a return to consciousness with spontaneous ventilation. The chest radiograph showed bilateral fluffy opacities with normal heart size. The patient was admitted to the ICU for observation, and he was discharged home the next day. Subsequent ECTs have been uneventful.
Discussion: The present case was most likely NPPE, as it presented immediately upon emergence and responded quickly to appropriate management. Cardiogenic pulmonary edema is unlikely as the patient had no history of cardiac disease. Pulmonary aspiration can present similarly but the chest radiograph usually has unilateral or predominantly one-sided shadows. Neurogenic pulmonary edema after head trauma or prolonged seizures is a slower process and usually is accompanied by elevated intracranial pressures (1). The initiating event in NPPE is a vigorous inspiratory effort against a closed glottis or upper airway obstruction (UAO)(2). We suspect that the UOA in this case was the result of the bite block pushing the tongue into the posterior oropharyngeal space. Though the outcome in this case was acceptable it reinforces the importance of taking steps to prevent airway obstruction by the bite block or other airway instrumentation prior to emergence and the return of spontaneous respirations.
References: 1. Anesthesiol Clin North Am 2001; 19:383-389. 2. J Clin Anesth1997;9:403-408.

S-73.

TIME TO WEAN AFTER TRACHEOTOMY DIFFERS AMONG SUBGROUPS OF CRITICALLY ILL PATIENTS

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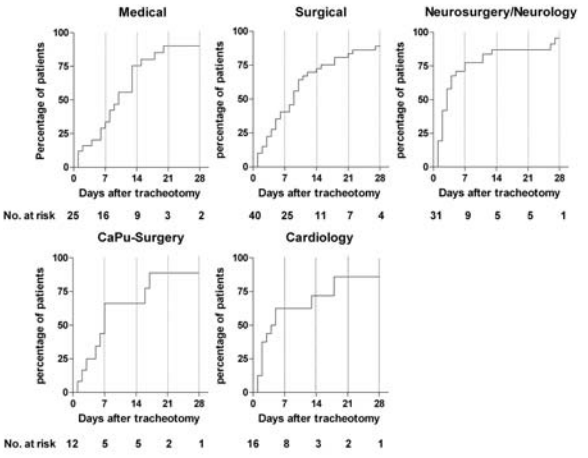
Introduction: Tracheotomy is increasingly often performed in mechanically ventilated intensive care unit (ICU)-patients (1-3). Tracheotomized patients are easily disconnected from the mechanical ventilator, enabling them to breathe spontaneously for several hours/day. Information on how much time tracheotomized patients need to fully wean from mechanical ventilation is scarce. In the present single-center observational study we determined time to wean for tracheotomized ICU-patients. In addition, we determined whether time to wean differs among ICU-patient subgroups.
Methods: Design: retrospective analysis of prospectively collected clinical data. Inclusion: translaryngeally intubated mechanically ventilated patients that received a tracheotomy during their stay in an academic ICU. The local Ethics committee approved the protocol. Definitions: time to wean after tracheotomy, time from day of tracheotomy until the day at which the patient breathed spontaneously without help of the mechanical ventilator > 24 hours. Medical, surgical, cardiopulmonary surgery, cardiology and neurosurgery/neurology patients were analyzed separately. In addition, patients who were admitted after cardiac arrest were analyzed separately from those who were admitted because of other reasons, as were patients with or without acute lung injury, and patients after acute ICU-admission or planned ICU-admission.
Results: Of all patients admitted to ICU, 129 (7%) received a tracheotomy. Significantly more tracheotomies were performed in neurosurgical/neurology patients and in those who were acutely admitted (16% and 12%, respectively). Tracheotomy was performed at a median time of 8 days [interquartile range, 4-13 days] after ICU-admittance. Median time to wean after tracheotomy was 5 [2-11] days for all patients. Neurosurgical/neurology patients and patients in the subgroup cardiology needed significantly less time to fully wean from mechanical ventilation than patients in other subgroups, 3 [2-7] and 3 [2-5] days, respectively ($P<0.05$). Figure 1 shows the Kaplan-Meier curve of the probability of complete weaning from the mechanical ventilator for the different subgroups. Log rank test of neurology/neurosurgery vs medical and surgical $P = 0.03$.
Discussion: The time to wean completely from mechanical ventilation after tracheotomy differs among the separate ICU-patient groups. A large proportion of patients with tracheotomy was completely weaned from the mechanical ventilator within one week, in particular neurosurgery/neurology patients and cardiology patients.
References: 1) Crit Care Med, 27, 1714-1720, 1999. 2) Am J Respir Crit Care Med 161, 1450-1458, 2000. 3) Crit Care Med 33, 290-298, 2005.



S-74.

EFFECTS OF TRADITIONAL VERSUS LOWER TIDAL VOLUMES ON PULMONARY INFLAMMATION AND COAGULATION IN MECHANICALLY VENTILATED MICE

AUTHORS: **E. K. Wolthuis**, G. Choi, M. Dzoljic, M. B. Vroom, M. W. Hollmann, M. J. Schultz;
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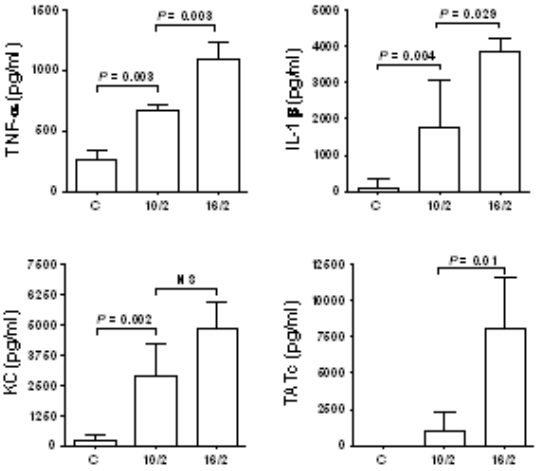
Introduction: In many animal models of mechanical ventilation (MV), employing large tidal volumes (V_T), lung injury has been caused. The aim of the present investigation was to set up a murine model of lung injury comparing more physiological V_T.
Methods: All experiments were carried out under approval of the local Animal Care Committee. A tracheotomy was performed in female pathogen-free C57Bl/6 mice. Two hours before mechanical ventilation, mice received 1 ml of normal saline (i.p.), and 0.25 ml of normal saline every 2 hours after the onset of MV. (Induction)-anaesthesia consisted of ketamine, medetomidine and atropine (KMA) (i.p.). Mice in the "high V_T-group" were ventilated with a peak pressure (P-peak) of 16 cmH_2O, resulting in V_T of ± 11 ml/kg (as measured by bodyplethysmography); mice in the "lower V_T-group" were ventilated with a P-peak of 10 cmH_2O, resulting in V_T of ± 7 ml/kg. Both groups were ventilated with a PEEP-level of 2 cmH_2O. Mice in the "non-ventilated control group" received half dose of KMA. All mice were sacrificed after 5 hours. Lungs were either lavaged, homogenized or formalin fixed for histological examination. Cytokines and thrombin-antithrombin complex (TATc) levels were measured by ELISA. The pulmonary pathology (PP)-score of lung injury consisted of alveolar congestion, haemorrhage, leukocyte infiltration and alveolar wall thickness (for each item 0-1-2 points). Statistics: Kruskall-Wallis and Mann-Whitney test. A P-value of < .05 was considered significant. Data are means (± SD).
Results: Levels of TNF and IL-1 were significantly higher in the high V_T-group as compared with levels in the lower V_T-group (figure: C = control; 10/2 = lower V_T-group, 16/2 = high V_T-group). Similarly, local TATc-levels were higher in the high V_T-group (figure). There was more neutrophil-influx in the lungs of mice in the high V_T-group as compared with mice in the low V_T-group (30 (± 7.7) vs 14.5 (7.9) * 10^4 cells; P = 0.015). PP-score was 2.7 (± 2.3) in control mice, 4.3 (± 1.0) in mice in the low V_T-group, and 6.0 (± 2.8) in mice in the high V_T-group.
Conclusion: Injurious MV using more physiological V_T causes local pulmonary inflammation and activation of coagulation. More inflammation and coagulation are found with larger V_T. These data extend previous animal studies in which exceptionally large V_T were used.



S-75.

AN EVALUATION OF THREE NEW GENERATION PULSE OXIMETERS DURING MOTION AND LOW PERFUSION IN VOLUNTEERS

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INTRODUCTION: Pulse oximeter (PO) accuracy is often compromised by low perfusion states and motion artifacts that can jeopardize patient's safety in the OR, PACU, and ICU. Many new generation POs claim to perform better during motion and low perfusion, especially under hypoxic conditions where accuracy is more critical. This study compares three new generation POs under conditions of low perfusion and motion in hypoxic and normoxic states.
METHODS: Following informed consent, 11 ASA-I volunteers (5F & 6M) between 18 & 40 were enrolled. POs tested were Masimo Radical V4.5, Nellcor N595 V3100 and Datex-Ohmeda TruSat. Sensors were randomly placed on index, middle, and ring fingers of left hand (test) and right hand (control) and optically shielded. The room temperature was 16-18ºC to reduce peripheral perfusion. A TOSCA ($PtcCo_2$ + Masimo Radical PO) placed on the right ear served as the control during hypoxia. During separate room air and desaturation (a disposable re-breathing circuit with a CO_2 absorber was employed to a SpO_2 of 75% on control PO and the subject was then given 100% oxygen until the control SpO_2 reached 100%) events, motion consisted of random tapping (with sensor disconnect / reconnect) and random rubbing. Motions were machine generated (MG) and self-generated (SG).The sensors were rotated and tested on all three fingers during normoxia. A computer recorded SpO_2 & pulse rate (PR) data. A missed event (false negative/sensitivity) was defined as the inability of the PO to detect desaturation and recover from a desaturation by the time the control reached 100%. A false alarm (false positive/specificity) was recorded during the normoxic phase, and defined as a $SpO_2 \leq 90\%$ during motion. An ANOVA with Fischer's post hoc test was performed; $p < 0.05$ was considered statistically significant.
RESULTS: There were a total of 176 motion tests; 44 with desaturation and 132 on room air. Missed events were counted out of 44 (22 with MG and 22 with SG) & false alarms out of 132 (66 with MG & 66 with SG) motions. Table shows the results.
CONCLUSION: During hypoxic/normoxic and low perfusion states, Masimo Radical (v. 4.5) performed better than Nellcor N-595 (v 3100) and Datex-Ohmeda TruSat with respect to maintaining accurate readings during motion.

Sensitivity and specificity of POs during MG and SG

Device	Missed Event	Sensitivity	False Alarm	Specificity
Masimo Radical (V4.5) MG	1/22	95%	0/66	100%
Masimo Radical (V4.5) SG	0/22	100%	2/66	97%
Nellcor N-595 (V3100) MG	3/22 *	86%	16/66*	76%
Nellcor N-595 (V3100) SG	7/22 *	68%	15/66*	77%
Datex-Ohmeda TruSat MG	9/22 *	59%	11/66*	83%
Datex-Ohmeda TruSat SG	10/22 *	55%	13/66*	80%

* $p < 0.05$ compared to Masimo

S-76.

EMERGENCY INTUBATION (EI) IN AN ANESTHESIOLOGIST/ INTENSIVIST (AI)-STAFFED SURGICAL INTENSIVE CARE UNIT (SICU)

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Introduction: EI in the SICU can be challenging and associated with major complications.[1] Critically ill SICU patients have multi-organ dysfunction as well as a potentially difficult airway. Airway exam is limited prior to EI. Repeated intubation attempts contribute to patient morbidity.[2] This retrospective review investigated the frequency, etiology, complications and effects on length of stay (LOS) of EI in a SICU staffed by AI.
Methods: Retrospective data were collected on EI patients in our SICU from January 1 through July 31, 2005. Records were reviewed for demographic data, airway management technique, etiology, complications, and LOS of EI SICU patients. Six double-boarded AI staff our SICU. Intubations are performed by the SICU house officer (anesthesiology resident or surgical intern) supervised by the attending AI. A fully equipped difficult airway cart is available in the SICU.[3]
Results: Three hundred and six patients were admitted to the SICU. Twelve patients required EI. Eleven EI patients were male. Age ranged between 46-84 years (average 65.7 years). Two patients required EI more than once (total EI=15). Postoperative pulmonary complications (PPC) were the etiology of 67% of EI: pneumonia (5), pleural effusion (1) and lobar collapse (4). Other etiologies included: expanding neck hematoma (1), seizure (1), sepsis (1) and self -extubation (2). Conventional laryngoscopy (CL) was utilized in 73% of EI (n=11), the Glidescope Video Laryngoscope (GVL) in 20% (n=3). The average number of attempts for CL and GVL was 1.3 and 1.6, respectively. Awake fiberoptic intubation was performed once. EI complications included one esophageal intubation and three hypotensive events (defined as a systolic blood pressure <90 mm Hg). No failed intubations or "cannot ventilate, cannot intubate" events occurred. LOS increased from an average 1.8 days for non-EI patients to 20.4 days in EI patients. Only one EI patient died prior to hospital discharge.
Discussion: Emergency airway management in critically ill SICU patients has been well-described.[1] Difficult EI (3 or more attempts) and its complications have a significant impact on morbidity.[2] PPC, a major reason for EI, are associated with significantly increased LOS.[4] SICU LOS increased more than 10-fold in EI patients. The immediate availability of a dedicated difficult airway cart as well as the AI staff for EI contributed to the low number of intubation attempts and the absence of failed intubations in our study. Further study and comparison of EI rates in other ICU settings is warranted particularly in those where the availability of AI is limited.
References: 1. Anesthesiology, 82: 367-76; 1995. 2. Anesth Analg, 99: 607-13; 2004. 3. Anesthesiology, 98: 1269-77; 2003. 4. Anesthesiology, 92: 1467-72; 2000.

S-77.

SELECTIVE NEURONAL NITRIC OXIDE SYNTHASE INHIBITION ATTENUATES PULMONARY DYSFUNCTION IN AN OVINE MODEL OF ACUTE LUNG INJURY

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Introduction: Excessive nitric oxide (NO) formation plays a pivotal role in the inflammatory response seen in acute lung injury (ALI). This study was designed as a prospective, controlled and randomized laboratory experiment to examine the effects of neuronal nitric oxide synthase (nNOS) inhibition on hypoxic pulmonary vasoconstriction (HPV) and pulmonary function in an established ovine model of ALI.
Methods: Following a baseline measurement, sheep were randomly assigned to a) healthy controls (sham), b) injured controls (40%, 3rd degree flame burn; 48 breaths of cotton smoke), or c) the injured intervention group treated with the specific nNOS inhibitor 7-nitroindazole (7-NI, 1 mg/kg/h) from 1 h post injury until the end of the 48-h study period (n = 7 each). Physiologic variables and nitrate/nitrite (NOx) plasma levels (chemiluminescence) were studied intermittently. Using an ultrasonic transit-time flow probe, positioned around the left pulmonary artery, HPV was assessed as decrease in left pulmonary blood flow (corrected for changes in cardiac index) in response to single lung hypoxic challenges at baseline, 24 h and 48 h. Post mortem, the lung was harvested for histological, immunological and molecular biological analyses. Data are expressed as mean ± SEM. For statistical analysis, a two-way analysis of variance (ANOVA) for repeated measurements with appropriate post hoc comparisons (Student-Newman-Keuls) was performed.
Results: There were no differences between groups as baseline. All physiologic variables remained stable in sham animals. In injured controls, the hypoxic challenge at baseline led to a 56% decrease in left pulmonary blood flow. After 24 h and 48 h, HPV was markedly reduced (17% and 6%; each $p < 0.001$ vs. baseline) and associated with progressive pulmonary shunting and reciprocal decreases in PaO_2/FiO_2. While inducible nitric oxide synthase (iNOS) mRNA remained unchanged, NOx plasma levels increased. This was linked to significant 3-nitrotyrosine formation (ELISA, immunohistochemistry). In vitro experiments (HPLC) confirmed that the administered 7-NI dose selectively inhibited nNOS and not iNOS. However, 7-NI significantly reduced iNOS mRNA, decreased NOx plasma levels, attenuated the loss of HPV (24 h: 44%, 48 h: 38%) and improved gas exchange. In addition, 7-NI significantly attenuated myocardial depression, airway obstruction, pulmonary edema, ventilatory pressures and histophatologic changes seen in control animals.
Discussion: The present study provides evidence that nNOS-derived NO plays an important role in the pathogenesis of ALI and suggests that nNOS inhibition represents an important therapeutic target in this setting. These data also suggest that nNOS may potentially regulate iNOS.

S-78.

A RETROSPECTIVE REVIEW TO DETERMINE THE CORRELATION BETWEEN PREOPERATIVE ARTERIAL BLOOD GAS LEVELS AND POSTOPERATIVE RESPIRATORY MORBIDITY AND MORTALITY IN PATIENTS UNDERGOING ROUX-EN-Y GASTRIC BYPASS

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Introduction: In the perioperative and postoperative periods, obese patients are at risk of developing pulmonary complications such as atelectasis, severe hypoxemia, pulmonary embolism, aspiration pneumonia and acute hypoventilation.[1] The purpose of this retrospective study was to explore the ability of preoperative Arterial Blood Gas (ABG) ratios in forecasting postoperative morbidity in patients undergoing laparoscopic Roux-en-Y gastric bypass (RYGB). Identification of certain morbidity predictors may allow physicians to focus more on preventive measures and early diagnosis in this subset of the bariatric population.
Methods: Patients who underwent lap-RYGB were chosen as the study population because of their consistent obesity and risk of postoperative respiratory complications. Patient characteristics such age, sex, BMI, race, history of sleep apnea and/or smoking and preoperative ABGs, as well as length of surgery were compared to length of intubation, re-intubation, need for follow-up surgery and postoperative complications. All patient identifiers were eliminated to ensure privacy. The relevant data was entered into a database that was later analyzed by a statistician.
Results: 174 patient charts were reviewed. Due to incomplete data, only 169 patient charts made it to the final analysis; 133 patients were female and 36 were male. The patient population age range was 17 to 69 years, with the average age being 44.9. The average Body Mass Index (BMI) for the study population was 48.3 with a range from 31.9 to 77.3. Prolonged postoperative intubation times (i.e. intubated beyond the postanesthesia care unit) occurred in 25 of the 169 patients, and a significant percentage of these patients had high preoperative pCO2 levels (p=0.0187). No correlation was found between low preoperative pO2 levels and postoperative complications such as prolonged intubation. Of the demographics studied, only increasing age was found to be a significant predictor of postoperative complications (p=0.0347).
Discussion: We expected to see a correlation between abnormal preoperative pO2 levels and postoperative respiratory distress. Instead we found a correlation between abnormal preoperative pCO2 levels and prolonged intubation postoperatively. As preoperative pCO2 levels increase, so does the patient's risk for prolonged intubation. This predictor can be used to aid the anesthesiologist in identifying bariatric patients at higher risk of postoperative respiratory distress.
References:
1. Pulmonary Complications of Obesity. The American Journal of The Medical Sciences 321: 249 (2001).

S-79.

RHAPC IMPROVES RENAL BLOOD FLOW IN OVINE SEPTIC SHOCK FOLLOWING ACUTE LUNG INJURY

AUTHORS: **M. O. Maybauer**[1], D. M. Maybauer[1], J. F. Fraser[2], M. Westphal[1], L. D. Traber[1], D. L. Traber[1];
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Introduction: Recombinant human activated protein C (rhAPC) has shown to reduce mortality in patients with severe sepsis. Aim of this study was to investigate in the effects of rhAPC on regional blood flow in our model of hyperdynamic septic shock following acute lung injury (ALI) (1).
Methods: Twelve sheep (33-38 kg) were operatively prepared for chronic study. After 7 days of recovery, sheep were randomly allocated to either the sham (group 1), control (group 2), or treatment group (group 3, n=4 each). After a tracheostomy was performed, ALI was produced in the 2nd and 3rd group by insufflation of 48 breaths of cotton smoke. Then a 30 mL suspension of live Pseudomonas aeruginosa bacteria (containing 2-5x10^{11} cfu) was instilled into the lungs according to an established protocol (1). The sham group received only the vehicle. The sheep were studied for 24h in the awake state and were ventilated with 100% oxygen. In group 3, rhAPC (24μg/kg/h) was intravenously administered, beginning 1 h post injury. The animals were resuscitated with Ringer's Lactate Solution to maintain filling pressures. Coloured microspheres were injected at baseline (BL), and 24h. Systemic hemodynamics were determined intermittently. Tissue samples for microsphere analysis were obtained after the experiment during necropsy. Statistical analysis: two-way ANOVA and Student-Newman-Keuls post hoc comparisons. Data are expressed as mean ± SEM. Significance $P<0.05$.
Results: Cardiovascular variables were stable in sham animals. In the control group, cardiac index (CI in L/min/m^2) increased significantly after 24h vs. BL (BL: 5.1±0.3 vs. 24h: 8.1±0.4), associated with a significant drop in mean arterial pressure (MAP in mmHg, BL: 100±2 vs. 24h: 68±4) and SVRI (in dynes/cm^5/m^2, BL: 1420±70 vs. 24h: 503±50). RhAPC stabilized CI (BL: 5.0±0.2 vs. 24h: 6.2±0.3) and raised MAP (BL: 96±2 vs. 24h: 81±6) and SVRI (BL: 1460±92 vs. 24h: 887±62). Renal blood flow (in mL/min/g) was significantly improved in the rhAPC group compared with controls (sham BL 8.0±1.7, 24h 8.5±1.8, control 7.5±1.5, 24h 3.0±1.0, rhAPC BL 7.7±1.2, 24h 7.5±1.1, $p<0.05$).
Discussion: RhAPC significantly improved hemodynamic variables and renal blood flow in this ovine model of septic shock and ALI. RhAPC might be a useful treatment for patients with smoke inhalation injury associated with sepsis.
Reference: (1) Murakami et al.: Crit Care Med 2002; 30(9):2083-90.

S-80.

DOES WHOLE BLOOD PLATELET AGGREGOMETRY DEMONSTRATE HYPERCOAGULABILITY IN MORBIDLY OBESE BARIATRIC SURGERY PATIENTS?

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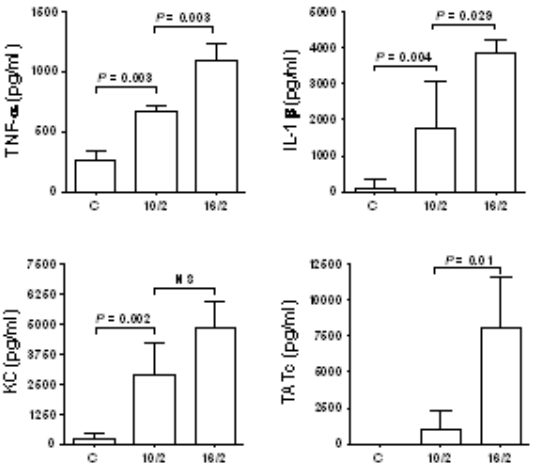
Introduction: Previous studies suggest hypercoagulability (elevations in prothrombotic coagulation cascade factors) 1, 2, 3 and elevated inflammation (C-reactive protein) 4 in morbidly obese patients. We hypothesized that whole blood platelet aggregation and inflammation in obese bariatric surgery patients would be elevated from normal levels before and immediately after surgery and that platelet aggregation would be higher in patients with higher body mass indexes (BMI) than in patients with lower BMIs.
Methods: After IRB approval and written patient consent, whole blood platelet aggregometry (WBPA) (Chronolog Corporation, Haverton, Pa, U.S.A) was performed on samples from 9 patients collected pre-op, immediately post-op, and on post-op days 1 and 3 using agonists ADP, Collagen, and Arachidonic acid. C-reactive protein was measured pre-op. Analysis of variance was used to compare aggregation values at the 4 different time points. We used SPSS software to calculate correlations between BMI and WBPA to the three different reagents and between C-reactive protein levels and WBPA.
Results: This patient population demonstrated markedly elevated C-reactive protein (20 mg/L average +/- 12.9) compared to normal (less than 3 mg/L). However, patients were not hypercoagulable by WBPA before or after surgery compared to normal ranges. BMI and WBPA to Collagen in patients not on statins (n=6) were significantly correlated (p=0.03) as shown in figure 1. There was not a statistically significant correlation between BMI and average platelet aggregation to any of the three reagents when patients on statins (n=3) were included, nor was there a correlation between C-reactive protein and platelet aggregation.
Discussion: We did not demonstrate hypercoagulability to most agonists in these obese patients, in contrast to our expectations. These observations may question the validity of whole blood platelet aggregation as a means of measuring hypercoagulability. However, statins reduce inflammation and thrombotic potential. Therefore, we did find a correlation between WBPA (collagen) and BMI in those not taking statins. Further studies of different platelet tests, different agonists, and larger numbers of patients will continue.
References: 1. Curr Opin Pharm. 2005; 5: 155-9.
2. Metabolism. 1990; 39(10): 1044-8.
3. Thromb. Haemost. 2004; 91: 683-9.
4. Curr Probl Cardiol. 2004; 29: 439-93.
Figure 1: Platelet Aggregation to Collagen in Relation to BMI for patient not taking Statins

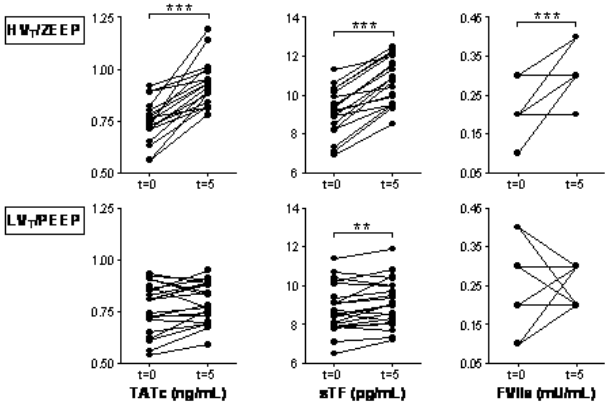


S-81.

MECHANICAL VENTILATION INDUCED ACTIVATION OF COAGULATION IN PATIENTS WITH HEALTHY LUNGS

AUTHORS: **E. K. Wolthuis**, G. Choi, P. Bresser, T. v. Poll, M. W. Hollmann, M. J. Schultz;
AFFILIATION: Academic Medical Center, Amsterdam, The Netherlands.

Introduction: Mechanical ventilation (MV) may initiate ventilator induced lung injury (VILI). Pulmonary inflammation is characterized by disturbed alveolar fibrin turnover, which is the net effect of activation of coagulation and inhibition of fibrinolysis. We hypothesized that MV promotes generation of alveolar fibrin, and that this is limited by lung-protective MV, using lower tidal volumes (V_T) and PEEP in patients with healthy lungs.
Methods: This trial was performed under approval of the local Medical Ethical Committee. Patients with healthy lungs expected to be mechanically ventilated for 5 or more hours during an elective surgical procedure were randomized to a MV strategy using either V_T 12 ml/kg and zero PEEP (HV_T/ZEEP) or V_T 6 ml/kg and 10 cmH_20 PEEP (LV_T/PEEP). A bronchoalveolar lavage was performed directly after initiation of MV, and repeated from the opposite lung after 5 hrs. Levels of coagulation (thrombin-antithrombin complexes, TATc; tissue factor, TF; factor VIIa, FVIIa) and fibrinolysis (plasminogen activator activity, PAA; plasminogen activator inhibitor-1, PAI-1; tissue-type plasminogen activator, tPA) were determined in lavage fluids. For analysis within groups, Wilcoxon signed-rank test was used; Mann-Whitney U test was used to analyze differences between groups. Data presented below are median [interquartile range] values.
Results: 19 patients were randomized to MV with HV_T/ZEEP, 21 patients to MV with LV_T/PEEP. There were no differences in baseline characteristics or outcome. After 5 hrs, patients ventilated with HV_T/ZEEP showed an increase in alveolar TATc levels (see figure). Activation of coagulation seemed to be mediated by TF and FVIIa. In contrast, TATc and FVIIa levels did not change during MV with LV_T/PEEP. TF was slightly elevated, but to a lesser extent than in the HV_T/ZEEP group. Alveolar fibrinolytic activity was unaffected in both groups.
Conclusion: MV induces activation of coagulation in healthy lungs, which is largely prevented by lung-protective MV-strategy.



S-82.

COAGULATION CHANGES DURING INITIAL RESUSCITATION IN SEVERLY BURNED PATIENTS

AUTHORS: R. Kratschmer, **E. G. Pivalizza**, S. M. Koch, D. J. Wainright, D. Freet, D. H. Parks;
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Introduction: Severely burned patients may have hyper and/or hypocoagulable changes as measured with static tests (1,2). We prospectively evaluated dynamic whole-blood coagulation with the Thrombelastograph™ (TEG®) during resuscitation of severely burned patients. The TEG® has been used in burn patients undergoing transfusion during surgery (2), and may be beneficial as one indicator of prognosis post-burn injury (3).
Method: After IRB approval and informed consent, patients with severe burns at a major burn unit were prospectively enrolled. Static coagulation tests (PT, INR, PTT, platelet count, fibrinogen) and TEG® (Haemoscope Corp., Skokie, IL) were analyzed at baseline, after 6, 12, 18 hours and daily for 7 days. TEG parameters measured were R time (initial fibrin formation), K time and angle (fibrin-platelet interaction) and maximum amplitude (MA - platelet function with fibrinogen contribution). Data was analyzed with ANOVA and t-test with Bonferroni correction for multiple comparisons (significance assumed with $p < 0.006$).
Results: Nine patients were enrolled; 7 male, age 45 ± 20 yrs, total BSA burn 39 ± 12%, with thermal (6), chemical (2) and electrical (1) etiology. Relevant data in Table 1.
Platelet count increased # ($p< 0.005$ day 5 vs. 6 hr) and fibrinogen decreased ** ($p < 0.003$ for day 2,3,4 vs. baseline) sequentially.
PT was initially increased, then decreased sequentially ## ($p < 0.006$ for 12-18 hr vs. day 4,5,7).
R time increased ‡ ($p <0.005$ for day 4,5,6 vs.all time points < 18hrs), although all values were within normal limits. There were no changes in K, angle or MA ($p>0.6$).
Conclusion: In this study of early resuscitation in severe burn patients, global assessment of coagulation by TEG® showed accelerated fibrin formation for the initial 18 hours after injury (despite opposing trends in PT) followed by stable, adequate indices of fibrin-platelet interaction reflecting the contrasting trends in platelet count and fibrinogen. The initial 'hypercoagulability' by TEG® supports prior findings with discrete coagulation tests (1).
TEG® guided assessment of the overall balance of coagulation has the advantage of integrating individual static indices, and further investigation will elucidate the potential role of the TEG® in these patients.

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Coagulation and TEG variables										
	Initial	Hour 6	Hour 12	Hour 18	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Platelets (10^3/ mm^{-3})	283.3 ± 45.8	273.1 ± 60.3	295.3 ± 87.4	302.8 ± 96.2	434.4 ± 168	548.3 ± 155	613.1 ± 240.1	697.5 ± 247.8 #	664.5 ± 227.1	612.3 ± 173.3
Fibrinogen (G/dL)	222 ± 85.9	164.1 ± 55.3	149.6 ± 47.7	126.7 ± 45.5	119.6 ± 35.9 **	100.9 ± 32.6 **	106.2 ± 33.6 **	137.2 ± 37.4	178.3 ± 53.1	190.3 ± 64.8
R time (mm)	2.2 ± 0.6	1.8 ± 1.1	2.4 ± 0.9	3.2 ± 0.7	2.7 ± 1.1	3.6 ± 1.8	4.3 ± 1.6 ‡	4.3 ± 1.7 ‡	4.9 ± 1.7 ‡	3.8 ± 1.5
Prothrombin time (sec)	11.4 ± 1.1	13.8 ± 5.1	14.1 ± 2.8 ##	13.9 ± 2.0 ##	13.8 ± 3.5	11.3 ± 2.0	10.7 ± 1.8	10.5 ± 1.7	10.8 ± 2.5	10.6 ± 2.1

S-83.

COAGULATION CHANGES IN LIVE LIVER DONORS: WHEN TO REMOVE AN EPIDURAL CATHETER

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Introduction:
Orthotopic liver transplantation (OLT) is an effective treatment for patients with end-stage liver disease (ESLD). Due to a rising demand of donor grafts, live donors are used to provide patients with ESLD another source of organs. Right hepatectomy through an upper abdominal incision results in significant postoperative pain. Thoracic epidural has been shown to be effective for this type of pain management. Performing a right hepatectomy for liver donation decreases hepatocyte mass by over 50%. This could lead to decrease synthesis of coagulation proteins normally manufactured by the liver, resulting in potential coagulopathy. Postoperative coagulopathy may effect timing of epidural cather removal.
Methods:
We retrospectively reviewed the coagulation profiles of the last 81 adult live OLT donors at our institution. Baseline PT, PTT, INR and platelet (PLT) counts were measured and followed postoperatively. Kolmogorov- Smirnov test was done to assess normality of the data. Independent T test was used to compare the groups. $p < 0.05$ was considered significant.
Results:
The coagulation profiles of healthy patients undergoing right hepatectomy are shown below. PT and INR peak on postoperative day (POD) 3, while PLT count reaches its lowest level on POD 4. All coagulation profiles reach normal levels by POD 4.

Donor Coagulation Profiles for Right hepatectomy (81 patients)						
	Baseline	Day 1	Day 2	Day 3	Day 4	Day 5
PT	11.4±0.7	12.4±1.2*	14.9±1.7*	15.3±1.7*	14.3±1.4*	13.9±1.2*
PTT	30.2±3.3	30.2±6	27.2±4.9*	28±5.3*	26.9±4.6*	26.6±3.6*
INR	1±0.1	1.1±0.1*	1.3±0.2*	1.4±0.2*	1.3±0.1*	1.2±0.1*
PLTS	263±59	251± 62	191±53*	165± 43*	156±39*	175±56*

* $p < 0.05$

Conclusion:
This retrospective analysis demonstrates that a temporary coagulopathy develops in healthy patients who donate their right hepatic lobe for live donor OLT recipients. Coagulopathy resolves by the forth postoperative day. This observation will allow adequate planing for postoperative pain control with thoracic epidural analgesia and guide an uneventful removal of the catheter by the forth postoperarive day.

S-84.

IMPACT OF REMAINING LIVER VOLUME AND ESTIMATED BLOOD LOSS ON ALBUMIN AND BILIRUBIN FOLLOWING DONOR RIGHT HEPATECTOMY

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Introduction: Right hepatectomy for liver transplantation typically requires removal of ± 60% of donor liver, resulting in temporary postoperative alterations of the donor hematologic and biochemical laboratory profile.[1,2] To examine the impact of the extent of the liver resection and estimated blood loss (EBL) on early (week 1) and late (week 3) changes in postoperative serum albumin (Alb) and bilirubin (Bili), we conducted a retrospective study over a four-year period.
Methods: Following institutional review board approval, demographics and perioperative data for 34 donors were reviewed including serial Alb, Bili, remaining liver/donor body weight ratio (RLBWR) and estimated blood loss (EBL). Patients receiving albumin postoperatively were subsequently excluded from analysis. The 2-sided t-test was used to compare means. Pearson and Spearman correlations were used to determine associations between low Alb, peak Bili, EBL and RLDBWR. A p-value of < 0.05 was considered statistically significant. The results are reported as means ± standard deviation.
Results: Donors (12f, 22m) were between 26 and 56 years old (43.3 ± 9.1) with a BMI (kg/m2) of 27.7 ± 4.2. RLBWR was 0.87 ± 0.3 (range 0.35 - 1.79), and EBL (ml) was 1506 ± 927. Baseline Alb (gm/dl) decreased from 4.1 ± 0.3 (n=30) to 2.29 ± 0.32 (n=30) in the 1st week (44%decline), and measured 2.7 ± 0.6 (n=18) in the 3rd week (34% below baseline). 1st week low Alb correlated significantly with increasing EBL, while 3rd week low Alb correlated significantly with decreasing RLBWR and with peak 3rd week Bili. Means for RLBWR, EBL and 1st week Alb were not significantly different comparing donors with available 3rd week Alb data and those without. Peak 1st week Bili (n=34) correlated significantly with RLBWR persisting as a 3rd week trend (n=23, p=0.0524).
Discussion: Alb declines sharply immediately following donor right hepatectomy recovering slowly. A similar initial Alb decrease was reported after major liver-unrelated surgery; complex physiologic mechanisms include blood (albumin) loss, catabolism, redistribution and hemodilution.[3] The 3rd week association between low Alb and RLBWR may reflect a size-related reduced synthetic remnant liver function that becomes increasingly apparent as the end of the preoperative albumins half-life (17 - 20 days) approaches postoperatively. A size related reduced metabolic remnant liver function surfaces earlier when considering Bili as a surrogate marker for metabolic (detoxification) liver function. The 3rd week association of low Alb and peak Bili appears to capture both, the hepatic synthetic and metabolic impairment, indicating a remnant liver size related prolonged recovery of these functions. An impact of this observation on postop donor care - i.e. dosing of medications, hepatoprotective/supportive alimentation regimens - is not inconceivable.
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S-85.

DOES POSITIVE END-EXPIRATORY PRESSURE IMPAIRS THE HEPATIC OUTFLOW IN PATIENTS AFTER LIVER TRANSPLANTATION?

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Introduction: Postoperative liver graft is influenced by many factors, such as ischemia, infection, drug toxicity, or acute rejection. Moreover, common postoperative intensive care interventions, such as application of vasoactive drugs (1) and mechanical ventilation with postive endexiratory pressue (PEEP) (2; 3), might further impair the graft function. Thus we performed a clinical investigation on patients after liver transplantation (LT) regarding to relationship between PEEP, hepatic performance, and hemodynamics.
Methods: 65 LT patients were recruited into the study. All patients were mechanically ventilated with biphasic positive airway pressure (BIPAP). The effects of three randomly chosen levels of PEEP (0 mbar, 5 mbar, 10 mbar) were studied in the immediate postoperative period in every patient. Systemic hemodynamic using a pulmonary arterial catheter and simultaneously the flow velocity of the hepatic veins, portal vein, and hepatic artery was obtained.
Results: Changes in flow velocities of the portal vein (PV), hepatic artery (HA) and hepatic veins (HV) between different PEEP levels did not reach statistical difference. Cardiac index (CI) significantly decreased at 5 and 10 mbar PEEP levels compared with 0 mbar (5.08 l/min/m^2 vs. 4.68 l/min/m^2 and 5.08 l/min/m^2 vs. 4.78 l/min/m^2; $p < 0.05$). Central venous pressure (CVP) significantly increased from 6.2 mmHg (PEEP=0 mbar) to 7.7 (PEEP=5 mbar) and 8.2 (PEEP = 10 mbar) respectively. Pulmonary capillary wedge (PCWP) significantly increased from baseline 8.9 (PEEP 0 mbar) to 9.8 mmHg (PEEP = 5 mbar) and 10.7 mmHg (PEEP = 10 mbar). Further hemodynamic values like mean arterial pressue, mean pulmonary arterial pressure and HR were not significantly affected by different PEEP levels.
Discussion: The major finding of our study is that ventilation with PEEP up to 10 mbar does not impair blood throughput of a transplanted liver, as indicated by unchanged blood flow in the portal and hepatic vein and hepatic artery. CI decreased at PEEP level 5 and 10 mbar, without clinical significance. In conclusion, short term ventilation with PEEP ≤ 10 mbar in LT patients does not impair the blood flow in and out of the liver.
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S-86.

A MULTICENTER EVALUATION OF THE SAFETY OF EARLY EXTUBATION IN LIVER TRANSPLANT PATIENTS

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Introduction: Physicians are unable to objectively assess whether to incorporate early extubation into their routine patient care of liver transplant patients as there is little information available on adverse outcomes. Thus the purpose of this study was to evaluate whether early extubation in liver transplant recipients is a safe practice. To accomplish this, we sought to determine the severity, type and number of all complications that occurred following early extubation and isolate patient variables that predict adverse outcome.
Methods: Seven institutions extubated liver transplant patients using a published protocol (1) and collected information on adverse events that occured within 72 hours following surgery. Events were graded amd categprozed using the approach published by the National Institute of Cancer (2).
Results: In 391 patients who were extubated early, complications occurred in 7.5% of liver transplant recipients within 72 hours of surgery. The rate fell to 2.7% when two institutions that experienced higher complication rates were excluded. Most complications were either pulmonary or surgical-related and were of Grade 3 or less in severity. Instititutions with the highest complication rates also had the most severe complications. The only variable that reliably predicted outcome among 13 preoperative and 5 intraoperative variables studied was the center at which early extubation was performed.
Conclusions: While early extubation can be considered a safe practice, there are considerable performance differences between institutions in the number and severity of perioperative complications that can cause patient compromise and accelerate respiratory failure. Thus it is difficult to predict the success of early extubation practice at the institutional level and evidence suggests that early extubation may not be suitable as a routine practice in all institutions.

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S-87.

NATIONAL EVALUATION OF HEALTH CARE PROVIDER ATTITUDES TO ORGAN DONATION AFTER CARDIAC DEATH

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Introduction Organ Donation after Cardiac Death will save lives by increasing the number of transplantable organs. Even though The Institute of Medicine found this a medically effective and ethically acceptable practice, some health care providers are reluctant to participate in care where the withdrawal of intensive care leads to organ donation. We thus aimed to identify what barriers health care providers perceive in Donation after Cardiac Death.
Methods: We used qualitative analysis of focus group transcripts to identify issues of broad importance shared by 141 health care providers representing critical care, perioperative nurses, transplant surgeons, medical examiners, organ procurement personnel, neurosurgeons and neurologists.
Results: All focus groups agreed that increased organ availability is a benefit but questioned the quality of organs recovered. A lack of standards for prognostication, cardiopulmonary death and failure to prevent a conflict in patient and donor interests are obstacles to acceptance of practice. Participants questioned the practices and motives of colleagues who participate in Donation after Cardiac Death, apprehensive that real or perceived impropriety would affect public perception.
Conclusions: Health care providers share a discomfort with medical practices in the clinical juncture where end of life care and organ donation interface due to an indistinct line between the two roles that each patient has in DCD practice. Recurrent themes that concentrate on the separation and standardization of care given at this interface are consistent with theories that care providers are hesitant to perform medical tasks that they consider to be outside the focus of their practice when there is potential conflict of interest. The use of neutral third parties or the reconciliation of organ donation as an integral option in end of care decisions are therefore logical interventions to improve acceptance of DCD.

S-88.

HEMODYNAMIC PROFILES IN LIVE DONOR LIVER TRANSPLANTION RECIPIENTS

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Methods:
81 adult patients, mean age of 50.9 ±12.6 years, who underwent LDLT between November 2000 and February 2005 were studied. Intraoperative hemodynamic monitoring included mean arterial pressure (MAP), mean pulmonary artery pressure (mPAP), pulmonary capillary wedge pressure (PCWP) and central venous pressure (CVP). Continuous cardiac output (CO), mixed venous saturation (SvO_2), and calculated systemic vascular resistance (SVR) were analyzed, together with metabolic parameters: pH, Sodium bicarbonate (HCO3-); serum sodium (Na^+); serum potassium (K^+); lactate and osmolarity.
One-way ANOVA or Kruskal-Wallis test with multiple comparisons versus control group (Dunn's method) was used to find statitically significant diferences ($p<0.05$). Data are reported as median and range.
Results:
Compared with the baseline, CO, MAP, and HR remained stable 5 minutes after reperfusion (III+5). Significant hypotension, defined as MAP ≤ 59 mmHg [1], occurred in 23.4% of patients (19/81) at reperfusion. In addition, PAP remained stable at III+5, while CVP significantly decreased.

Table 1: Hemodynamic and Metabolic Profiles During LDLT

	I	I+60	II	III+5	III+90
CO (l/min)	8.7 (3.2-18.2)	8.7 (2.9-19.9)	8.4 (4.6-17.6)	7.6 (3.2-16.8)	9.0 (4.5-18.6)
SvO_2 (%)	84 (71-93)	85 (74-96)	88 (76-96)*	87 (64-99)*	87 (70-94)
MAP (mmHg)	73 (57-105)	77 (57-108)	75 (68-112)	72 (38-113)	73 (65-93)
HR (bpm)	85.5 (55-115)	85 (55-120)	85.5 (50-125)	80 (50-120)	80 (50-120)
CVP (mmHg)	10 (3-22)	10 (2-22)	7.59 (4-16)*	8 (1-20)*	9 (2-24)*
mPAP (mmHg)	21 (12-50)	20 (7-57)	18 (7-38)*	19 (8-55)	22 (12-47)
SVR (dynes·sec·cm^{-5})	613 (217-1943)	570 (217-2144)	663 (236-1321)	651 (216-2063)	580 (228-1296)
pH	7.4 (7.2-7.6)	7.4 (7.3-7.5)	7.4 (7.2-7.6)	7.4 (7.2-7.5)	7.4 (7.3-7.5)
HCO3-	21 (18-26)	20 (19-25)	20 (14-27)	20 (14-31)	22 (14-26)
Na^+ (mmol/l)	135 (118-144)	136 (120-144)	135 (121-154)	136 (125-147)	137 (124-147)
K (mmol/l)	3.5 (2.8-5)	3.6 (2.4-4.1)	3.5 (2.8-5.2)	3.6(2.6-4.8)	3.7 (3-4.9)
Osmolarity	289 (265-311)	292 (277-314)	306 (282-328)*	305 (287-322)*	309 (292-326)*
Lactate (mmol/l)	1.9 (0.5-5.5)	2.1 (0.4-6.9)	5.4 (1.5-14.0)*	6.4 (2.1-13.7)*	5.4 (1.3-18.0)*

$p < 0.05$ compared with baseline

Conclusions:
The results of this study show a low incidence of hypotension (23.4%), decreasing CVP, and stable mPAP values after reperfusion of the donor graft in LDLT recipients. These findings contrast changes described in the "Post Reperfusion Syndrome" (PRS), where hypotension can occur in 29% of patients, and elevations of CVP, PAP and K^+ were observed [2]. Since donor organs for LDLT are from healthy individuals, there should be no hypotension or oxygen delivery issues involving the donor grafts, and preservation/ischemic injury should be minimal. Therefore, one could predict that the incidence of hypotension and PRS may be lower in LDLT, as was shown in this series of patients. Understanding this is required for optimal patient management and more studies should be undertaken to verify and explain these findings. Maintaining euvolemia prior to reperfusion may further decrease this reported low incidence of hypotension.

S-89.

EMERGENCY PRESERVATION AND RESUSCITATION WITH ENERGY SUBSTRATES AND HYPOTHERMIA ALLOW RELIABLE NEUROLOGICAL RECOVERY AFTER 3 H OF CARDIAC ARREST FOLLOWING RAPID EXSANGUINATION IN DOGS

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Introduction Emergency Preservation and Resuscitation (EPR) is a novel concept for resuscitation of traumatic cardiac arrest (CA) to overcome the futility of conventional CPR in the presence of volume depletion and trauma. Our previous data suggested that the maximal preservation time (for transport and damage control surgery) using profound hypothermia (~8°C) was ~2 h. Since brain energy demand is likely to be considerable for more than 10 min during induction of hypothermia, we hypothesized that providing energy substrates during induction of hypothermic EPR may avoid further energy depletion, or even restore energy reserves, and allows intact recovery of neurological function after a 3 h CA.
Methods: Dogs (n=24, 20-25 kg) were exsanguinated (~60 ml/kg blood loss) to pulselessness over 4 min and CA at 5 min. At 2 min after CA, 80 ml/kg of flush solution was perfused into the right femoral artery, followed by cardiopulmonary bypass (CPB) to induce systemic hypothermia until tympanic temperatures (Tty) reached 8°C. Four treatments (n=6, per group) for induction of EPR were tested. Each treatment include a flush solution (normal saline with or without 2.5% glucose (G+ or G-) and either 100% or 0% O2 (O+ or O-) supplied to the CPB oxygenator. After completion of EPR induction (~25 min), the no-flow state was maintained until 3 h after the onset of CA. Delayed resuscitation was then initiated with CPB for 2 h, mild hypothermia (34°C) for 36 h, controlled ventilation for 48 h, and intensive care to outcome evaluation at 72 h after CA based on Overall Performance Category (OPC), Neurologic Deficit Score (NDS) and Histological Deficit Score (HDS).
Results The total flush time to reach Tty 8°C was similar between groups (NS). The two G+ groups had lower sodium levels ($p<0.05$) at the end of flush. The lactate levels were higher in the two O- groups during early resuscitation phase ($p<0.05$). At 72 h, all animals in the G+O+ group regained consciousness with a better NDS and OPC (both $p<0.05$ vs O- groups). In the G-O+ group, 4 of 6 dogs regained consciousness (NS vs O- groups). All but 1 dog in the O- groups remained comatose. HDS of the O+G+ group in the neocortex was best, while HDS of the O-G+ group was the poorest in most brain regions ($p<0.05$ vs other groups).
Conclusions: Rapid induction of EPR with profound hypothermia using a combination of oxygen and 2.5% glucose allowed satisfactory recovery of neurological function after a 3 h CA. Improvement in energy metabolism and other mechanisms may be responsible for the benefits. We suggest that adding oxygen and glucose to cooling solutions may augment the efficacy of either resuscitative or elective deep or profound hypothermia.

S-90.

ADVERSE DRUG EVENTS IN THE INTENSIVE CARE UNIT ARE ASSOCIATED WITH ALTERED NURSING TASK DISTRIBUTION AND INCREASED WORKLOAD

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Introduction: Adverse drug events (ADE) are a common cause of patient harm in intensive care units (ICU) but the factors that contribute to ADE are not fully known. We conducted a quantitative observational study of ICU nurses (RN) to examine the effects of ADE on task distribution and workload.
Methods: Behavioral task analysis [Anesthesiology 80:77, 1994 and 87:144, 1997] was performed on ICU nurses by a single trained observer during 153 four-hour observation periods (henceforth cases) in three different San Diego teaching hospitals. Sixty nursing task categories were iteratively refined and validated before use via custom software. RN workload was assessed every 9-13 min, first by the observer and then by the RN using the 15-point (6 to 20) Borg Scale. At the start and end of each case, RN completed the NASA Task Load Index (TLX), consisting of six 10-point subscales (0- 9) that assess temporal, physical and mental demands [Human Mental Workload. North-Holland: Elsevier, 139, 1988]. Adverse drug events (ADE) were identified at the end of each case using a structured survey tool [J Biomed Informatics 36:106, 2003]. Task data and TLX were analyzed using two-way mixed ANOVA. Borg ratings were analyzed using Mann-Whitney U tests.
Results: 107 ICU RN with 12.9±1 yrs reported ADE during 31 of 153 (20%) cases. More than one ADE occurred in 6 cases. Conversation, the most common task group, consumed ~10% less RN time during ADE-containing cases (28.0±1.5%; mean±SEM) than during cases without ADE (31.1±0.9%; $p<0.01$). Significantly more time was spent performing manual tasks during ADE (27.6±1.4% vs. 23.6±0.7% for No ADE; $p<0.001$). There were no differences in the time ICU RN's spent on medication-related tasks (10.7±0.4% overall), documentation tasks (18.9±0.5% of RN time), or infusion pump use (11±1 interactions per case). Both self-reported (11.3±0.4 vs. 9.0±0.2; $p<0.001$) and observer-scored (12.4±0.4 vs. 9.4±0.2; $p<0.001$) workload was greater during ADE cases. TLX workload was also significantly greater in ADE cases than No ADE cases, both pre- and post- observation (32.2±1.3 vs. 29.4±0.9 pre and 33.4±1.2 vs. 29.8±0.8 post; both $p<0.05$).
Discussion: ADE were associated with altered ICU nurse task distribution and workload. ADE were captured using an active surveillance method - a brief investigator-administered survey instrument - which yielded a much higher incidence (20%) than typical with traditional self-reporting systems. In observation periods containing ADE, nurses spent more time doing manual tasks and less time conversing, and had higher workload. We cannot assess whether these changes are a cause or consequence of the ADE (or both). Future analyses will examine institutional factors, time of day, and infusion pump programming errors. This preliminary study demonstrates the potential value of structured observation and quantitative analysis of actual care processes.
Supported by FDA and AHRQ.

S-91.

IS STRESS HYPERGLYCAEMIA ASSOCIATED WITH INCREASED MORTALITY IN INTENSIVE CARE PATIENTS?

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Stress hyperglycaemia is a plasma glucose level ≥ 11.1 mmol/L in the absence of diabetes. It arises due to insulin resistance or deficiency as a result of pathophysiological changes and medical treatments. ICU patients are likely to develop it. It increases hospital mortality after myocardial infarction and ischaemic stroke. We evaluated the association of stress hyperglycaemia with outcome in non-diabetic ICU patients.
A retrospective study was conducted of consecutive ICU admissions over a 12 month period when tight glucose control was being implemented. Local ICNARC data were retrieved. Primary end points of the study were ICU and hospital mortality and compared between patients who developed stress hyperglycaemia in the first 24 hours of admission and those that were normoglycaemic.
During the study period, 548 non-diabetic patients were admitted, of which 33% (n=180) developed stress hyperglycaemia. These patients were predominantly male, significantly older and physiologically more deranged compared with normoglycaemic patients. The stress hyperglycaemia group had a significantly longer ICU stay, a 10% higher ICU mortality and 17% higher hospital mortality. In ICU survivors, 18% of stress hyperglycaemia vs. 1.9% of normoglycaemia patients died pre-hospital discharge. Stress hyperglycaemic patients had up to 25 times increased risk of death even if they survived from ICU (RR 9.4, 95%CI 3.6-24.5). In addition, admission glucose was recorded in 100% of patients, compared with up to 50% missing data for some other parameters. This study has demonstrated that stress hyperglycaemia is common, and a feasible and important marker of ICU outcome. Treating it can improve mortality.

Table 1. Stress hyperglycaemia and outcomes (mean (SD) or median (interquartiles))

	Normoglycaemia Plasma glucose <11.1mmol/L	Stress hyperglycaemia Plasma glucose ≥11.1mmol/L
No. of patients (%)	368 (67%)	180 (33%)
Age (yrs)	64 (47-75)	67 (56-76)*
Gender (M/F)	235/133	126/54
APACHE II score	19 (8)	23 (8)*
Highest H^+ (nmol/L)	50 (44-59)	62 (50-75)*
Highest glucose (mmol/L)	7.7 (6.8-9.3)	14.3 (12.6-16.7)*
Highest creatinine (mmol/L)	105 (81-164)	131 (102-182)*
ICU-length of stay (hrs)	43 (22-104)	60 (25-163)*
ICU mortality (%)	27% (99/368)	37% (66/180)
Hospital mortality (%)	31% (114/368)	48% (86/180)*
ICU survivor pre-hospital discharge mortality (%)	1.9% (5/269)	18% (20/114)*

*$P<0.05$ compared with normoglycaemia.

S-92.

MEAN GLUCOSE ON ICU DAY 1 AS A PREDICTOR OF HOSPITAL MORTALITY IN CRITICALLY ILL PATIENTS: A COMPARISON WITH APACHE III

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Introduction: Tight glycemic control has been demonstrated to improve outcomes in critically ill patients. Although the APACHE III Acute Physiology Score includes blood glucose level as a component, it is possible that the score underestimates hospital mortality due to the strong association between glycemic control and hospital mortality seen in other studies.
Methods: With IRB approval, a retrospective review of the APACHE III database for data on patients admitted to a post-vascular and thoracic surgery intensive care unit at a tertiary referral center between January 2003 and June 2005 was performed. We collected demographics, first day acute physiology score (APS) and APACHE III score for all patient admissions, as well as ICU and hospital discharge status. All first day glucose measurements were also recorded.
Logistic regression models were constructed using hospital discharge status as the dependent variable and APS, APACHE III score and first day mean glucose values as the predictor variables. The discrimination of the models was tested using the area under the receiver operating characteristic curve (AUC). The relative contributions of these predictors for hospital discharge status were assessed.
Results: Data were available for 2202 ICU admissions. 60% were male. Mean (± standard deviation) age was 66.5 (±15.0) years. 66% were admitted for "active" treatment as defined by APACHE III. Mean APS and APACHE III score were 36.2 (±19.4) and 49.0 (±21.8), respectively. Median ICU length of stay was 2 days (interquartile range 1 to 4). There were 69 ICU deaths and an additional 43 in-hospital deaths. Mean day-1 glucose for the entire study sample was 140.1 (±38.2) mg/dL. The AUC for APS and APACHE III score mortality prediction were 0.809 and 0.820, respectively. The mean day 1 glucose value was not associated with hospital mortality in a logistic regression model. Mean day 1 glucose was identical in survivors (140.6±37.7) and non-survivors (140.8 ±46.5)
Discussion: As expected, APACHE III predicts hospital mortality moderately well for patients after vascular and thoracic surgery. While glucose has been shown to correlate with survival in several studies, the mean glucose level on the first ICU day does not. The APACHE III score does take account of the worst glucose value, but the addition of the mean glucose level to the day-1 APACHE III score is not useful for predicting mortality.

S-93.

Q AND NON-Q WAVES MYOCARDIAL INFACTUS IN PATIENTS UNDERGOING MAJOR ORTHOPEDIC SURGERY

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INTRODUCTION: A previous study established that the frequency of myocardial infactus (MI) occurring with 30 days following primary knee and total hip replacement was 2.2%. (1) In this study, MI was defined as (1) creatine kinase MB fraction greater than 3 time the upper limit of normal and (2) electrocardiographic evidence of new Q wave. Non Q wave MI represents an equally important perioperative complication, but little is know about its frequency in patients undergoing major orthopedic surgery. This study was designed to established the frequency of Q and non-Q wave myocardial infactus in patients undergoing total hip and total knee replacement
METHODS: From our computer data base we determined the patients who underwent either total knee or hip replacement between January 1 1997 and June 30 2005. This population was cross reference with the MI CPT codes for Q or non-Q wave MI prior to, during or and after surgery. Data are presented as median. A t-test was used for comparisons. Alpha was set up at 0.05.
RESULTS: 8,040 patients underwent major lower extremity joint replacement. Among them, we recorded 32 patients (15 men and 17 woman), median age 78 years (77 for men and 81 for women) who developed a MI during the perioperative period. 22% underwent of total knee replacement and 72% of the remaining patients presented with a hip fracture. Except for one, every patient had a significant preoperative cardiac history. 25% of these MI occurred prior to surgery, 19% during surgery and 56% postoperatively. 34% of patients presented with a non-Q wave infactus. 2/3 of patients did not benefited from the use of spinal anesthesia or peripheral nerve blocks prior to surgery.
DISCUSSION: Our data indicate that consideration should also be given to Non-Q wave MI. In our series, the non-Q wave MI accounted for 1/3 of the total of perioperative MI. We also demonstrated that MI. Perioperative MI represents mostly a complication of very elderly patients, especially those presenting preoperatively with hip fracture. Finally our data supports the concept that the use spinal and peripheral nerve block anesthesia have cardiac protective effects.
REFERENCES:
Mantilla et al Anesthesiology 2002; 96:1140-6

S-94.

DOBUTAMINE DOES NOT INFLUENCE INFLAMMATORY PATHWAYS DURING HUMAN ENDOTOXEMIA

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Introduction: Catecholamines have anti-inflammatory and anticoagulant properties (1-3). Dobutamine is a synthetic catecholamine frequently used in patients with septic cardiomyopathy. We determined whether a continuous infusion of dobutamine exerts immunomodulatory effects in healthy volunteers challenged with endotoxin.
Methods: Following IRB approval and informed consent 16 male healthy volunteers were prospectively assigned to receive either a constant infusion with dobutamine (10 μg kg^{-1} min^{-1}; n=8) or physiological saline (n=8). All subjects were challenged with a bolus injection of endotoxin prepared from *Escherichia coli* (4 ng/kg). Dobutamine infusion was commenced one hour prior to endotoxin challenge and was continued until three hours thereafter. Data were expressed as mean ± sd and analyzed using a mixed models approach (4); $p < 0.05$ was considered significant
Results: Dobutamine infusion was associated with an increase in mean arterial blood pressure (peak 122 ± 5 mm Hg) and heart rate (peak 84 ± 4 beats per minute, both $P < 0.05$ versus saline). Endotoxin injection induced the systemic release of cytokines (tumor necrosis factor-β, interleukins 6, 8 and 10) and secretory phospholipase A_2, endothelial cell activation (rise in the plasma levels of soluble E-selectin and von Willebrand factor), activation of coagulation (increased plasma levels of soluble tissue factor, F1+2 prothrombin fragment and thrombin-antithrombin complexes), and activation with subsequent inhibition of fibrinolysis (increased plasma concentrations of tissue-type plasminogen activator, plasminogen activator inhibitor type I and plasmin-α2-antiplasmin complexes). None of these responses were influenced by dobutamine.
Discussion: Dobutamine, infused in a clinically relevant dose, does not influence inflammatory and coagulant pathways during human endotoxemia.
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2.Guirao X, Kumar A, Katz J et al. Catecholamines increase monocyte TNF receptors and inhibit TNF through β_2- adrenoreceptor activation. Am J Physiol 1997;273:E1203-E1208.
3.Van der Poll T, Lowry SF. Lipopolysaccharide-induced interleukin 8 production by human whole blood is enhanced by epinephrine and inhibited by hydrocortisone. Infect Immun 1997;65:2378-2381.
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Economics, Education & Patient Safety

S-95.

KNOWLEDGE OF PERIOPERATIVE CARE BY PRIMARY CARE PHYSICIANS: A COMPARISON WITH ANESTHESIOLOGISTS

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Introduction: Primary care physicians (PCP's) are commonly asked to evaluate patients prior to surgery. We hypothesized that there would be knowledge gaps in basic perioperative concepts when family medicine and internal medicine residents are compared to anesthesiology residents.
Methods: Questionnaires designed to evaluate knowledge of preoperative evaluation and preparation as well as potential physiologic changes during anesthesia and surgery were distributed to resident physicians (n =120) in internal medicine, family medicine and anesthesiology at our institution. Survey questions were generated after searching MEDLINE and OVID for articles relevant to perioperative care between January 1980 to October 2003. Other questions were developed based on commonly known misconceptions among primary care physicians regarding anesthesia and surgery (1, 2). The "right" answer was obtained from a standard reference textbook of anesthesia (3). A 2-way analysis of variance test was used to determine the interaction between specialty and questionnaire score. Student Newman Keuls test was used for pairwise comparisons of scores between anesthesiology and family Medicine, and between anesthesiology and internal Medicine. Survey questions were also analyzed for differences based on response to individual questions.
Results: The overall response rate was 50.8%; anesthesiology residents was 57.1% and internal medicine and family practice residents was 52% and 48%, respectively. There were significant differences in overall questionnaire scores between anesthesiology (mean 27.5 ± 4) and internal medicine residents (mean 21.4 ± 3) and between anesthesiology and family medicine residents (mean 20.2 ± 5). Significant differences were found in response to questions related to preoperative testing, hemodynamic changes with induction of anesthesia and appropriate use of neuraxial blockade. No statistically significant difference was found based on level of training.
Discussion: With PCP's increasingly involved in perioperative patient care (4); it is important that they are familiar with perioperative pathophysiology. We conclude that although PCP's are knowledgeable about preoperative preparation, there is however a knowledge gap that needs to be addressed. Creating a defined perioperative medicine curriculum in primary care training programs and continuing education amongst PCP's are suggested ways of bridging this gap. Co-operation between specialty societies that provide perioperative care (anesthesiologists, hospitalists, cardiologists etc) in formulating and updating guidelines will ensure uniformity of practice and continued improvement in the quality of care.
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S-96.

SURVEY OF PROPOFOL ABUSE IN ACADEMIC ANESTHESIA PROGRAMS

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Introduction: It is well established that substance abuse and addiction is a significant problem in anesthesia. However, the potential abuse of propofol in anesthesia is poorly described. **Methods:**To begin to define the occurrence of propofol as a drug of abuse in anesthesiology, we surveyed all academic anesthesia departments in the United States about their experience with propofol abuse in the last 5 years.
Results: We had 71 surveys returned from the 120 departments surveyed. Of these surveys there were 9 confirmed anesthesiology department members found to be abusing propofol. Of these individuals, there were 4 deaths. The positive reports are briefly described below.
1. Attending M.D. anesthesiologist who was sent for rehabilitation and successfully returned to work.
2. Attending M.D. anesthesiologist who was sent for rehabilitation and is now out of medicine completely.
3. Attending M.D. anesthesiologist who was sent for rehabilitation and successfully returned to work.
4. Resident M.D. anesthesiologist who was sent for rehabilitation and successfully retuned to work.
5. Resident M.D. anesthesiologist who was found to have died of propofol overdose.
6. Resident M.D. anesthesiologist who was sent for rehabilitation and left rehabilitation and was lost to follow up. Individual was known to be abusing up to 100 mg in a single use.
7. Resident M.D. anesthesiologist who was found to have died of propofol overdose.
8. Resident M.D. anesthesiologist who was found to have died of propofol overdose.
9. Operating room technician who was found to have died of propofol overdose
In our initial research, we also learned of a family practice resident, an orthopedic surgery resident, and an operating room nurse who had been known to actively abuse propofol. Of the academic centers returning information 48/71 (68%) do not secure and/or actively account for propofol (as opiates are accounted for). 19/71 (27%) do account for and secure propofol. 3 centers did not indicate if propofol is secured/ accounted for or not.
Discussion: This data indicates that greater then 13% of academic anesthesia centers that answered our survey have had an individual abusing propofol in the last 5 years. This is quite a significant number as it does not take into account the many private practice groups throughout the country. Nor does it account for those who may be abusing without detection, as propofol is not tested for in drug screening of anesthesia providers suspected of substance abuse. Our research also indicated that the abuse of propofol is not limited to anesthesia providers, but afflicts other specialties as well. Of those discovered abusing propofol, one-half were discovered when they were found dead from an overdose. The reason for the growing abuse of this seemingly unattractive (as compared to opiates) and very lethal drug is unclear.

S-97.

ELECTROCARDIOGRAM INTERPRETATION SKILLS IMPROVE DURING ANESTHESIA RESIDENCY TRAINING

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Introduction:
The ability to interpret Electrocardiograms (ECG) is an essential element in the practice of anesthesia. The American Board of Anesthesiology does not require residency programs to implement electrocardiogram training during residency. Many studies have looked at the competency in interpreting 12-lead ECGs amongst physicians. Interpretation results ranged from 36.4% to 92.8% (1). The only previous study involving anesthesiology residents revealed no difference in ECG interpretation skills between CA-I, II or III (2). This study was a non-longitudinal comparison involving different residency classes. In order to rule out possible sampling errors in the previous study, this follow up longitudinal study compared ECG interpretation skills of the same anesthesiology residents during their CA-I and CA-III years.
Methods:
With IRB approval, 18 anesthesiology residents volunteered to interpret eight 12-lead electrocardiograms. The control included three cardiologists who initially interpreted the ECGs. All three cardiologists had the same diagnosis for every ECG used in our study. During there CA-I year the residents were asked to interpret the ECGs. They were asked to select one diagnosis for each ECG. A list of 16 ECG diagnoses from the American College of Cardiology (ACC) was provided. The answers to the ECGs were never discussed. The same residents during their CA-III years were asked to repeat the interpretation of the ECGs. All results were recorded and matched with the cardiologist's diagnosis.
Results:
Using the student t-test, there was significant improvement in ECG interpretation skills from the CA-I to CA-III year ($p<0.001364$). The volunteers correctly answered 46.47±17.75% of the ECGs correctly in their CA-1 year, and 66.91±16.53% in their CA-III year.
Discussion:
The ability to interpret EKGs does improve during Anesthesiology Residency Training. The ACC and The American Heart Association recommended interpretation of 500 ECGs under supervision to attain initial competency (3). In order to maintain competency in ECG interpretation 100 ECGs yearly must be read. Our results also reveal that although anesthesiology residents did not perform as well as cardiologist, they were in line with practicing medicine attendings. Because electrocardiogram interpretations are vital in the practice of anesthesia, future studies should focus on which areas in electrocardiogram interpretation requires additional attention during residency training.
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2. Maalouf D, Cuff G, Appelbaum R, Ranganathan P, Kim J. Electrocardiogram Interpretation Skills Do Not Improve With Residency Training. Anesthesiology 2004;101:A1333
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S-98.

RIGHT VS. LEFT-SIDED DOUBLE LUMEN TUBES: SAFETY PROFILES OF FREQUENT USERS

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Background: Left-sided double lumen tubes (DLT) are perceived to be safer than right-sided DLTs because they may be less prone to malpositions during one lung ventilation (OLV).[1] Studies with small groups of patients indicate that right-DLTs can be used without increased risk of right upper lobe collapse, but might be associated with more frequent malpositions.[2] Our practice is to achieve OLV with a DLT placed to the side opposite surgery. Thus, if right-DLTs are more prone to clinically significant malposition in broad use, then the incidence and severity of hypoxia, hypercapnea and high airway pressures would be higher in a large group of patients receiving OLV via right-sided tubes during thoracic surgery than in a similar group receiving OLV via left-sided tubes.
Methods: We conducted a retrospective review of all patients on our thoracic anesthesia service whose anesthetics were documented using an automated information management system (AIMS) between 4/15/03 and 1/1/05. The AIMS automatically records SpO2, EtCO2 and peak inspiratory pressure every 30 seconds. DLT placement is documented via menu choices that force the user to record left vs. right-sided tube use. Side of surgery was also obtained. We compared the frequency of right and left-DLT use by our thoracic anesthesiologists. Next, we examined the incidence, duration and severity of hypoxia ($SpO2<90\%$), hypercapnea ($EtCO2 > 45$mmHg) and high airway pressures ($PIP > 35$ cm $H2O$) for lung and chest wall surgery patients receiving OLV via right vs. left-DLTs. Group counts and means were compared by standard statistical methods.
Results: The table shows results for a large number of cases under everyday usage conditions. Right and left sided tubes were almost exclusively used on the side contralateral to surgery. There were no differences in the incidence or duration of hypoxia, hypercarbia or high airway pressures. The was a small but significant increase in EtCO2 for patients having left lung ventilation, probably reflecting the impact of smaller lung volume on gas exchange.

Left and Right Sided Tubes Ipsilateral/Contralateral Surgery	Left DLT (n=450) 34/416	Right DLT (n=241) 6/235	P
Cases with SpO2 < 90%	50	19	NS
Mean Duration ± SD (min)	8.3 ± 6.2	6.5 ± 4.7	NS
Mean Lowest SpO2 ± SD (%)	85 ± 4	85 ± 4	NS
Cases with EtCO2 > 45 mmHg	120	63	NS
Mean Duration ± SD (min)	9.9 ± 10.6	7.2 ± 4.7	NS
Mean Highest EtCO2 ± SD	52 ± 5	50 ± 4	<0.05
Cases with PIP > 35 cm H2O	301	173	NS
Mean Duration ± SD (min)	18.2 ± 19.6	16.7 ± 5.8	NS
Mean Highest PIP ± SD	43 ± 6	42 ± 4	NS

Conclusions: The supposition that left-sided DLTs are safer than right-sided DLTs when intraoperative hypoxia, hypercapnea and high airway pressures are used as criteria and when these tubes are employed by frequent users is not supported by our data.
References:
1. Benumof, et.al., Anesthesiology 1987; 67: 729-38.
2. Campos JH, et.al. Anesth Analg 2000; 90: 535-40.

S-99.

PUBLICATION RATE OF ABSTRACTS PRESENTED AT THE 2000 AMERICAN SOCIETY OF ANESTHESIOLOGISTS ANNUAL MEETING

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Introduction: Abstract presentations are an effective means of rapidly disseminating current research. However, their results are not validated under the scrutiny of peer-review journal publications. The purpose of this study was to determine the publication rate of abstracts presented at the 2000 American Society of Anesthesiologists meeting and to determine characteristics that were associated with publication.
Methods: Pubmed (Medline) search from January 1999 through July 2005 was conducted for publications resulting from 1371 abstracts presented at the 2000 ASA meeting. Search criteria included abstract title, names of every contributing author, and keywords when no hits or 50+ hits were found. A database was compiled to include subspecialty categories, study type, author origin, time to publication, journal demographics, and journal impact factor as calculated by the Institute for Scientific Information to determine the strength of publications.
Results: Of 1371 abstracts, 432 or 31.5% ultimately resulted in peer-review journal publications. Basic science abstracts fared better than clinical studies; 160 of 456 (35.1%) of basic science abstracts and 272 of 915 (29.7%) of clinical studies were published. 724 of 1371 (52.8%) of the abstracts were submitted from the US followed by 390 (28.4%) submissions from Europe and 187 (13.6%) submissions from Asia (see Table). Their overall publication rates were similar (US 30.5%, Europe 32.6%, Asia 32.6%) as were their journal impact factors (2.3 to 2.7).
Discussion: The publication rate in this study was substantially lower than the publication rate of 47.7% that was previously shown for abstracts from the 1995 International Anesthesia Research Society Congress (1). It was also lower than the average publication rate for many other medical specialties (2-3). The abstract publication rate is seen as a measure of the quality of a meeting in the scientific community. Factors such as increasing clinical workload, publication bias, or simply modest quality of the scientific data presented may explain this apparent decline in our specialty and must be further investigated. The economic consequences of our findings in a period of budget constraints and competitive funding should also be taken into serious consideration.
References:
1. Anesth Analg 2001;92:S110.
2. Am J Obstet Gynecol 2004;191:32-5.
3. BMC Med Res Methodol 2003;3:1-12.

Country of origin	Total clinical vs basic science	Published	Impact Factor mean (median;range)
US	478	136 (28%)	2.4 (2.3; 0-16.6)
	246	85 (35%)	3.1 (3.1; 0-8.5)
Europe	292	89 (30%)	2.3 (2.3; 0-7.6)
	98	38 (39%)	2.7 (2.3; 0-5.3)
Asia	88	29 (33%)	2.7 (2.1; 0-29.5)
	99	32 (32%)	2.9 (2.4; 0-10.1)
Canada	31	11 (35%)	2.2 (2.1; 0-2.5)
	3	1 (33%)	2.3
Israel	10	4 (40%)	1.4 (1.6; 0-2.5)
	7	3(47%)	2.9 (3.4; 1.4-3.8)
South America	6	0	0
	3	1 (33%)	2.3
Middle East	6	2 (33%)	0.5 (0.5; 0-1)
	0	0	0
Africa	4	1 (25%)	2.3
	0	0	0

S-100.

DIFFERENTIAL EFFECT OF AN AIRWAY TRAINING CENTER BY SURGERY SUBTYPE

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Introduction: Previous studies have demonstrated that an Airway Study and Training Center (ASTC) can increase the overall rate of fiberoptic intubation at an institution[1]. The purpose of this retrospective study was to determine whether this increase in the use of fiberoptic techniques following faculty and resident training differed depending on the types of surgical procedures being performed. If differences do exist, the best target audience for advanced airway skills training may then be identified.
Methods: All general anesthetics performed at our medical center over a ten year period (1994-2003) were included in this retrospective study. The first five years of the study predated the creation of the ASTC. The final five years of the study period followed the establishment of the center. Surgical cases were divided into 12 subgroups based on the types of surgery (e.g., vascular, ENT, plastics). Chi square analysis was used to compare the rates of fiberoptic intubation during the two periods for each of the 12 surgical subgroups.
Results: 41,221 patients received general anesthesia during the first five year period. 54,809 patients received general anesthesia during the second period. The overall rate of fiberoptic intubation was 3.5% (1,450 patients) during the first period and 4.1% (2,238 patients) during the period following the establishment of the ASTC ($p<0.001$). Among the subgroups, the rate of fiberoptic intubation increased significantly for general, cardiac, vascular, and urologic surgery cases but was essentially unchanged for other specialties (see table).

Surgery Type	% fiberoptic pre	% fiberoptic post	p value
Vascular	1.20%	2.90%	p< 0.001
Urology	1.20%	2.20%	p< 0.01
Gynecologic	1.30%	1.80%	NS
Orthopedics	1.40%	1.10%	NS
General	1.90%	2.50%	p< 0.01
Plastics	2.30%	2.80%	NS
Breast	2.40%	2.20%	NS
Cardiac	3.10%	5.20%	p< 0.001
ENT	3.30%	3.50%	NS
Thyroid	5.30%	5.30%	NS
Neurosurgery	6.90%	7.10%	NS
Thoracic	23%	23%	NS

Discussion: The results of this study suggest that the impact of an airway training center on rates of fiberoptic intubation are not evenly distributed across all surgical subtypes. Specifically, the use of fiberoptic techniques in cardiac, vascular, general, and urologic surgeries appears to have increased the most relative to other specialties many of which started off with relatively high rates of fiberoptic use. Understanding the reasons for this difference may improve future dissemination of advanced airway skills among subspecialty anesthesiologists.
Reference: 1) An Airway Training Center Can Increase the Use of Advanced Airway Management Techniques at a University Hospital. Poster discussion 2006 ASA meeting, New Orleans, LA.

S-101.

EDUCATION OF ANESTHESIA RESIDENTS IN BLOOD COMPATIBILITY

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Human error remains a significant risk for recipients of blood product transfusion, far outweighing risks associated with virally transmitted disease [1]. However, volume of transfusions are significant at many academic level 1 trauma centers (> 50,000 blood and component units per annum at our institution).
Given the regular arrival of new anesthesiology residents, staff at our hospital transfusion service/pathology department developed a comprehensive table of ABO and Rh compatibilities for the commonly used blood products (Table 1 - red blood cells, Table 2 - platelets, Table 3 - fresh frozen plasma and cryoprecipitate). These tables will be distributed to all anesthesiology residents and prominently displayed in laminated form on all anesthesia machines.
In addition, communication with transfusion service staff is encouraged, especially in the emergent trauma and urgent transplant situations.
This initiative will address aspects of the ACGME core competencies, including both systems-based practice and communication (with transfusion service), patient safety as a critical component of patient care and medical knowledge of product compatabilities. Quality assurance may be able to be assessed after implementation of the program.
References: 1. Stainsby D. Anesthesiol Clin North America 2005;23(2):253-61

IF YOUR TYPE IS	[2]YOU CAN RECEIVE RED CELLS FROM							
	O+	O=	A+	A=	B+	B=	AB+	AB=
O+	X	X						
O=		X						
A+	X	X	X	X				
A=		X		X				
B+	X	X			X	X		
B=		X				X		
AB+	X	X	X	X	X	X	X	X
AB=		X		X		X		X

IF YOUR TYPE IS	YOU CAN RECEIVE PLATELETS FROM							
	O+	O=	A+	A=	B+	B=	AB+	AB=
O+	X	X	X	X	X	X	X	X
O=		X		X		X		X
A+	(3rd)	(3rd)	X	X	(2nd)	(2nd)	X	X
A=		(3rd)		X		(2nd)		X
B+	(3rd)	(3rd)	(2nd)	(2nd)	X	X	X	X
B=		(3rd)		(2nd)		X		X
AB+	(4th)	(4th)	(2nd)	(2nd)	(3rd)	(3rd)	X	X
AB=		(4th)		(3rd)		(2nd)		X

IF YOUR TYPE IS	YOU CAN RECEIVE PLASMA AND/OR CRYO FROM							
	O+	O=	A+	A=	B+	B=	AB+	AB=
O+	X	X	X	X	X	X	X	X
O=	X	X	X	X	X	X	X	X
A+			X	X			X	X
A=			X	X			X	X
B+					X	X	X	X
B=					X	X	X	X
AB+							X	X
AB=							X	X

S-102.

COMPARING RUBRIC AND NUMERICAL RATINGS AND RELIABILITY IN EVALUATING RESIDENT CASE-BASED DISCUSSION

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Introduction: The Core Competencies Outcomes Project mandates that multiple methods and observers be used in the evaluation of residents, and that the methods must be multiple, reliable and dependable. One evaluation method is case-based discussion. Examiners' evaluation of residents based upon this format may be subjective. The goal of this study is to evaluate if rubrics can be used to objectively score a resident's performance on these tasks. A rubric is a scoring guide used to evaluate the quality of students' constructed responses. A rubric has three essential features: evaluative criteria, quality definitions, and a scoring strategy. We sought to compare rubric-based evaluation of resident case-based discussion to a single numerical score. The primary question we asked was which evaluation method would provide better reliability across examiners.
Methods: Faculty were divided into three groups: 1) Faculty examiners designed each case comprised of a stem case and questions. Twelve residents were videotaped presenting and interacting with the examiner. Preparation for the case was randomly varied across residents: 2 hours, 48 hours, 1 week. Faculty evaluators (n=10) were divided into two groups and viewed all 12 videotapes. 2) Control evaluators (N) assigned a single numerical score (1-10 scale). 3) Rubric evaluators (R) used 5 criteria each with 4 categories of skill.
Results: Across ten videotapes, using a 0-10 post-hoc composite score, rubric evaluators gave higher overall scores than numeric evaluators (Mean R= 7.95; Mean C=5.78, p=.001). Across evaluators, reliability was nonsignificantly better for R than C groups (R st dev = 1.3, C st dev =1.4). Rubric evaluators provided assessments based on five independent criteria allowing individualized assessment of resident competencies.
Discussion: Our results indicate that rubric-based evaluation of resident case-based discussion is as reliable as single numerical scales for assigning proficiency. Rubric methods allows for better discrimination of skill category criteria.
References:
1. Teach Learn Med,16(1):77.2004

S-103.

OPTIMAL ADMINISTRATION OF PERIOPERATIVE ANTIBIOTICS USING SYSTEM REDESIGN

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Introduction: Surgical infection is a leading cause of patient injury, mortality and excess healthcare costs.[1] An estimated 2.6% of the nearly 30 million operations carried out each year are complicated by surgical infections.[1] 50% of surgical infections are estimated to be preventable.[1] Baystate Medical Center (BMC) was chosen in early 2002 to be a representative in a nationwide quality improvement initiative. The goal of the collaborative was to optimize surgical patient outcomes by improving the use of evidence-based practices shown to reduce surgical infections. These evidence based practices consisted of 1. administration of antibiotics within 60 minutes prior to incision, 2. appropriate selection of antibiotics, and 3. discontinuation of prophylactic antibiotics within 24 hours of surgery. Initially, the pilot surgical populations were cardiac and vascular patients with the addition of total joint replacement, abdominal and gynecological surgeries added in 2004.
Methods: After evaluation of our existing process incorporating rapid cycle PDSA (plan-do-study-act) techniques, a complete process redesign of the peri-operative system was undertaken. The system was (and is) continuously improved using multiple small tests of change techniques to ensure compliance and improvement of the three processes. Many changes were made. Order sets in our computerized physician order entry (CPOE) system were revised to eliminate the "administer on-call to O.R." orders. Changes were made in OR documentation to prompt and better capture antibiotic administration times (prompt placed on anesthesia record). Anesthesiologists were identified as the practioner most appropriate to administer the antibiotics. Nurses prepared the antibiotic in the pre-operative holding area for administration by anesthesiologists in the OR. Surgical preoperative order sheets were redesigned to simplify antibiotic ordering, and CPOE was modified to eliminate antibiotic duration after 24 hours. Evidence based education was provided to all "stake-holders", and results were displayed prominently as a dashboard in the operating rooms. On time antibiotic administration was defined as antibiotics administered within 60 minutes prior to incision. Appropriate selection was defined by current recommendations and guidelines. Discontinuation was defined by prophylactic antibiotics stopped within 24 hours of surgical end time.
Results: Our baseline rate for percentage of patients receiving prophylactic antibiotics within 60 minutes prior to incision was 29%. After implementation of the above strategies, our most recent percentage was 94% (2nd quarter 2005). Our average baseline interval from antibiotic administration to incision time was 71 minutes. This has improved to 23 minutes. Baseline appropriate antibiotic selection was 95%, and is now 100%. Discontinuation of antibiotic therapy within 24 hours after surgery was at an 11% level and has increased to 82%.
Discussion: The use of rapid cycle PDSA, effective communication, CPOE and other quality improvement techniques can improve the compliance of evidence-based practices known to decrease rates of surgical infection.
References: 1. www.surgicalinfectionprevention.org

S-104.

THE PREVALENCE OF UNDIAGNOSED DIABETES, IMPAIRED FASTING GLYCAEMIA AND METABOLIC SYNDROME AMONGST PATIENTS PRESENTING FOR ELECTIVE SURGERY, AND THEIR ASSOCIATION WITH POST-OPERATIVE COMPLICATIONS

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Introduction: In the UK there are approximately 1 million people with undiagnosed non-insulin dependent diabetes (NIDDM)[1]. NIDDM is part of a syndrome of insulin resistance called the metabolic syndrome, affecting 25% of the U.K population[2]. Undiagnosed diabetes and the metabolic syndrome are associated with increased cardiovascular morbidity[3,4]. Cardiovascular complications are the leading cause of postoperative death[5]. Impaired fasting glycaemia (IFG) is a strong predictor of developing diabetes. The primary aims of this study were to quantify the prevalence of undiagnosed diabetes, IFG and metabolic syndrome amongst surgical patients at a large teaching hospital, and to assess their association with post-operative complications.
Methods: A prospective observational study was conducted of consecutive adult non-diabetic patients presenting for elective surgery over a four-month period. Random glucose levels were taken in the pre-assessment clinic, and post-operatively. Fasting plasma glucose and lipids samples were taken prior to induction of anaesthesia. Diabetes and IFG were diagnosed according to American Diabetes Association criteria, and metabolic syndrome according to ATP III criteria [3]. Post-operative complications assessed included cardiac events, infections, unplanned ITU admission and mortality.
Results: 209 patients were recruited. None of these had previously undiagnosed diabetes, however 18% (n=38) had IFG. IFG patients had a significantly higher incidence of post-op complications compared to patients with normal fasting glycaemia (31% vs. 8%). Incidence of metabolic syndrome was 33%. Age and sex distribution did not differ significantly between patients with and without metabolic syndrome (as shown in table 1). Metabolic syndrome patients had a significantly higher incidence of post-op complications (22% vs 8%).
Table 1: Comparison of demographics and outcome of patients with and without metabolic syndrome

	Metabolic syndrome present (n=68)	Metabolic syndrome absent (n=141)	P value
Age (yrs)(med)(IQR)	56 (14)	56 (16)	NS
Sex (m:f)	74:67	34:34	NS
IFG	28%	13%	P=0.04
Post-op complications	22%	8%	P=0.006

Med=Median IQR=Interquartile range NS=Not significant
Discussion: There was a significant incidence of IFG (18%) and metabolic syndrome (33%). Impaired glucose tolerance is associated with increased cardiovascular morbidity. Moreover, if left untreated, IFG patients develop end-organ disease by the time diabetes is diagnosed. In this study IFG and metabolic syndrome were both associated with significant post-op complications. Further work is required to assess the potential value of screening for these conditions pre-operatively and their role as predictors of peri-operative risk.
References:
1. Diabetes UK. 2000
2. JAMA. 2002; 287: 356-9
3. NCEP Panel. (ATPIII). 2002.
4. Diabetes Care. 2001; 24: 683-9
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S-105.

VITAL SIGNS DEVIATE SIGNIFICANTLY FROM NORMAL MORE OFTEN IN CASES CONTAINING NON-ROUTINE EVENTS BUT THESE DEVIATIONS ARE STILL COMMON IN CASES REPORTED AS ROUTINE

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Introduction: Intraoperative disturbances in patient physiology predict more serious perioperative adverse events. Previously, we videotaped over 400 anesthetics and identified non-routine events (NRE) during more than 30% of these cases [1]. A NRE is any event that deviates from optimal care for a specific patient [2]. We hypothesized that NRE-containing cases would have more episodes of significant physiological derangement (SPD) than "routine" (NoNRE) cases. We further hypothesized that there would be an undesirable incidence of SPD in NoNRE cases.
Methods: Videotapes of anesthesia care were observed to measure the incidence and duration of selected vitals falling outside defined "normal" ranges. Each video included a full display of the physiological monitors. In the original study, the occurrence of an intraoperative NRE was reported at the end of the case by the provider and confirmed with dual clinician expert video review [1]. Twelve NRE and 56 NoNRE cases were identified using the criteria of: Less than 5 hours duration; General, urological, or orthopedic surgery; and ASA 3 patients. Eleven cases from each group were randomly selected to be watched, in a random order, by a trained assistant who was blinded to cases' classification. The observer recorded, using custom software, the time any variable fell outside the following ranges: SBP<80 or ≥200, DBP<40 or ≥100, HR<45 or ≥120, and SpO2<92. SPD episodes lasting <30 seconds (<15 sec for HR) and artifacts were excluded from analysis. The data were analyzed using one- and two-way parametric and non-parametric tests.
Results: Case length was not different between the two groups. The NRE group had 176 SPD events while the NoNRE group had 39 events (p=.014). There were twice as many unique SPD events in NRE cases (p=0.006) and more events per hour (6.6±1.7 vs. 1.6±0.6; p=.042). The average percent time per case for any of the variables to be out-of-range was 6.6±1.0% for NRE and 1.7±0.4% for NoNRE (p=.029). In all cases, HR events were most common. In NRE cases, BP events lasted longest while SpO2 events lasted longest in NoNRE cases. For individual variables, only SBP differences were significant, both for number of events (3.1±1.7 NRE vs 0.4±0.2 NoNRE; p<.007) and percent of case time with an event (5.7±2.7% vs. 0.8±0.4%; p=.022).
Discussion: This preliminary study demonstrates a significant incidence of physiological derangements during both routine and NRE-containing anesthetics. Future analysis will examine whether these SPD precede, are associated with, or are a consequence of NRE. Data from electronic anesthesia records could validate and extend these findings. Favorable results could guide the development of predictive models to improve anesthetic care.
References:
1. Quality Safety Healthcare 13: 136, 2004 and Anesth Analg 98:S58, 2004
2. J Biomed Informatics 36:106, 2003
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S-106.

POSTOPERATIVE DELIRIUM DOES NOT PREDICT LONG-TERM POSTOPERATIVE COGNITIVE DYSFUNCTION OR FUNCTIONAL DECLINE

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Introduction: Postoperative delirium (POD) is common in the elderly and is associated with a variety of adverse outcomes.[1] However, its effects on long term cognitive and functional status are not well-defined. We investigated the effect of POD on cognitive and functional status measured three months postoperatively.
Methods: Following Institutional Review Board approval, patients ≥ 65 years old having elective hip or knee arthroplasty were enrolled. Participants underwent preoperative neurocognitive and functional testing including the Mini Mental Status Exam (MMSE), the Adult Verbal Learning Test (AVLT), the Stroop Color Word Test (SCWT), the Controlled Word Association Test (COWAT), Activities of Daily Living (ADLs) and Instrumental Activities of Daily Living (IADLs). POD was assessed using the Confusion Assessment Method (CAM). CAM (+) patients and age-, procedure-, gender-, and MMSE-matched CAM (-) controls had repeat neurocognitive and functional testing three months postoperatively. Data are presented as mean ± S.D. or median (range). p≤0.05 was considered significant using Chi-square, rank sum or two sample T-tests, as appropriate. Neurocognitive data are age-adjusted using the Mayo Older Americans Normative Study.[3]
Results: 46 of 426 (10.3%) enrolled patients developed POD. Follow-up data are currently available on 36 CAM (+) patients and 26 CAM (-) controls. POD was associated with increased length of stay [6.9 ± 2.8 days for CAM (+) patients vs. 5.2 ± 1.2 days for CAM (-) patients, p<0.001] and incidence of medical complications [25/46 (53.2%) of CAM (+) patients vs. 60/380 (15.8%) CAM (-), p<0.001]. Changes from baseline in neurocognitive and functional status at three months were not significantly different between CAM (+) patients and controls (see Table).

	CAM (+)		CAM (-)	
	Median	Range	Median	*p*-value
$\Delta AVLT_{Learning\ Efficiency}$	5	-19 - 23	9	0.097
$\Delta AVLT_{\%\ Retention}$	7	-42 -61	3	0.321
$\Delta AVLT_{Delayed\ Recall}$	6	-33 - 26	5	0.907
ΔSCWT	0	-12 - 20	2	0.171
ΔCOWAT	1	-2 - 3	0	0.263
ΔADLs	0	-2 - 2	0	0.890
ΔIADLs	0	-4 - 3	0	0.614

Discussion: Preliminary analysis indicates that POD is associated increased length of stay and incidence of medical complications. However, it does not predict neurocognitive and functional decline three months postoperatively. If confirmed, the results support the hypothesis that POD and postoperative cognitive dysfunction are unique and unrelated forms of central nervous system dysfunction. Improved understanding of these two clinical entities will help guide further research.
References: 1. JAGS 48:618-24, 2000. 2. Ann Intern Med, 113:941-948, 1990. 3. Clin Neuropsychol 6(Suppl):83-104, 1992.

S-107.

PROBABILISTIC DECISION TREES AND DATA-MINING METHODS OF INTRA-OPERATIVE MEDICAL RECORDS FOR PREDICTING ADVERSE EVENTS

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Introduction: Nearly 100,000 patients are estimated to die preventable deaths annually in hospitals. Human error is a leading cause for patient harm. Identifying and learning from these events is an important goal of providing safer care to patients. Predicting these aberrant events in real time might help to prevent future patient harm.
Methods: We analyzed our clinical PICIS® intra-operative electronic medical record system (IOEMR)database to identify certain adverse events (AE) and the precursors that might be identified to avert them. A decision tree generator C4.5 was used to create a probability model as the main data mining tool. The relational clinical database was converted to a flat file. The output is in the form of a decision tree which demonstrates the relationships between the parameters in the flat file and the possibility of the occurrence of AE. These relationships are then further converted into if-then prediction rules to help create alerts to physician in real time.
Results: The IOEMR contains data from more than 21,000 patients treated in 2003-4. Each patient file includes 20 vital sign parameters like heart rate, blood pressure, temperature etc., which are automatically measured and recorded every one minute during the patient's stay in the operation room. Among the 21,000 patients in the database, 500 patients had vital sign fluctuations which met the department's criteria for AE. To improve the prediction ability of our analysis, we used refined definitions for four types of complications: Hypertension, Hypotension, Hyperthermia and Hypothermia __ chosen as they are easy to measure and unambiguous. We further introduced two concepts: leading time (T1) and window size (T2) which denote the time in advance we can make the predictions and the data we need to complete these predictions, respectively. We tested different pairs of (T1, T2) for each of the four AE and then choose optimal pairs which result in hthe ighest prediction accuracy. Using this mended algorithm, we were able to achieve an accuracy of 70% for predicting apriori adverse events in the dataset (figure 1 and figure 2). These figures demonstrate the error rate when predicting hypotension and hypothermia for illustration purpose.
Conclusions: In this abstract, we present a data mining based AE prediction mode which has potential for making intraoperative care safer. Although we would like to predict the specific AE, we found that voluntarily submitted quality assurance documentation greatly under-reported the incidence of many AE and therefore hindered our analysis. Our model can predict the possible occurrence of four types of AE in advance by analyzing real time data based on past AE data. Our model has the potential to alert anesthesiologists in real time to prevent AE precursor conditions from progressing to full blown AE.

S-108.

MOTION AND LOW PERFUSION INDUCED FAILURES OF NEW GENERATION PULSE OXIMETERS - FAILURE RATES AND RECOVERY TIMES IN VOLUNTEERS

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INTRODUCTION: Patient movement and low perfusion due to lower temperature is common in the PACU and OR, especially during extubation. How long the Pulse Oximeter (PO) takes to recover and display accurate SpO_2 and Pulse Rate (PR) after motion induced failure is of paramount importance for the safety of patients. Our study compares the recovery time for SpO_2 and PR for three major brands of new PO technologies.
METHODS: Following informed consent, 11 ASA-I volunteers (5F/6M) ages 18 through 40 were enrolled. The POs tested were Masimo Radical V4.5, Nellcor N595 V3100, and Datex-Ohmeda TruSat. Sensors were randomly placed on the index, middle, and ring fingers of the left hand (test) and the right hand (control), and all sensors were optically shielded. The room temperature was lowered to 16-18ºC to reduce peripheral perfusion. A TOSCA ($PtcCO_2$ + Masimo Radical PO) sensor was placed on the right ear to serve as the control during hypoxia. During separate room air and desaturation (employing a disposable re-breathing circuit with a CO_2 absorber to a SpO_2 of 75% on the control PO, and the subject was then given 100% oxygen until the control SpO_2 reached 100%) events, motion consisted of random tapping (with sensor disconnect / reconnect) and random rubbing. Motions were machine generated (MG), and self generated (SG). The sensors were rotated and tested on all three fingers during the room air events. A computer recorded SpO_2 and PR data. Recovery times and Failure rates were analyzed. Recovery time (RT) is defined as time required for the POs to recover SpO_2 and PR to control value. Failure rates (FR) is defined as % of time the POs displayed values off by 7% for SpO_2 and 10% for PR of the control value at the end of motion. ANOVA with Fischer's post hoc test and Chi-square analysis as appropriate were performed with $p < 0.05$ considered statistically significant.

RESULTS: There were a total of 176 motion tests (88 during MG and 88 during SG) when POs could fail. The table shows our results.
DISCUSSION/CONCLUSION: Although none of the POs tested worked perfectly, Masimo had the shortest RT and the lowest FR for SpO_2 and PR during motion and low perfusion. Thus, Masimo may serve better for patient safety.

RT and FR of POs during MG and SG

Device		SpO_2			Pulse Rate		
Pulse Oximeter		Mean RT in Seconds (range)	# of times fail/total	Fail-ure Rate	Mean RT in seconds (range)	# of times fail/total	Failure Rate
Masimo	MG	18 (18)	1/88	1.1%	9 (6-12)	4/88	4.5%
Nellcor	MG	13.2 (3-21)	13/88*	14.8%	22.4 (6-66)*	27/88*	30.7%
Datex-Ohmeda	MG	23.1 (12-30)	10/88*	11.4%	25.2 (12-48)*	18/88*	20.5%
Pulse Oximeter		Mean RT in seconds (range)	# of times fail/total	Fail-ure Rate	Mean RT in seconds (range)	# of times fail/total	Failure Rate
Masimo	SG	12.3 (12-15)	2/88	2.2%	10.3 (6-21)	14/88	15.9
Nellcor	SG	15.3 (9-24)	19/88*	21.5%	19.0 (6-33)*	37/88*	42.0
Datex - Ohmeda	SG	24.3 (12-36)	12/88*	13.6%	23.4 (9-45)*	19/88*	21.5

*p=<0.05 compared to Masimo

S-109.

THE POSITIVE ROLE OF HUMAN FACTORS IN IMPROVING PEDIATRIC CARDIAC SURGERY OUTCOMES

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Objective: Pediatric cardiac surgery (PCS) encompasses a sophisticated microsystem dependent on a complex organizational structure, coordinated team efforts of multiple individuals, and high cognitive and technical performance. We studied the impact of human factors on intraoperative events, and outcomes. We hypothesized that human factors influences the occurrence of adverse events during PCS.
Methods: Prospective observations of PCS procedures in 2 urban academic health centers. The observations included from inception of anesthesia, to patient hand-off in the ICU by 2 observers trained in PCS techniques and human factors methodology. Observations from each case were transcribed and analyzed. Case complexity was calculated using the AristotleR scoring system. Adverse events (AE) were defined as unintended incidents in care that result in adverse outcomes or may require additional care to prevent adverse outcomes. Events were coded according to outcome into compensated or non-compensated major or minor events. Events were further classified by types of event and compensatory mechanisms. Chi square analysis, AOV and linear regression model were used to analyze relationships between length of the cases, number of events, case complexity and outcomes. Outcomes were coded using a 1-4 scale.
Results: Between 9/1/03 and 9/30/04, 80 of 345 consecutive cases were observed (24%). The mean age was 499 days (range 1-5758 days), the mean complexity was 12.1, and the mortality was 4.8%. Anesthesia induction epoch (mean=73 min; SD=22 min) showed no correlation with case complexity and no differences were noted between outcome groups. Surgery epoch (mean=201 min; SD=91 min) correlated with increasing complexity. AOV showed significantly longer surgery time with death outcomes compared to other groups. Post-surgery epoch (mean=25 min; SD=11 min) had a slight increase correlated with case complexity, but no significant differences were noted between outcomes group. An average of 1.2 major events (range 0-6) occurred per case. The most common type of event was a cardiovascular event (16% of major events), followed by an airway/pulmonary event (14%). Most major events (45%) occurred during the post-bypass period. Cognitive compensation was the most common (41%). An average of 15.3 minor events (range 2-35) occurred per case mostly during cardiopulmonary bypass (31%) in surgery epoch. The most common type of minor events was communication failures (26%). 45% of minor events were compensated by system solutions. The number of major events per case correlated with patient outcomes ($p<0.05$), and case complexity ($p<0.01$).
Conclusions: The study demonstrated the important role of human factors in PCS. The duration of surgery and the number of major events during PCS increases with case complexity and impacts patient outcomes. Negotiated minor events seem to immunize the PCS from adverse outcomes. Team training focusing on recovery and compensatory mechanisms in resource and systems management could reduce adverse patient outcomes in PCS.

S-110.

EXTREME ACUTE NORMOVOLEMIC HEMODILUTION DESPITE A 'NORMAL' TRANSFUSION TRIGGER

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Introduction: Clinical results and mathematical modeling (MM) of acute normovolemic hemodilution (ANH) are conflicting. MM of ANH was performed in a 'theoretical model-patient', only; extreme ANH (e-ANH) aimed at accepting an extremely low hct min but not an extreme number of ANH-U exchanged with a 'normal' hct min-level; quantitative perspectives of dilution-coagulopathy that might limit e-ANH were not considered. This mathematical analysis (MA) is based on original patients' lab-data and evaluates 1st lab-parameter limiting extent of ANH; 2nd max. number of ANH-U to be exchanged until reaching first ANH-limiting lab-parameter at given 'normal' hct min; 3rd max. allowable blood-loss (MABL) w/ vs. w/o ANH; 4th gender-specific perspectives.
Methods: Prospective MA of original lab-data from 207 pat. eligible for ANH and undergoing major elective surgery; ANH was not applied clinically. Calculating presumed blood-volume (PBV), mathematical concept, formulae concerning ANH, saving RBC (+RBC), re-transfusion of ANH-U, and calculating MABL has been described elsewhere (1, 2): Isovolemic exchange of blood vs. artificial colloid (volume-effect 1.0); applying ANH (500 ml per U) until reaching first ANH-limiting parameter (hct min [24, 21], platelets min [100, 50/nl], fibrinogen min [100 mg/dl]; re-transfusion of ANH-U plus administration of colloid to maintain hct min despite ongoing BL until all ANH-U had been re-transfused (MABL). Statistical analysis by ANOVA w/ Scheffé post-hoc test/ Kruskal-Wallis-test. Data were given as mean ± SD. Statistical significance with $p<0.05$ (*between groups/ male vs. female; °within group w/ vs. w/o ANH).

Results: Tab. 1 summarizes relevant data.

tab. 1	**n = 207**		**male: 52 (25.1%)**
	hct init (%)		44.5 ± 3.4*
	plts init (G/L)		257.4 ± 63.8
	fib'gen (mg/dl)		321.1 ± 83.6
	hct min = 24%		**hct min = 21%**
	male	**female**	**female**
parameter limiting at first ANH at pre-set hct min		***hct 24%*** n = 191/207 (92.3%)	***hct 21%*** n = 170/207 (82.1%)
	42/52 (80.8%)	149/155 (96.1%)	140/155 (90.35%)
	fibrinogen 100 mg/dl n = 6/207 (2.9%)	***fibrinogen 100 mg/dl*** n = 19/207 (9.2%)	4/52 (7.7%) 7/155 (4.5%)
5.9 ± 1.5*	ANH-U at hct min/1st limiting lab-param.	4.4 ± 1.5 U 3.9 ± 1.1*	5.3 ± 1.3*
RBC-mass saved by ANH (ml)	272 ± 98*	178 ± 93* 147 ± 66*	377 ± 120* 258 ± 116* 218 ± 84*
MABL (L) w/ ANH	4.3 ± 1.0*°	3.1 ± 1.1* 2.7 ± 0.8*°	4.2 ± 1.3* 3.7 ± 1.0*°
MABL (L) w/o ANH	3.2 ± 0.6*	2.4 ± 0.7 2.1 ± 0.5*°	3.0 ± 0.8 2.7 ± 0.6*°

Discussion: This MA reflects max. efficacy (+RBC) and effectiveness (MABL) of e-ANH with a 'normal' hct min. Hct is the primary parameter limiting e-ANH. Even e-ANH is poorly efficacious in saving RBC (approx. 2 RBC-U). In order to achieve max. efficacy/ effectiveness of e-ANH, at least 5 ANH-U have to be exchanged in males, and 3 in females. e-ANH is more efficacious/effective in males than females.
References: 1. Surgery 1962; 51: 224 - 232. 2. J Surg Res 1999; 86: 206 - 212. Erratum in J Surg Res 2000; 88: 215

S-111.

IMPACT OF POSTOPERATIVE NAUSEA AND VOMITING ON RESOURCE UTILIZATION AFTER INPATIENT SURGERIES

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Introduction: Postoperative nausea and vomiting (PONV) are frequent and unpleasant side effects following surgery. It may prolong recovery from surgery and delay discharge from post anesthesia care unit (PACU) which lead to increased resource utilization. Much of the data on burden of PONV were based on randomized clinical trial results. The current study sought to investigate the resource utilization of PONV with the standard of care in a high risk population.
Methods: Following approval by the Duke IRB, data were collected prospectively and retrieved from the Duke Electronic Perioperative Anesthesia Database between December 1, 2004 and February 28, 2005. Patients were included in the study if they were age ≥ 18 years, had a pre-operative ASA status of I, II, or III; underwent general anesthesia; were at high risk for PONV with at least 2 of the following factors: female, previous history of PONV or motion sickness, non-smoker or use of postoperative opioid[1]. Analyses were performed to describe the frequency of prophylactic anti-emetic use, the incidence of PONV during PACU, and the impact of PONV on resource utilization including length of PACU stay and rescue anti-emetic use.
Results: A total of 3,641 patients were included in the analysis. The mean age was 52 (range 18-97) years, 70% were female, and 88% had prior general anesthesia. The mean duration of surgery was 163 minutes. Prophylactic anti-emetics were administered in 79% of patients. During PACU stay, 16% experienced nausea, 3% experienced vomiting, and 16% experienced either nausea or vomiting. The incidence of vomiting was significantly greater ($p = 0.03$) in patients who did not receive prophylactic anti-emetics (4%) compared to those who received prophylactic anti-emetics (2%). Overall, 27% of the patients used rescue medication during PACU stay with 95% among those with PONV and 14% among those without PONV ($p< 0.0001$). The overall PACU length of stay was 123 minutes; PONV experiences delayed discharge from PACU by an average of 23 minutes. The most frequently used anti-emetic was ondansetron (62% prophylactic and 68% rescue) followed by prophylactic dexamethasone (25%) and rescue promethazine (18%).
Discussion: Despite frequent prophylactic anti-emetic use, nearly 1 in 6 patients experienced PONV in the PACU. PONV significantly ncreased the use of rescue anti-emetic medication and lengthened PACU stay by 20%. There is room for improvement to prevent PONV to reduce resource consumption and improve patient outcomes.
References:
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S-112.

IMPLEMENTATION OF A MULTIDISCIPLINARY OR MANAGEMENT TEAM IMPROVES OVERALL OPERATING ROOM EFFICIENCY

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Introduction: As healthcare organizations become increasingly dependent upon surgery contribution margins to drive revenue, increasing pressure is placed on surgical services to improve surgical throughput. In spite of information systems and logical block scheduling assignments that have allowed improved predictive scheduling and reduction of equipment and personnel conflicts, the operating room remains an unpredictable environment with a complex interplay between surgery, anesthesiology, and nursing, often with conflicting goals and incentives. The aim of this paper is to illustrate the impact of the implementation of a multidisciplinary daily OR management team on OR efficiency.
Methods: To actively manage the daily operating room schedule we created a multidisciplinary OR management team comprised of, a "Charge" OR nurse, "Charge" CRNA, and "Charge" Anesthesiologist, who are continually in communication throughout the day, reviewing and managing the ongoing surgical schedule, with the collective goal of efficient use of all available OR resources, allowing for optimum OR access, and a reduction in patient delays. Gap-time, or ALL non-utilized time between cases in the same room, was chosen as our measure of improved performance. Gap-time was calculated both by service line, and overall, and compared between fiscal year 2003 and fiscal year 2005.
Results: Fiscal Year 2003 was compared to Fiscal Year 2005. There was a 4.56% increase in hours/OR/day. Gap time decreased for every service line, with an overall decrease in gap time of 35.29%. Using an OR Hospital expense of $6.84/minute, and an average gap reduction time, we calculated the total annual dollar savings to the Hospital.

Shadyside Hospital Main OR	2003	2005	% Change
Total Cases	12,121	13,432	10.81%
	Gap 2003	Gap 2005	% Change
Surgical Service			
CARDIAC	1:32	1:11	-22.83%
GENERAL	1:38	0:42	-57.14%
GENERAL UROLOGY	1:34	0:53	-43.62%
GYNE	1:21	1:13	-9.88%
NEURO	1:21	0:51	-37.04%
ORTHO	1:23	0:43	-48.19%
OTO	1:54	1:05	-42.98%
PLASTIC	1:01	0:36	-40.98%
THORACIC	0:54	0:47	-12.96%
VASCULAR	1:01	0:49	-19.67%
Average	1:21	0:53	-35.29%
Hours/OR/Day	5.26	5.50	4.56%
Gap reduction in minutes		0:28	
$ Savings		2,007,793.00	

Discussion: Historically, surgical services committees have focused on "turnover" time or the time between same surgeon cases, when searching for ways to improve OR efficiency. The impact of reducing turnover times on increasing caseload, or reducing cost is unclear. Gap time, which includes all non-utilized time between any cases in the same room, was significant at our institution and was clearly affected by OR nursing, anesthesiology, and surgical issues. Our study demonstrates that a multidisciplinary team charged with constant vigilance and management of issues affecting OR efficiency is cost effective and reduces non-productive time.

S-113.

PRIMARY VS. REVISION KNEE ARTHROPLASTY: THE IMPACT ON PERIOPERATIVE UTILIZATION

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INTRODUCTION: Compared with the primary procedure, revision total knee arthroplasties (TKAs) place a significant burden on physicians, operating rooms, and hospital staff because of increased operating room (OR) utilization, increased blood loss, and increased complication rates (1, 2). Although one would expect increased post-operative care unit (PACU) utilization associated with these issues (which should be considered in OR scheduling) this has not been investigated. We therefore studied peri-operative utilization for revision TKAs as compared with primary surgeries. Specifically, we wanted to evaluate the differences in OR and PACU time usage, as well as total analgesic consumption.
METHODS: We retrospectively studied 232 patients undergoing primary or revision TKA over a 10-month period, and determined differences in OR utilization, PACU utilization, OR opiate usage, and PACU opiate usage between the two groups. To calculate opiate use, doses of opiates given were converted to morphine equivalents (ME) in mg.
RESULTS: 195 patients underwent primary TKA, and 37 patients underwent revision surgery. As anticipated, the average OR time for a revision TKA was longer: 205±76 (mean±SEM) min, compared to 168±47 minutes for a primary surgery ($p<0.001$, t-test). PACU utilization, in contrast, was similar between the groups: 135±84 vs 117±56 min for revisions and primary TKA, respectively ($p=0.39$). Interestingly, both intraoperative (32±24 vs 26±25 ME, $p=0.36$) and PACU opiate requirements (12±15 vs 10±10 ME, $p=0.98$) were also similar between groups. A subgroup analysis indicated that this was independent of anesthetic technique (general anesthesia vs general anesthesia with neuraxial or peripheral nerve blockade vs subarachnoid block).
DISCUSSION: Our study demonstrated a 22% increase in operative times for revision TKA versus primary TKA, but no increases in either PACU utilization or early postoperative analgesia requirements. This finding has significant implications for OR performance and scheduling. When multiple revisions are planned, the hospital need only budget an increase in operating times, as opposed to an expectation of increased PACU utilization. In addition, the lack of effect of anesthetic technique on PACU utilization and opiate requirements suggest that the true benefits of more complex techniques should be evaluated in greater detail.
References:
1. JAMA, 1994. 271(17): p. 1349-57
2. J Bone Joint Surg Am, 2003. 85-A Suppl 1: p. S18-20

S-114.

ASSESSING SATISFACTION WITH A NEW FACULTY INCENTIVE PLAN

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Introduction: We developed a survey for assessing the satisfaction of anesthesiology faculty with an incentive payment plan (1) and implemented a new incentive plan that rewards individual faculty twice each year in accordance with their clinical productivity and how well they meet their individual goals for education, research, and community service (2). We now report on assessment of faculty satisfaction after 2 years' experience with the new plan in one academic health center.
Methods: At the start of each academic year, for two years after the implementation of a new incentive payment plan, we have distributed an anonymous survey (1) to permanent clinical faculty, including those who had resigned in the past year. Likert-scale responses were collapsed to "Agreement" (= "Agree" + "Strongly Agree") and "Non-Agreement" (= "Disagree Strongly" + "Disagree" + "Neutral") for each question. Responses were analyzed with multivariable methods, including contingency table (Cochran-Armitage Trend Test), exact logistic regression (univariate odds ratio [OR]; sample size too small for multivariate OR's), and recursive partitioning (Classification and Regression Tree algorithm) analyses; $P<0.05$ was considered to indicate statistical significance.
Results: Surveys were returned from 28 (of 28 faculty) in Year 1 and 26 (of 31) in Year 2 after incentive plan implementation; their responses were compared with those of 20 (of 26) faculty described (1) before implementation. Significant increases occurred in faculty understanding how their most recent incentive was determined (20.0% of faculty at implementation to 44.4% at Year 1 to 57.7% in Year 2, $P=0.0162$), in the belief that their most recent incentive correlated with their level of goal achievement (30.0 to 50.0 to 80.8%, $P=0.0005$), and in the belief that the incentive plan motivated them to provide more care (5.0 to 17.9 to 44.0%, $P=0.0022$). Univariate predictors of being "highly satisfied" with the plan included being satisfied with the method used to evaluate progress toward personal goals (OR 19.2, $P=0.0106$), understanding how the incentive was determined (OR 14.9, $P=0.0068$), and believing that the plan motivated educational activities (OR 13.4, $P=0.0219$), research work (OR 9.1, $P=0.0372$), or greater productivity (OR 8.0, $P=0.0414$). All faculty who both understood how their incentive was determined and believed that the plan motivated them to greater productivity were "highly satisfied" with the incentive plan.
Discussion: The survey instrument is responsive to changing perceptions and provides meaningful information relating to faculty satisfaction with a payment incentive plan. The newly-implemented incentive payment plan is effective in motivating faculty to support the multiple missions of a clinical anesthesiology department in academic medicine.
1. Anesth Analg 2004;98;S68.
2. Physician Executive 2005; 31: 54-56.

S-115.

MODEL FOR PREDICTION OF PHYSICIAN DRUG UTILIZATION AND COST IN CLINICAL ANESTHESIA

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Introduction: Several studies have compared the cost effectiveness of anesthetic agents.[1] While some investigators concluded that anesthetic drug selection significantly affects long-term costs[2], there are limited data regarding the predictors of more expensive anesthetic agent usage. The purpose of the current investigation was to identify predictors of perioperative anesthetic drug costs related to the patient, the practitioners, and the surgical setting.
Methods: An IRB-approved retrospective analysis was performed using 9,823 electronic anesthesia records from cases performed between October 2004 and March 2005. All cases had complete data sets. The analysis for patients having more than one anesthetic during this time period was limited to the first anesthetic performed. The total cost of anesthetic and anesthetic adjuvant medications administered by intravenous bolus, intravenous infusion of inhalation was calculated for each case using the hospital formulary price list. For single-use medications, the least expensive pricing was calculated for the number of vials required. For multiple-use medications, the anesthetic cost per dose was calculated. Practitioner-related predictors that were tested include resident or CRNA involvement and years of attending experience (post-residency completion). Surgical and patient-related variables that were tested included patient age, weight, gender, outpatient versus inpatient status, American Society of Anesthesiologists (ASA) physical status classification, subspecialty of surgical procedure, emergency status, length of anesthetic, and primary anesthetic technique. Univariate linear regression was used to identify potential predictors of anesthetic expense per case.
Results: The strongest univariate predictors of anesthetic expense were determined to be anesthetic technique (general anesthesia was most expensive), increasing length of anesthetic, subspecialty of procedure (neurosurgery was most expensive) and patient class (day-of-admission surgery was most expensive), all of which had $r^2 > 0.05$ and p-values <0.0001. Patient age and weight, ASA status and nurse anesthetist involvement demonstrated a smaller degree of association, with $0.011<r^2<0.05$, but with p-values <0.0001. The lowest degree of statistically significant univariate association was noted with resident involvement, emergency status of procedure, and attending years of experience. A multivariate regression analysis is currently underway.
Discussion: It has been reported that anesthesiologists have direct control of 3% of total surgical costs through their selection of drugs and supplies.[3] While this may appear insignificant, small savings per case can accumulate to very large amounts in busy perioperative programs. Identifying predictors of current usage patterns should help reduce costs by enabling the establishment of benchmarks and ongoing monitoring of expenditures. Modifying the drug selection behavior of outlier practitioners using this methodology may have beneficial effects on anesthetic drug expenditures.
References:
1. Canadian Journal of Anaesthesia. 2004 Nov;51(9):892-8.
2. Anesthesiology. 1997 May;86(5):1145-60.
3. Anesthesiology. 1995 Dec;83(6):1138-44.

S-116.

THE ECONOMIC IMPACT OF A CLINICAL PRODUCTIVITY INCENTIVE PLAN

AUTHORS: **J. Roskoph**[1], J. Williams[1], V. Trott[2], L. Handley[1];
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Introduction: In response to the multiple and varied clinical settings faced by a large multi-site academic department, two faculty tracts were developed; one purely clinical, the other clinical academicians. A comprehensive clinical incentive compensation plan was constructed and implemented based on actual anesthetizing hours for both groups. In addition, the academic group was also compensated in part on academic and research productivity. The economic impact on the department was analyzed.
Methods:. After local site comparison, individual productivity was most equitably measured using Actual Clinical Billable Hours with Overlap. Clinical Site specific mean productivity standards were developed for benchmarking. Compensation packages were constructed so that the former salary was reduced by 21% to fund the incentive portion of the plan. Incentive tiers were developed as variation from the mean site specific data. The productivity data was analyzed to determine the overall impact to the department.
Results: For Fiscal Year 2005, the Academic faculty achieved the desired thresholds at all rank levels and thus the Academic Incentive portion for this discussion is considered fixed. Overall, the Department increased the total Billable Hours with Overlap by 14% while reducing overall FTE count by 2.4 (2%). The number of additional FTEs that would have been required to provide service to cover the increased hours and FTE loss totaled 13.71(14%), at a potential cost of $5.86 million. The clinical incentive plan resulted in an additional $2.19 million outlay to the department faculty, or a cost savings of $3.67 million.

	Diff. Hours	AVG HOURS	%hour change per FTE	Additional FTE to cover hours	Cost to cover
Site 1	2,580	1,588.03	18.17%	1.62	$612,995.25
Site 2	3,732	1,741.33	11.59%	2.14	$723,152.20
Site 3	7,823	1,861.07	15.31%	4.20	$1,538,716.33
Site 4	10,081	2,011.76	18.94%	5.01	$1,825,831.05
Site 5	793	1,343.43	3.29%	0.59	$189,782.95
Site 6	457	3,430.44	2.22%	0.13	$51,424.45

	Diff. FTE	Diff Costs for FTE	Costs to Hire	FY04 - FY05 Differential Compensation Costs
Site 1	-1.50	-$565,960.51	$1,178,955.76	-$16,341.60
Site 2	0.15	$50,612.68	$672,539.52	$236,023.33
Site 3	-2.32	-$849,288.05	$2,388,004.38	$630,077.43
Site 4	0.91	$331,558.71	$1,494,272.34	$988,941.07
Site 5	0.35	$112,482.32	$77,300.63	$250,382.00
Site 6	0.00	$0.00	$51,424.45	$101,796.93
			$5,862,497.09	$2,190,879.17
			Net Savings	$3,671,617.92

Discussion: Anesthesia departments are being asked to develop incentive plans to justify compensation models. Although a multitude of models are possible, the common denominator must be choosing a plan with a positive Net Present Value. One measure of success is generating more unit hours with either the same or less number of faculty, through either longer work days or increasing concurrencies. Billable Hours with Overlap rewards for both of these variables. Although paying additional dollars for additional work to the faculty increases costs, we demonstrated that hiring additional faculty to cover the additional work is a more costly proposition.

S-117.

THE IMPACT OF DELAYS ON DAILY OPERATING ROOM THROUGHPUT

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Introduction:
Efficient utilization of the operating room is the goal of hospital administrators and directors of the operating room (OR). While busy ORs are desirable, delays in the operating room and prolonged turnover times result in frustration and economic loss to the parent institution. In addition, delays and overruns can adversely affect patient care and staff morale. The OR schedule was reviewed retrospectively to determine the impact of delays on OR utilization and economics.
Methods:
Data were gathered from analysis of the OR database for a three month period. Delays were noted as part of a quality assurance monitoring system. Delays in the starting time were logged as to the cause and coded for analysis. Over two thousand (2000) operative procedures were performed during this time period. Descriptive statistics were calculated for all variables including frequencies and percents for categorical variables and mean, median, and standard deviation.
Results:
A total of.27% of all surgeries had some form of delay.
The average delay time was 99 minutes (SD±93 minutes) with a median delay time of 72 minutes, ranging from 1 minute to 688 minutes.
The most frequent reasons given, in order are
1. Preceding procedure being delayed = 42%
2. Physician late = 17%
3. Previous cases exceeding the scheduled time frame = 5%
4. Paperwork incomplete (consent, labs) = 5%
5. Missing information (consultation) delaying start of case= 5%

Discussion
Delays in the OR schedule continue to be a problem that affects overall OR utilization. Potential benefits in reducing delays are both quantitative (complete more cases in the scheduled time slot) and qualitative (improve staff morale). The economic impact ($42 dollars/ minute estimated) results in an additional expenditure of $4200 for the idle time per delayed surgery. Improvements in OR utilization have to be achieved to lower overall costs.

S-118.

DETECTING CHANGES IN PERIOPERATIVE SYSTEM PERFORMANCE USING STATISTICAL PROCESS CONTROL

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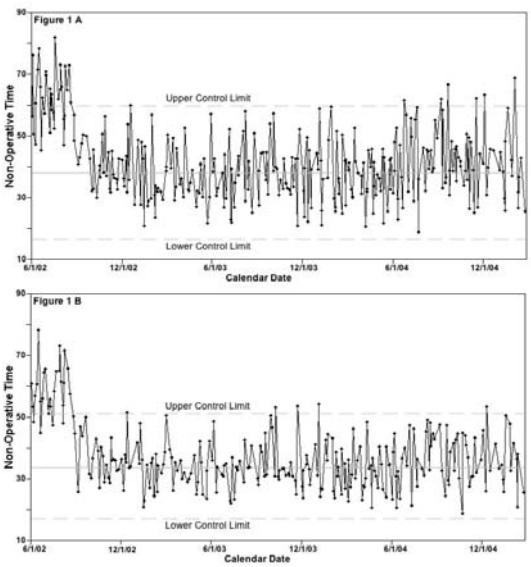
Introduction: In the tight-margin environment of modern hospitals, process managers need to know when things are not working as they should. Our institution has developed a high-throughput OR, called the OR of the Future (ORF). Non-operative time in this OR was reduced by 40% compared to Standard Operating Rooms (SORs), allowing extra cases to be accomplished each day (1). We have used Statistical Process Control (SPC), a technique with applications in healthcare (2), to identify a systematic increase in non-operative times starting 6/04. The purpose of our study is to demonstrate the utility of SPC for monitoring OR performance and to identify the systemic factors causing the upward drift in non-operative times in our new OR.
Methods: With IRB approval, we retrospectively performed a longitudinal SPC analysis of ORF non-operative times from its inauguration in 9/02 to 2/25/05 using a bin size of 5 cases per bin (see Fig. 1 panel A). The center line of the figure is the average non-operative time of the ORF, while the control limits are analogous to ± 3 standard deviations (SD) from the mean. Points beyond the control limits were considered to be potentially non-random occurrences and were subjected to detailed analysis.
Results: Analysis of points outside the control limits indicated that 1/3 of the longer-than-normal non-operative times are attributable to PACU congestion, which contributes to non-operative time. To filter out the effect of PACU congestion, we removed all data points in which the OR emergence time (which would include time spent waiting for a PACU bed) was greater than the mean + 2SD. We then repeated the SPC analysis (see Fig. 1 panel B). This largely eliminated the systematic increase in non-operative time.



Discussion: Increasing congestion of our institution's PACU as function of time has degraded ORF process improvements and it is reasonable to expect that the rest of the ORs have suffered the same fate. The important conclusion from this result is that the entire perioperative process must be optimized to achieve maximal OR productivity. Furthermore, SPC analysis offers opportunities for early detection of changes in perioperative systems.
References: (1) Anesthesiology 103:406 (2005), (2) Qual Saf Health Care 12: 458 (2003)

S-119.

MAINTENANCE COSTS ASSOCIATED WITH PATIENT CONTROLLED EPIDURAL ANALGESIA

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Introduction: Hospital cost containment remains a significant issue when making therapeutic decisions. Recent studies establish cost drivers associated with IV-PCA (patient controlled analgesia) and PCEA (patient controlled epidural analgesia), but did not include maintenance and pump failure related costs. The purpose of this study is to evaluate costs associated with maintenance of epidural pumps on a per pump basis.
Methods: Our academic medical center has an inventory of 136 epidural pumps. A retrospective review of these pumps was analyzed over a six year period, on an annual basis, for parts cost, number of pumps called for service, and total labor hours. These pumps have been in service for a period ranging from 1-6 years. Data were collected from the Biomedical Department Database over a 6 year period.
Results:

Year	N=number of repair incidences	Labor Hours	N=Pumps Needing Repair	Parts Cost $	N=Pumps Needing Parts	N=Total Number of Pumps	Percent Needing Repair (%)	Average Labor Hours Per Pump	Average Parts Cost per Pump ($)	Average Repair Incidences
6	85	58.4	51	331	5	136	37.5	0.43	2.43	0.625
5	92	97	34	0	0	60	56.7	1.61	0	1.53
4	84	66.3	37	130	6	60	61.7	1.1	2.1	1.4
3	64	50.2	33	0	0	60	55	0.83	0	1.1
2	57	31.2	42	0	0	60	70	0.52	0	0.95
1	33	32	5	0	0	60	8.3	0.53	0	0.55
Average Over 6 years	69.2	55.9	33.7	76.8	1.8	72.7	48.2	.84	.76	1.03

Discussion: On average approximately 69.2 reports for pump problems were reviewed by the biomedical department each year, over a 6 year period. During this time period, the annual labor hours were 0.84 hrs and parts cost per pump were $0.76 per pump. In total, over a 6 year period, 48.2% of pumps needed repair each year in addition to annual preventive maintenance.
Pump maintenance requires efforts from many healthcare personnel; the nurse must first identify pump failure, nursing time is utilized in replacing the pump, and sending the pump to the biomedical department. Additional time is required for the supply department to send and store additional pumps while maintenance is being performed, resulting in inadequate pain relief, causing analgesic gaps. This study only recognizes the materials and time required by the biomedical department to return the pump to service. An unexpected finding in this study was the high number of pumps in inventory compared to the actual number of pumps needed on a daily basis (on average 20). This is a substantial expense considering the average cost of a new pump is $3,500. Many pumps are “missing in action” and add to the total cost of therapy. Epidural and IV-PCA pumps consume considerable amounts of healthcare resources associated with the management of post-operative pain. Additional studies are required to assess the actual total economic burden.

S-120.

AN OPERATING ROOM MANAGEMENT ROTATION FOR RESIDENT EDUCATION IN SYSTEMS-BASED PRACTICE

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Introduction: The ACGME Outcome Project mandates that residents develop competency in the area of “systems-based practice”, demonstrating “an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value”[1]. Toward this end, the resident must understand how their practice affects other health care professionals, practice resource allocation that does not compromise the quality of care, and partner with health care managers and providers to assess, coordinate, and improve system performance. We have met these goals through the creation of a senior resident rotation in Operating Room Management.
Methods: All CA3 residents are assigned to the two-week rotation during the final six months of their residency. The resident works closely with a faculty member to assume primary responsibility for all aspects of the daily scheduling and management of the inpatient operating room including assignment of personnel, triage of “add-on” and emergency cases, coordination with nursing staff, and interaction with surgeons and consultants. Residents simultaneously receive experience with the “care team” approach to anesthesia, working with anesthetists as the supervising physician (with a faculty physician fulfilling the requirements of the true “medical direction” role). Readings focus on utilization, estimation and impact of surgical time, economics from both an anesthesiology group and hospital perspective, and patient access to surgical and intensive care services. Residents are evaluated by the faculty based on their growth in knowledge, interpersonal skills, medical decision-making, and leadership skills.
Discussion: Competency in systems-based practice, like many of the Core Competencies, is at first an elusive concept. Close consideration, however, has led us to a resident experience that covers the spectrum of systems-based practice in anesthesiology while incorporating elements of interpersonal skills, professionalism, and the application of medical knowledge. Residents must not only assess and optimally utilize the resources available to them, but assume responsibility for the effects those decisions have on colleagues, surgeons, and patient flow through the perioperative process. In addition, the experience and readings of the rotation combine with a didactic series to form a component of a more extensive curriculum in Practice Management. Resident feedback has been extremely positive, with the rotation giving senior residents insight into a system within which they have lived, but never quite understood, for nearly three years.
References:
1. www.acgme.org

S-121.

KNOWLEDGE, ATTITUDE AND PRACTICE OF EMERGENCY DEPARTMENT PERSONNEL ABOUT CRICOID PRESSURE

AUTHORS: **O. O. Nafiu**[1], S. Bradin[2], K. K. Tremper[1];
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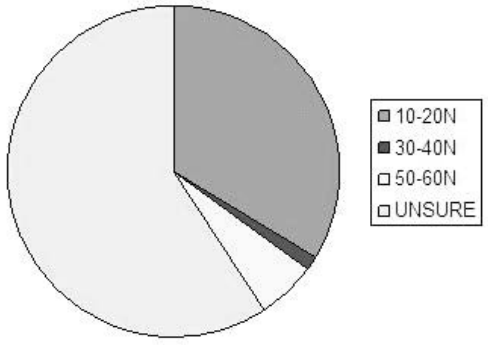
INTRODUCTION
Cricoid pressure (CP) is an important maneuver used during rapid sequence intubation to prevent regurgitation of gastric and esophageal contents into the pharynx and their subsequent pulmonary aspiration.[1] Ostensibly a simple technique, it is regarded by most clinicians as a standard of care for patients at risk for aspiration.[1] This survey assesses the theoretical knowledge, attitude and practice of emergency department (ED) personnel about CP at a US teaching hospital. To the best of our knowledge,this is the first attempt to assess ED personnel involved in emergency airway management on the same day.
METHODS
This questionnaire-based survey was carried out at the ED of the University of Michigan Hospital. We asked 10 multiple choice questions. The ED physicians are responsible for most emergency intubations, referring the most difficult cases to the anesthesiology team. We distributed questionnaires to faculty, residents and nurses at the monthly morbidity and mortality meeting. Annonymously completed questionnaires were returned to the investigators at the end of the meeting. We excluded from analysis questionnaires that were returned after the meeting.
RESULTS
Eighty three completed questionnaires were returned: 38 residents, 25 Attendings and 20 nurses. Sixty two (75%) of the respondents were from the adult ED while 21 (25%) were from the pediatric ED. Most of the respondents knew the anatomical structure to which pressure is applied. However 24 respondents (14 nurses and 10 residents) thought that CP is applied to both the cricoid and thyroid cartilage. Interestingly, 70% of the nurses in this survey gave an incorrect response to the question on the anatomical localization of cricoid pressure. Majority of respondents rated their training in CP application as either poor or non-existent. Most were able to name two contraindications to the application of CP. Most respondents were either unsure of the recommended amount of cricoid force in the asleep patient or quoted values that were too low (Fig.1).

Fig 1. VALUES QUOTED FOR CRICOID PRESSURE IN ASLEEP PATIENTS.



DISCUSSION
The theoretical knowledge about cricoid pressure is poor in this survey from a major US teaching hospital emergency department. More specific education and training is needed to improve the clinical use of cricoid pressure and possibly increase patient safety.
REFERENCES:
1. Schmidt A, Akeson J. Practice and knowledge of cricoid pressure in southern Sweden. Acta Anaesthesiol Scand 2001; 45: 1210-1214.

S-122.

PROPOFOL FORMULATIONS WITH EDTA AND MICROBIAL GROWTH

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Introduction:
Propofol formulated in lipid supports microbial growth, therefore propofol currently available in the United States contains a bacteriostatic agent to retard microbial growth. In this study, we compared the effects of propofol with and without EDTA (disodium edetate) on the microbial contamination status of the venous access system used in the ICU, the growth curves of bacteria in vitro, and the changes in bacterial counts recovered from contaminated venous access systems after 24 hours of fluid infusion.
Methods:
To examine microbial contamination in the ICU, the venous access system (InterLink (BD)) of the infusion line was wiped with a sterile swab after 12-hour infusion of propofol with or without EDTA. To compare the bacterial growth, S. aureus (MSSA, MRSA), E. coli, P. aeruginosa, K. pneumoniae and S. marcescens were grown in propofol with or without EDTA or in saline at ambient temperature (22.5°C). To examine the changes in bacterial counts recovered from contaminated venous access systems, intravenous fluid infusion lines were connected to three types of venous access systems: Planecta (JMS), three-way stopcock (TOP) and InterLink. Planecta has no dead space, but the others do. The venous access systems were infused with propofol with or without EDTA, or saline, each containing 10000 CFU/ml MRSA. After flushing the lines with acetate Ringers solution at 50 ml/h, bacteria remaining in the venous access system of individual lines were quantitatively cultured at 1, 6, 12, and 24 hours.
Results:
Microbial contamination rates for InterLink were 2/25 for propofol with EDTA and 3/25 for propofol without EDTA, and isolated microbes were S.epidermidis, nonfermentative GNR, CNS, C.albicans, S aureus (MRSA) and E.facium. Bacterial growth of MSSA, MRSA, and E.coli were suppressed for 48 hours with propofol with EDTA compared with propofol without EDTA; K.pneumoniae was suppressed for 24 hours with propofol with EDTA. However, P.aeruginosa and S.marcescens grew in both propofols. No bacteria were recovered from the Planecta venous access system after 12 hours; however, both propofols led to gross contamination in the dead space of the three-way stopcock and InterLink venous access system at 1, 6, 12 and 24 hours.
Discussion: The growth of bacteria was suppressed in propofol with EDTA. However, even in this formulation, bacterial growth was observed with continued survival of bacteria in the venous access systems with dead space, which might lead to serious nosocomial infections. If nosocomial infection occurs, the extended costs of treatment and hospital stay in a large Japanese hospital are estimated at more than 11 million dollars per year. Medical professionals therefore must follow strict aseptic precautions when handling propofol and the use of EDTA-containing formulations should be considered.
References:
1. Life support and Anesthesia.11:1174-5,2004
2. The Japanese Journal of clinical and experimental medicine.81:1086-9,2004

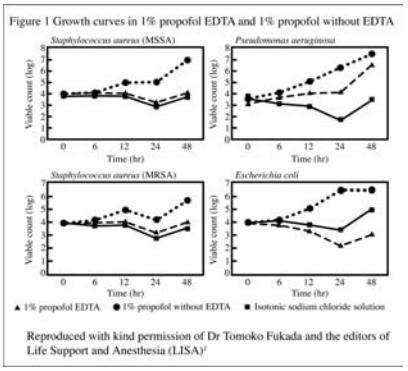
S-123.

PROPOFOL EDTA AND REDUCED INCIDENCE OF INFECTION

AUTHORS: **T. Fukada**[1], M. Ozaki[1], S. Kimura[2], J. Jansson[3];
AFFILIATION: [1]Tokyo Women's Medical University, Tokyo, Japan, [2]International Medical Center of Japan, Tokyo, Japan, [3]AstraZeneca R&D, Sodertalje, Sweden.

Introduction: Propofol formulated in lipid supports microbial growth with the potential for extrinsic microbial contamination leading to serious postoperative nosocomial infections.
Incidence and literature data for nosocomial infections indicates that the reported incidence of outbreaks is abolished and reports of individual nosocomial infections are reduced, following introduction of propofol with EDTA.
Methods: Literature comparing postoperative infections following propofol EDTA and propofol use was reviewed.
Review of a drug safety database[1] assessed postoperative infection or fever reports for the USA prior to and following propofol EDTA introduction.
Additionally, the growth rates of methicillin resistant and methicillin susceptible Staphylococcus aureus (MRSA and MSSA), Pseudomonas aeruginosa and Escherichia coli, were compared in propofol with EDTA, propofol without EDTA and saline when incubated at 22.5ºC.[2]
The medical and economic implications of postoperative nosocomial infections were also considered.
Results: The review of literature indicated higher postoperative infection rates where non-EDTA propofol was used. USA data concerning reports of postoperative infection or fever showed a large decrease in numbers and abolition of 'clusters' following introduction of propofol EDTA.
In-vitro, microbial growth of all four bacterial strains investigated, commonly associated with nosocomial infections, was suppressed with propofol EDTA compared with propofol.Extended costs of treatment and hospitalisation in a large Japanese hospital due to nosocomial infections (including MRSA and non-MRSA) are estimated at more than $11 million per year.[3]

Figure 1. Growth curves in 1% propofol EDTA and 1% propofol without EDTA



Discussion: The retarding action of EDTA on microbial growth has been confirmed by in vitro studies; its addition to propofol provides an additional safety precaution in conjunction with good aseptic practice.
Data from a safety database and literature shows an abolition of 'clusters' of infection and a marked reduction in the incidence of postoperative nosocomial infections.
Medical professionals must follow strict aseptic precautions when handling propofol, and the use of EDTA containing formulations should be considered. Non-adherence and use of non-EDTA propofols put patients at increased risk of nosocomial postoperative infections, potentially increasing morbidity and mortality with serious economic consequences for hospitals.
References:
1. AstraZeneca Drug Safety Database, data on file
2. Life Support and Anesthesia:11(11): 1174-1175, 2004.
3. The Japanese Journal of Clinical and Experimental Medicine: 81(7): 1086-1089, 2004.

S-124.

ANESTHETIC MANAGEMENT OF PATIENTS WITH DEEP ANESTHESIA FOR SEVOFLURANE BURST SUPPRESSION TREATMENT

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Introduction: Deep anesthesia can cause hypoperfusion and end organ ischemia. Is it safe to administrate very deep anesthesia for patients? As a part of study of the efficacy of sevoflurane burst suppression therapy (BST), high dose of inhalational anesthetic agent sevoflurane is used to produce a cessation of brainwave activity to treat refractory unipolar and bipolar depression. Eight percent sevoflurane is used to achieve end tidal 2.4-3.5 MAC. This study examined the safety of deep anesthesia for BST.
Methods: 39 patients with drug treatment-resistant depression were treated for a total of 197 therapies with sevoflurane BST producing at least two consecutive minutes of electro-cerebral silence in each treatment. Occurrence of severe complications such as myocardial infarct (MI) and stroke were monitored and assessed before, during, immediately after, and up to one month after final treatment. All patients had routine anesthesia pre-op evaluation, and received 500-1000 ml Lactated Ringer's solution (LR) prior to BST. Patients were intubated after induction and maintained with 8% Sevoflurane until experiencing electro-cerebral silence for two minutes. ASA standard monitors were employed in addition of 5-lead EEG. Hypotension, defined as systolic blood pressure (BP) decrease 25% or more from base line, was treated with lactate ringer's solution (LR), ephedrine, and phenylephrine.
Results: 39 patients had a total of 197 treatments. The end-tidal MACs of sevoflurane ranged from 2.4-3.5. The period of time that patients were exposed to deep anesthesia is the time from intubation to turning off sevoflurane, which was from 21-42 minutes. All patients received fluid therapy with LR ranging from 450 to 1200 ml during the procedure. Some patients also received ephedrine and/or phenylephrine. No patient had MI, stroke, or clinically significant ischemia during the procedure period.
Conclusion: With careful pre and intra-procedure anesthetic management, sevoflurane BST may be carried out without apparently serious complications resulting from sevoflurane induced.

S-125.

EFFICACY OF ANTIEMETIC PROPHYLAXIS IN PATIENTS AT HIGH VERSUS LOW RISK OF DEVELOPING PONV

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Introduction: Postoperative and postdischarge nausea and vomiting (PONV/PDNV) remain common complications after elective surgery. Antiemetic drugs are routinely administered for prophylaxis (at time of skin closure) in patients undergoing procedures associated with a high incidence of PONV and PDNV.[1,2] Risk factors associated with PONV include female gender, nonsmoking status, history of PONV or motion sickness, and use of opioid analgesics.[3] A prospective observational study was designed to assess antiemetic prophylaxis in patients at high versus low risk of developing PONV.
Methods: 130 patients undergoing elective laparoscopic or major plastic surgery were assigned to a high (≥2) or lower (<2) risk group based on a risk scoring system (one point for each risk factor). The occurrence of nausea, vomiting, and need for rescue antiemetics were assessed at specific time intervals from 0-6, 6-24, 24-48, and 48-72 hours after surgery.
Results: Prophylactic antiemetics were administered to 92% and 87% of patients in the high and low risk groups, respectively. Despite frequent use of one or more prophylactic antiemetics, vomiting was reported in 21% of the high-risk group (vs 6% low-risk) prior to discharge and in 22% after discharge. The occurrence of postdischarge nausea for the high-risk group was 26%, compared with 13% for the low-risk group. Overall, 50% of the high-risk patients reported nausea and/or vomiting during the 72-hour observation period. Twenty-two percent of high-risk patients required a rescue antiemetic in the PACU and 43% required rescue antiemetics after discharge from the PACU.

	High Risk (N=98)	**Low Risk** (N=32)		
Demographics				
Mean age, y (range)	48 (19-84)	51 (32-68)		
Gender, M/F	17/81	28/4		
No smoking history, %	77	50		
No alcohol consumption, %	46	19		
History of PONV, %	36	3		
History of motion sickness, %	23	3		
Anesthesia time, min	173±85	207±79		
Surgery time, min	141±30	177±31		
Prophylaxis Treatment, %				
No antiemetic	8	13		
1 antiemetic	29	50		
2 antiemetics	22	25		
3 or more antiemetics	41	13		
Vomiting, %				
Prior to discharge (0-6h)	21	6		
Post-discharge (>6h)	22	9		
Overall (0-72h)	36	16		
Nausea, %				
Prior to discharge (0-6h)	23	25		
Postdischarge (>6h)	26	13		
Overall (0-72h)	39	28		
Nausea and/or Vomiting, %				
Prior to discharge (0-6h)	35	25		
Postdischarge (>6h)	36	13		
Overall (0-72h)	50	28		
	PACU Rescue	Post-dischg Rescue	PACU Rescue	Post-dischg Rescue
Use of Antiemetics in Postoperative Period, %	78	57	91	75
No antiemetics	18	33	9	19
1 antiemetic	4	8	0	6
2 antiemetics	0	2	0	0
3 or more antiemetics				

Discussion: Despite that over 90% of high-risk patients received antiemetic prophylaxis, almost half of these patients required a rescue antiemetic in the postoperative period. Over 25% of low-risk patients also required a rescue antiemetic. These data suggest that PONV and PDNV are still common despite frequent use of antiemetic prophylaxis in both high- and low-risk surgical populations.
References
1. Anesthesiology. 1999;91:693-700.
2. Anesth Analg. 1999;89:1337-1339.
3. Can J Anesth. 2004;51:326-341.

S-126.

IMPLEMENTING A POSTOPERATIVE NAUSEA AND VOMITING (PONV) ALGORITHM AND CHANGING THE CONTENTS OF THE ANESTHESIA DRUG TRAY IMPROVED THE COST EFFECTIVENESS OF PONV PROPHYLAXIS

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Introduction: Not all patients require antiemetic prophylaxis for PONV, as PONV occurs in only 25-30% of surgery patients. Low risk patients are unlikely to benefit from prophylaxis. To decrease adverse events and improve patient safety and cost effectiveness, patients at moderate to high risk for PONV should receive prophylaxis. The pharmacy and anesthesia departments substituted antiemetics in the anesthesia drug tray and developed an algorithm based on PONV risk scores to help select patients who would most likely benefit from prophylaxis and improve cost effectiveness.
Methods: Baseline data was collected on 121 surgical patients undergoing general anesthesia during April 2004. A PONV risk score (Table 1) and prophylaxis algorithm (Table 2) for our hospital was developed based on PONV consensus guidelines(1), current literature(2) and best practices from other institutions. Anesthesiology staff, residents, student nurse anesthetists and perioperative nurses were educated by pharmacy and anesthesia staff. The algorithm was implemented in September 2004, and its effect evaluated on 220 patients. The ondansetron vials were moved from the anesthesia drug trays, but were available as needed from the OR pharmacy based on the patient's PONV score and the prophylaxis algorithm.
Results: The average monthly ondansetron cost prior to the PONV algorithm implementation was $11,500. Following implementation, the average monthly cost of ondansetron decreased to $4,100. The annualized reduction in expenditures based on this data was $88,800, decreasing from $186,000 to $97,200, an improvement of 52%.
Conclusion: Implementation of a PONV prophylaxis algorithm and moving the vial of the most expensive antiemetic, ondansetron, from the anesthesia drug tray to the OR pharmacy improved use and cost effectiveness of PONV prophylaxis, especially with regard to ondansetron.
References: (1)Anesth Analg 2003; 97:62-71. (2) Anesthesiology 1999; 91(3):693-700.
*Table 1: Risk factors 6-10 were evaluated only if score for risk factors 1-5 was zero.

PONV Risk Factors	
1) Gender	Female=1
2) History	History of PONV or motion sickness = 1
3) Smoking status	Non-smoking = 1
4) Postop Opioid Use	Yes = 1
5) Operation duration	≥60 min = 1
6) Age	≤50 years = 1
7) Weight	Obese (BMI) ≥30) = 1
8) Gastric emptying	Delayed = 1
9) Type of surgery	Intraabdominal, major GYN, laparoscopic, tonsillectomy or strabismus = 1
10)Anesthetic	General = 1

Prophylactic Antiemetics Based on PONV Risk Score				
Score: 0 Low Risk	Score: 1 Mild-Moderate Risk	Score: 2 Moderate-High Risk	Score: 3 High Risk	Score: ≥4 Very High Risk
No prophylaxis	Droperidol or Scop patch or Dexamethasone (Scop=Scopolamine)	Droperidol or Scop patch + Dexamethasone (combination therapy)	Droperidol, Scop patch + Dexamethasone +/- Ondansetron (combination therapy)	Treat as a high risk patient but also consider Propofol for total IV anesthesia (multi-modal therapy)

S-127.

INTROPERATIVE ADMINISTRATION OF PACKED RED BLOOD CELLS DOES NOT INFLUENCE LIVER ALLOGRAFT SURVIVAL

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Introduction. Packed red blood cell transfusion is common in liver transplant recipients. Many centers have reported an association with transfusion and poor allograft survival, although this remains controversial. Larger studies are necessary to determine the full impact of intraoperative transfusion on liver transplant outcomes. Therefore, the purpose of this study was to examine the influence of intraoperative factors on acute rejection as well as allograft survival after liver transplantation. **Methods:** At a single center, medical records of all liver transplant recipients (18 years or older) transplanted between 1989-2004 were reviewed (n=425). Operative factors that were analyzed included age at the time of transplant, time after transplant, gender, anesthetic time, operative time, anhepatic time, pre- and post-operative weight, and the amount of cell saver, RBC, FFP, cryoprecipitate, platelet, antifibrinolytic, crystalloid and colloid infusion. **Results:** The mean age was 48±11 years and most (56%) patients were male. Indications for transplant included viral hepatitis (43%), cholestatic liver disease (17%) and alcoholic disease (17%). Mean follow-up was 7±4 years. Sixty-two patients (15%) suffered graft loss at a mean time of 1.5±2.5 years after transplantation and 98 patients (21%) experienced acute rejection. The mean operative and anesthetic times were 7.0±2.5 hours and 8.8±2.8 hours, respectively. 79 (19%) patients did not require RBC transfusion, and the mean number of RBC transfusions was 4.8±5.8, median 3 units. 142 (33%) patients did not require platelet transfusion, and the mean number was 10±12, median 10 units. Simple regression analysis revealed an association of acute rejection with operative time (P=0.005), time after transplant (P<0.001), and volume of crystalloid infused (P=0.033). Stepwise logistic regression analysis reported the operative time (P<0.001) and time after transplant (P<0.001) to be associated with acute rejection. In a univariate analysis, greater than 6 RBC transfusions was associated with graft loss (P=0.043). Simple regression analysis revealed an association of graft loss with anesthesia time (P=0.03) and number of platelets transfused (P=0.053). Stepwise logistic regression analysis reported number of platelets (P=0.016) as the only factor associated with graft loss. **Conclusion:** In this large group of liver transplant recipients, packed red blood cell transfusion did not influence outcomes after liver transplantation. The strongest intraoperative predictor of acute rejection appears to be operative time. Intraoperative administration of platelets appears to predict graft survival. All other intraoperative infusions analyzed do not influence outcomes after liver transplantation.

S-128.

CLINICAL DATA AND MATHEMATICAL COMPARISON CONCERNING THE EFFICACY OF PREOPERATIVE AUTOLOGOUS BLOOD DONATION AND PERIOPERATIVE BLOOD SALVAGE IN MAJOR ORTHOPAEDIC SURGERY PATIENTS

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Introduction: Preoperative autologous blood donation (PABD) and perioperative blood salvage (PBS) have become established blood conservation measures. So far, data comparing efficacy, i.e. increase/recovery in/of RBC-mass (+RBC) of either measure is still lacking.
Methods: Prospective analysis in 693 consecutive major orthopaedic surgery patients eligible for PABD. +RBC due to PABD was calculated by the hct-method by calculating patient's presumed blood-volume according to Nadler et al (1), and knowing initial hct (hct init) and hct at pre-set points of time. In parallel, +RBC due to PBS -if no PABD were applied in these patients- was calculated according to formulas published elsewhere (2). From this mathematical analysis of PBS a RBC-recovery rate of 30 percent was assumed for mathematical comparison to PABD. Re-transfusion of salvaged RBC together with colloid in order to maintain hct min at pre-set level; thus resulting in maximal allowable blood loss (MABL) substituted for. MABL according to either PABD or PBS was calculated according to formulas published elsewhere (2). Statistical analysis was performed by either t-/U-test or ANOVA w/ Scheffé-test or Kruskal-Wallis-test, respectively. Data were given as mean ± SD. Statistical significance was set with p <0.05 (*between groups; °within groups).

Results: Tab. 1 summarizes relevant data.

parameter	n = 693: 282 (m)/412 (f) (40.5%/59.5%)		
age (yrs)	62.7 ± 10.8		
presumed blood vol. (L)	4.6 ± 0.8		
RBC mass (L)	1.8 ± 0.4		
hct init (%)	39.2 ± 3.3		
hct preop. (%)	36.9 ± 2.7		
time PAD to surgery (d)	27.9 ± 10.9		
+RBC to PABD (ml)	164 ± 11*		
pre-set hct min levels (%)	18%	21%	24%
+RBC to PBS30 (ml)	431 ± 134*	346 ± 116*	273 ± 100*
δ +RBC (PBS30 - PABD) (ml)	267 ± 178	183 ± 166	109 ± 156
MABL to PABD (L)	4.7 ± 1.1*°	3.8 ± 0.9*°	3.1 ± 0.8*
MABL to PBS30 (L)	6.0 ± 1.6*°	4.5 ± 1.3*°	3.4 ± 1.1*
δ MABL (PBS30 - PABD) (L)	1.2 ± 0.8	0.7 ± 0.6	0.3 ± 0.5*
PBS30 > PABD: n (%)	670 (96.7%)	610 (88%)	495 (71.4%)

Discussion: Mathematical analysis concerning efficacy (+RBC) of PABD vs. PBS demonstrated PBS superior to PABD; even w/ a RBC-recovery rate of 30 percent, only. The lower hct min tolerated, the more efficacious is PBS, and the lower the percentage of patients taking advantage from PABD. In patients with a low initial hct/small initial total RBC-mass and/or a long time-interval between PABD and surgery (>4 weeks), PABD was the blood conservation measure of choice; while in patients with a high initial hct/big initial total RBC-mass and/or a short time-interval between PABD and surgery (<4 weeks), PBS was the more efficacious blood conservation measuure.
References: 1. Surgery 1962; 51: 224 - 232. 2. J Surg Res 1999; 86: 206 - 212. Erratum in J Surg Res 2000; 88: 215

S-129.

FIFTY YEARS OF THE AMERICAN SOCIETY OF ANESTHESIOLOGISTS' PRESIDENTIAL REPORTS

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Introduction: Every president of the American Society of Anesthesiologists (ASA) concludes his/her term in office with a presentation to the House of Delegates. This address is subsequently published in the ASA Newsletter. The purpose of this abstract is to present a broad summary of the ASA's current activities, describe stimulating proposals, and comment on some of the unfinished responsibilities and challenges. This investigation examined key areas of the ASA Presidents' speeches for the past 50 years (1954-2004).
Methods: A copy of every Presidential address since 1954 was obtained with the assistance of the administrative office of the ASA. Each presentation was examined for recurring issues and changes in policy. The ten most frequently discussed topics were tabulated.
Results:

Issues	No. of yrs. cited	% of total no. of yrs. (50)
Job placement	2	4
Dues	5	10
Membership	10	20
Patient Safety	11	22
Cont. Med Education	16	32
Public education	16	32
Shortage/Anesthesiologists	17	34
Wood Library-Museum	18	36
Conflicts with CRNAs	23	46
Financial reimbursement	25	50

Discussion: Minimal discourse occurred regarding the subjects of finding a job for graduates, increasing membership numbers, and yearly dues. These concerns reflected a society and profession in its infancy; most citations were in the period 1950-60's. Apprehension about a shortage of qualified medical students entering the profession dominated the yearly reports, particularly prior to the 1980's. In 1954, a committee was formed that accomplished the following: "a thorough re-evaluation of the problem of indoctrinating medical students into the study of Anesthesiology." The Wood Library- Museum (WLM) was uniformly praised and supported through the decades; in 1996 the president of the ASA stated, "the WLM attests to our keeping faith with the primary purpose for which the ASA was founded and for which it still exists: to raise the standards of the specialty by fostering and encouraging education and scientific progress in Anesthesiology." Presidential reports about nurse anesthetists have been pervasive, quarrelsome, and adversarial. In 2001 the President proclaimed, "The American Association of Nurse Anesthetists continues to twist facts. Half-truths, personal attacks and distortions are still the methods they use to try to achieve their goal." In conclusion, analysis of the ASA Presidential Reports makes clear what were the challenges that faced a new and growing professional organization, which areas have been successfully dealt with and supported by the mature society, and those issues that continue to require continued dedication and effort.

S-130.

PRESCRIPTION DRUG ABUSE AMONG TEENS: PATTERNS AND PERCEPTIONS

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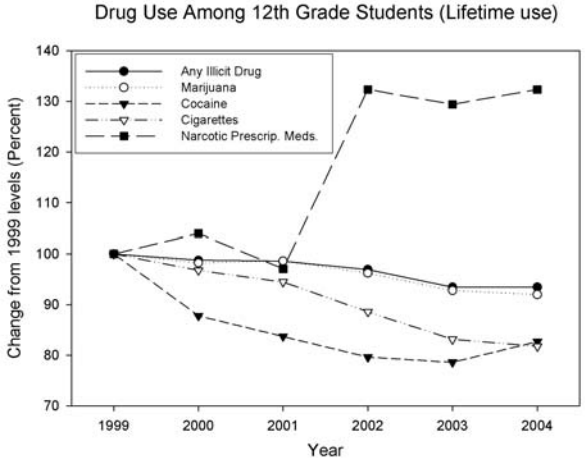
Introduction: Although drug use among teens and pre-teens seems to be in decline, abuse of prescription medication appears to be taking its place. Effective campaigns by federal and private sectors battling teen drug abuse has focused on abuse of drugs traditionally favored by this age group (i.e. marijuana and cocaine), but little, if any consideration has been given to the abuse of prescription medications. For teens, prescription medications such as Vicodin and OxyContin may be viewed as safe because they see legitimate use by adults with little negative consequence.
Methods: Non-medical use of prescription medications for teens will be evaluated using two sources of data that focus on this age group: the Monitoring The Future (MTF) database and results from the Partnership for a Drug-Free America. To display trends in a comparable manner, all plotted values were defined as percent change from levels reported in 1999. We chose to focus on students in the 12th grade for the MTF data although similar trends for 8th and 10th graders were found.
Results: Trends from the MTF data (figure) for some of the more commonly abused drugs as well as a composite of all illicit substances and Narcotic Prescription Medications (NPM) show a steady decreasing trend over the years for all categories except NPM. NPM show a large jump in 2002, which correspond to the addition of an explicit listing of drug trade names, OxyContin and Vicodin to the questionnaire. The increasing popularity of these drugs is evidenced by a 2004 PATS survey which reported that approximately 1 in 5 teens have experimented with pain killers, 18% of teens reporting non-medical use of Vicodin and 10% of OxyContin.
Examining race using the 2003 MTF data, 12% of the sample self-identified as black, 62% as white and 26% other or missing. For those who abused prescription medications less than 4% self-identified as black and 74% identified as white, indicating that prescription medications is far more prevalent among whites than blacks ($P<0.0001$).
Conclusion: Non-medical use of prescription medications is becoming increasingly popular among teenagers and in particularly white teens. Given the success of education programs targeting marijuana and cigarettes, similar programs should be considered to increase awareness about the dangers of prescription medication abuse.



S-131.

AWARENESS ABOUT ANAESTHESIOLOGIST AND THE SCOPE OF ANAESTHESIOLOGY IN NON-SURGICAL PATIENTS AND THEIR ATTENDANTS

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Introduction: The present study was conducted to assess awareness regarding anesthesiology and its contributions to patient care amongst non- surgical patients and their attendants. Although there are a few surveys from developed nations[1, 2] aiming to assess public awareness regarding anesthesiology, there is a paucity of such reports from developing nations.
Methods: Three hundred non-surgical outdoor patients and their attendants were surveyed using a specifically formulated questionnaire containing 15 questions, aiming to assess their awareness and fears related to anesthesiology and the role of anesthesiologists in patient care. Subjects more than 18 years of age and educated till atleast matriculation were included whereas medical and para-medical staff, very sick and non-consenting patients was excluded from the study.
Results: Majority of the respondents (67%) were aware that some form of analgesia or anesthesia is given prior to surgery. Most of the subjects believed the surgeon (25%) or nursing staff (24%) to be responsible for administering anesthesia. Total number of subjects who knew that a specially trained person administers anesthesia (anesthesiologist) was only 18%. A large number of subjects (70.67%) were able to identify at least one correct working area of the anesthesiologist and of these 85.37% marked it as the operation theatre. On asking what the various methods by which a patient is anaesthetized are, most of the people knew only about intravenous injection (200/300). Despite the fact that more than 50% respondents gave equal or more importance to the anesthesiologist as compared to the surgeon, only 21.67% of respondents thought that choice of anesthesiologist attending to them was a consideration before surgery. A miniscule percentage of patients (4%) believed that monitoring of the patient intraoperatively is done by the anesthesiologist. This figure of 4% is comparable to the findings of a survey in New York (5%)[1] while it is much lower than that reported in British population (54%)[2]. The higher percentage in the British survey could be because the study group included surgical patients. Majority (87%) believed general anesthesia was devoid of any complications and 99.67% respondents believed local anesthesia to be safe.
Discussion: Our study points towards the poor knowledge about an anesthesiologist and his work suggesting lack of interaction between patients and anesthesiologist. Pre-anesthetic meetings should be used by the attending anesthesiologist to make the patient aware regarding relevance of anesthesiology for patient care. He should specifically address patients' concerns regarding anesthesia course and inform them about his role in monitoring vital signs and maintaining normal homeostasis. In-hospital patients will form a very important group of public to be educated, as personal experience and hearsay was the commonest source of information attained in our survey.
References: (1) Anesthesia 1994; 49:165-6.
(2) Anaesth Analg 1991; 73:190-8.

S-132.

BLOOD TRANSFUSIONS IN ORTHOPEDICS

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INTRODUCTION: Major orthopedic surgery can lead to significant perioperative blood loss: Bierbuam et al [1] reported that between 39% to 57% of patients undergoing total hip (THR) and total knee replacement (TKR) were transfused. Neither allogeneic nor autologus transfusions are without drawbacks e.g a higher rate of wound infections [2], potential risk of viral infections [2], ABO-incompatible blood transfusions immunosuppression, and cost. Consequently, appropriate perioperative blood management has to be established [3]. It has been reported that baseline, day-of-surgery and postoperative hemoglobin levels <10g/dl are associated with higher allogeneic transfusion rates [2]. The purpose of our study was to assess the relationship between preoperative hemoglobin and postoperative transfusion in orthopedics.
METHODS: We retrospectively evaluated 63 consecutive patients (July 2005) undergoing either THR and TKR. Demographic data and baseline hemoglobin values were recorded. Hemoglobin values and number of units transfused from the day of surgery until discharge were collected in all patients. In addition, difference between median baseline hemoglobin values in transfused and non-transfused patients were compared using a t-test. Alpha was set up at a level of 0.05.
RESULTS: Forty-two females, twenty-one males were included; the median age was 65 years. Twenty-six and thirty-seven patients respectively underwent THR and TKR.
Twenty-four patients (38%) received between 1 and 5 units of blood perioperatively.
The median baseline hemoglobin of the transfused patients was 12.5g/dl, while median baseline hemoglobin was 13.4g/dl for non-transfused patients ($p \leq 0.05$). The distribution of the first transfusion for both THR and TKR was: 12.5% on POD#0, 37.5% on POD#1, 8.3% on POD#2, 25% on POD#3 and 16.7% on POD#4. Following THR 69% of transfusions occurred on POD#1, while 82% of transfusions for TKR occurred between POD#3 and POD#4.
DISCUSSION: Our data confirm that THR are transfused more frequently than TKR [1]. We also demonstrated a significant difference in median baseline hemoglobin between transfused and non-transfused patients. Finally, our data clearly demonstrates that the type of surgery affect the timing of transfusion: in THR the requirement for transfusion is most frequently immediate while it is delayed in TKR.
REFERENCES:
[1] J Bone Joint Surg Am 1999; 81: 2-10
[2] Transfusion 2003; 43: 459-469
[3] Anesthesiology Clin N Am 2005; 23: 305-313

S-133.

CLINICAL AND ECONOMIC EFFICIENCY OF APPROACHES TO PREVENT PONV

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Introduction: The knowledge on predictive factors for postoperative nausea and vomiting (PONV) has grown rapidly during the last years and several predictive models have been developed. The applicability of these risk-scores has also be determined. However, their potential clinical and economic benefit in terms of improved efficiency of antiemetics is far from being clear. Therefore, we investigated the theoretical benefit of various decision models based on data of published investigations.
Methods: A simplified score that uses four predictive factors in order to determine five risk groups was used (1). The distribution of risk factors (RF) was determined based on previous publications (2,3) and on own institutional data (no RF=40%, 1 RF=30%, 2 RF=15%, 3 RF=10%, 4 RF=5%). A relative risk reduction in the range of 30% was assumed for each prophylactic antiemetic (4). Eight approaches were investigated depending on the action if none, one, two, three or four risk factors are present (number in parenthesis are the number of antiemetics applied in each risk group). Approach A: (1/1/1/1/1), B: (2/2/2/2/2), C: (3/3/3/3/3), D: (0/0/0/1/1) E: (0/0/1/1/1), F: (0/0/1/2/2), G: 0/0/1/2/3), H: (0/1/2/3/4). Relevant outcomes were the resulting incidence, the number of treated patients [P], the number of necessary doses [D] and the benefit ratio, i.e. number of patients with beneficial administration of antiemetics and those without PONV and no antiemetics applied divided by the doses of antiemetics used [BR].
Results: The incidence can be reduced from a baseline of 51% (2) to 36% (P: 100, D: 100, BR: 0.15), 25% (P: 100, D: 200, BR: 0.13) and 17% (P: 100, D: 300, BR: 0.11) if a universal single, double or triple prophylaxis is applied (A, B, C). With a single risk-adapted approach (D, E) incidences can be reduced to 41% (P: 52, D: 52, BR: 0.79) and 36% (P: 90, D: 90, BR: 0.25). The theoretical incidences with a multimodal risk-adapted approach (F, G, H) are 29% (P: 90, D: 142, BR: 0.21), 28% (P: 90, D: 154, BR: 0.20)and 19% (P: 99, D: 253, BR: 0.13).
Discussion: Risk adapted approaches to manage PONV per se do not guarantee a low incidence of PONV, which remains a “20%-Problem”. Since the distribution of risk factors determines the efficacy of the antiemetic approach, patient population as well as readiness to administer treatment should be taken into account when implementing an institutional guideline to manage PONV. Inherent limited overall efficacy highlights the importance of treatment guidelines. However, risk-adapted approaches may help to reduce the ineffective administration of antiemetics. Thus, they may offer cost-savings without losing overall efficacy.
References: 1. Anesthesiology 1999;91:693-700. 2. Can J Anaesth 2004;51:320-5. 3. Can J Anaesth 2004;51:13-9. 4. N Engl J Med 2004;350:2441-51.

S-134.

THE INCIDENCE OF INTRAOPERATIVE LARYNGEAL EDEMA IN RHEUMATOID ARTHRITIS PATIENTS

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Rheumatoid arthritis patients often have cricoarytenoid arthritis and are at risk from developing laryngeal edema or narrowed glottic aperture perioperatively. Assessing the laryngeal morbidity in those patients before anesthesia should help us planning the optimal airway management. We examined the glottis of rheumatoid arthritis patients by fiberoptic laryngoscopy to seek for the incidence and relevant preoperative risk factors of laryngeal edema. [Methods] After local ethics committee approval and informed consent, we enrolled 85 rheumatoid arthritis patients that opted for general anesthesia for their elective surgery. At a preoperative visit, we examined them for the following clinical signs and risk factors of laryngeal morbidity: cough, hoarseness, hard of swallowing, feeling of a foreign body in the larynx, laryngeal pain at rest or on swallowing, tenderness at the thyroid cartilage, laryngeal pain on vocalization, wheezing, and difficulty in breathing. Immediately after the induction of general anesthesia, we performed fiberoptic laryngoscopy through a laryngeal mask airway and examined the glottis for the presence of laryngeal edema. Correlations were sought between the presence of laryngeal edema and all the clinical signs listed above using Fisher’s exact test at a significance threshold of $p < 0.05$. [Results] The enrolled patients consisted of 10 males and 75 females, averaged 56 years in age, 155 cm in height, and 52 kg in weight. We found the laryngeal edema in 28 (33%) out of the 85 patients. Seven, two, and two of them presented with cough, feeling of a foreign body in the larynx, and hard of swallowing, respectively, none of which did not correlate with the presence of laryngeal edema. In addition we found the past history of multiple joint replacement, limited range of motion in the spine, and limited mouth opening in 37, 23, and 21 out of the 85 patients, but found no correlations with laryngeal edema. There were no cases of difficulty in the placement of a laryngeal mask airway or in the lung ventilation. [Discussion] The present results implicate that one in three rheumatoid arthritis patients has laryngeal edema observed just after the induction of general anesthesia, but that its presence cannot be foreseen from the clinical signs. The placement of a laryngeal mask airway could also pose a risk of worsening laryngeal edema in such patients.

Equipment/Monitoring

S-135.

THE LMA CTRACH™ - A NEW LARYNGEAL MASK AIRWAY FOR ENDOTRACHEAL INTUBATION UNDER VISION

AUTHORS: **E. H. Liu**;
AFFILIATION: National University Hospital, Singapore, Singapore.

Introduction: The LMA CTrach system consists of a LMA CTrach Airway (CTrach) with inbuilt fiberoptic channels and a detachable LCD CTrach Viewer. Based on the Intubating Laryngeal Mask Airway (Fastrach), this new system enables viewing of the larynx and process of endotracheal intubation through the laryngeal mask. It is designed for both general and difficult airway management. We evaluated the success of intubation with the LMA CTrach system.
Method: We obtained IRB approval and consent from 100 patients requiring general anesthesia and endotracheal intubation for elective surgery. After induction of anesthesia, we assessed the difficulty of laryngoscopy using a Macintosh laryngoscope. The CTrach was inserted with the head and neck in neutral position with minimal movement, and adjusted to optimize ventilation, with minimal resistance and leak. The viewer was then attached, and where necessary, the CTrach was partially withdrawal, suctioned or rotated, to view the larynx. A wire reinforced silicone endotracheal tube (ETT) was then passed through the CTrach into the larynx under vision. If we were unable to see the larynx after 3 minutes, we carried out blind intubation via the CTrach. After intubation, the viewer was detached, the CTrach removed over the ETT, the breathing system connected and anesthesia continued.
Results: The overall success of intubation with the CTrach was 96%, all at the first attempt. We were able to view the larynx in 84 patients, and succeeded in intubation in 83 (98.8%) of these patients. In 16 patients where the larynx could not bee seen, we succeeded in blind intubation in 13 of 14 (92.9%) patients. We did not attempt intubation in 2 patients with sub-optimal ventilation. The median (IQR) time was 26 (20 - 33) sec to optimise ventilation with the CTrach, 65 (30 -141) sec to view the larynx, and 166 (114 - 233) sec for the entire process. The success rates of intubation and viewing the larynx were not related to conventional laryngoscopy difficulty on Pearson correlation tests.
Discussion: The 96% first attempt intubation success rate with the CTrach compares favourably with 79.8% reported for blind intubation with the Fastrach system.(1) Reducing intubation attempts may reduce trauma and improve safety. However, the quality of the best possible views and ease of these views were modest and variable, and expectations of this system must be moderated. The CTrach enabled nearly continuous ventilation during the viewing and intubation process in all patients. This promising device should be evaluated specifically in difficult airway management.
Reference:
1. Anaesthesia 1998;53:1174-9.

S-136.

THE GLIDESCOPE®: INTUBATION OF SPONTANEOUSLY BREATHING PATIENTS WITH KNOWN OR ANTICIPATED DIFFICULT AIRWAYS. A REPORT OF TEN CASES

AUTHORS: **M. Dupanovic**, S. Popat, D. Layer, R. Jensen;
AFFILIATION: University of Rochester, NY, Rochester, NY.

Introduction: Patients with known or anticipated difficult airways are often intubated while breathing spontaneously. Fiberoptic intubation is the recommended technique under these circumstances.[1] This report describes use of the GlideScope Video Laryngoscope® (GSVL) as an alternative to fiberoptic intubation.[2]
Methods: We reviewed anesthetic records of ten patients who were intubated with the GSVL while breathing spontaneously. Patient characteristics, technique of topicalization and sedation, success of intubation, and complications were collected.
Results: Indications included previous history of difficult intubaton and/or physical signs predictive of difficult intubation (25 mm interdental gap, Mallampati IV) and signs predictive of difficult ventilation (airway tumor, a large thyroid gland with tracheal displacement, vocal cord paralysis with tracheal stenosis, partially closed tracheostomy with postoperative airway swelling). One patient had 7th cervical vertebrae fracture and a cervical collar. Nine intubations were successful on the first or second attempt. The average BMI was 28.5 kg/m^2 (range 18-40). The Mallampati score (MP) ranged from I (three patients) to IV (two patients). The view at laryngoscopy using the Cormack-Lehane grading system, as modified by Yentis and Lee,[3] ranged from I-IIb. Airway was topicalized initially by smearing 2% lidocaine jelly on the base of patient's tongue. Additionally either Cetacaine spray to the pharynx or atomized 4% lidocaine to the laryngotracheal structures was used. The goals of sedation were amnesia, patient's comfort and optimal intubating conditions along with preservation of spontaneous ventilation. Sedation ranged from small amounts of midazolam and fentanyl to inhalation of sevoflurane. Dexmedetomidine infusion and small amounts of ketamine and/or propofol were used in some patients. Only two patients complained of postoperative sore throat.
Discussion: This report demonstrates that the GSVL can successfully be used for intubation of spontaneously breathing patients despite the presence of various airway problems. One intubation failed on two attempts. This was due to utilization of a Laser-Shield® II ETT#5 (outer diameter 8 mm) on a patient with bilateral vocal cord paralysis and an estimated glottic aperture of 4 mm. The pliable tip of this ETT, under sharp configuration, would not pass through the narrow glottis. The GSVL should be considered as an alternative or as an additional device to the fiberoptic bronchoscope for awake intubations. The advantages of GSVL are a "macro view" of the larynx, less affected by blood or secretions, and the insertion of the ETT under visual control. The disadvantages are the inability to use the GSVL unless interincisor gap is at least 20 mm and the necessity of having a sharp angle on the ETT for its delivery through the glottis.
References:
1.Ovassapian A. Fiberoptic Endoscopy and the Difficult Airway, Lippincott-Raven, 1996.
2. GlideScope®, System Operation & Service Manual (Saturn Biomedical Systems INC, Burnaby, BC, Canada).
3. Anaesthesia 1998; 53: 1041-4.

S-137.

USE OF THE STREAMLINED PHARYNX AIRWAY LINER (SLIPA ™) IN 36 PATIENTS UNDER GENERAL ANESTHESIA WITH CONTROLLED VENTILATION

AUTHORS: **P. Zimmermann**, N. Roewer, F. Kehl;
AFFILIATION: University of Wuerzburg, Wuerzburg, Germany.

Introduction:
The SLIPA™ is a novel, single use disposable supraglottic airway made of soft, hollow plastic. No cuff is necessary because its boot - shaped form is similar to that of a pressurized pharynx. We tested its usefulness in general anesthesia cases with positive pressure ventilation.
Methods:
36 ASA 1-3 patients (aged 54 to 85 yrs., mean height 168 cm, mean weight 68 kg, mean body mass index 24.8) scheduled for ophtalmic surgery under general anesthesia were recruited. After preoxygenation with 100% O_2, Anesthesia was induced and maintained with Remifentanil (0.1 - 0.25 mcg/kg/min) and Propofol 4 - 6 mg/kg/h). SLIPA^{Tm} introduction was attempted immediately after loss of the eyelid reflex.
Results:
The SLIPA™ could be introduced in all patients. Mean insertion time was 10 seconds and only in 6 patients further manipulation of the device was necessary to obtain a tight seal. In 4 patients the SLIPA™ had to be exchanged for a different size.
Even without a cuff, sealing of the pharynx was excellent and positive pressure ventilation with a tidal volume of 10 ml/kg body weight was possible in all cases. No gastric air insufflation or regurgitation of gastric content was recorded at these ventilator settings. In 6/36 patients minor blood tinged sputum was noted at removal and 8/36 patients reported slight pharyngeal discomfort (max. 2/10 on a linear scale; mean 0.46). The remaining 28 patients had no complaints at all.
Discussion:
We conclude that the SLIPA™ is a useful and economic disposable airway alternative for minor surgery under general anesthesia.

References:
AnesthAnalg 2002;94:759-61

S-138.

EXPERIMENTAL STUDY OF THE JET ENDOTRACHEAL TUBE IN PIGS

AUTHORS: **H. Wei**;
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Introduction: The "jet endotracheal tube" (JET) has been designed to facilitate emergent intubation in apneic or paralyzed patients with difficult airways. The feasibility and the complications of the JET and the methods to use it were investigated in pigs.
Methods: Efficiency of jet ventilation (driving pressure of 15 psi, breathing rate of 15/min and I/E ratio of 1:1) using a Lab fabricated JET prototype was investigated in ten fully paralyzed male adult pigs weighing 52.8±6.3 kg. Arterial blood gas (ABG), $PetCO_2$, hemodynamic variables (SAP, DAP, HR), body temperature were monitored during spontaneous breathing for baseline and after jet ventilation for 20 min using the JET with its distal tip pointed either directly to or 45° to the right of the vocal cord opening. In addition, the effectiveness of using $PetCO_2$, chest rise and breath sounds on the front chest to facilitate tracheal placement of the JET blindly in a simulated difficult airway was studied. Ease of use and complications of the JET were noted.
Results: No significant differences could be detected in hemodynamic variables and rectal temperature between baseline and any mode of jet ventilation. Jet ventilation with the distal tip of the JET pointed directly to the vocal cord opening, but not 45° to the right, provides adequate oxygenation and ventilation during intubation. In a simulated difficult airway, $PetCO_2$, chest rise and breath sound on the front chest all were effective methods to differentiate whether the distal tip of the JET pointing directly or 45° to the right of the vocal cord opening, and therefore assisted blind placement of the JET. The combination of all three methods works the best. No severe complications were detected with the correct use of the JET. The final design of the JET was created based on the experimental data as illustrated in figure 1.
Discussion: The JET provides adequate oxygenation and ventilation during intubation in apneic pigs, and facilitates the intubation blindly in a simulated difficult airway. The JET is easy to use, and serious complications were not observed. In patients needing emergent intubation, a JET with $PetCO_2$ monitoring catheter may be an alternative to currently available techniques.

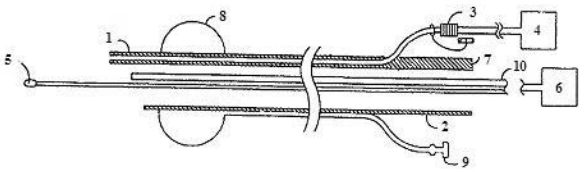

Figure 1. Final design of the jet endotracheal tube (JET). 1). Anterior wall of the JET; 2). Posterior wall of the JET; 3). Proximal end of the Jet channel inside the anterior wall of the JET; 4). Jet ventilator; 5). Distal end of the $PetCO_2$ monitoring catheter; 6) $PetCO_2$ monitor; 7). Proximal end of the JET; 8). Inflation cuff; 9). Proximal end of cuff inflation tube; 10). Metal stylet.

S-139.

THE EFFECTS OF NITROUS OXIDE ON SINGLE USE LARYNGEAL MASK CUFF PRESSURE. -LARYNGEAL MASK UNIQUE™ VS SOFT SEAL™

AUTHORS: **N. Sato**, H. Sakurai, F. Tokunaga, N. Nakamura, A. Ishikawa, J. Noguchi;
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Objective
Nitrous oxide will diffuse into the cuff of a tracheal tube, resulting in an increase in the cuff pressure. It is reported that disposal laryngeal mask airway (LM) has more stable intracuff pressure during N_2O anesthesia compared with reusable LM. We designed this study to evaluate the difference of time-course changes of cuff pressure between different brands of single use LM.
Method
After institutional approval, sixteen female patients undergoing total knee arthroplasty were randomly assigned in two groups. Laryngeal mask Unique™ (The Laryngeal Mask Company Ltd, UK) was inserted in group LM-U patients and Soft Seal™ (Portex Ltd, UK) was inserted in group LM-S patients. General anesthesia was induced by injection of propofol 3mg/kg. Immediately after induction, LM was inserted and inflate the cuff with standard dose of air. The cuff was deflated and was attached to a pressure transducer. Intra-cuff pressure was adjusted to 60 cmH_2O. Spontaneous anesthesia was maintained with 1% sevoflurane in 66% N_2O. Data were analyzed with JMP statistical program. Comparisons were perfomed by two-way repeated measures ANOVA.
Result
The study was completed for 15 patients. Intra-cuff pressure raised steadily in both groups. However, there is a significant difference in cuff pressure between the groups (Fig.1). LM-U was advanced to the LM-S with regard to cuff pressure during N_2O anesthesia.
Discussion
It was reported that the permeability of N_2O related to the material and the thickness of the cuff. Both single use LM is made from polyvinyl chloride, there is no material difference. Therefore, we assume that the difference of cuff pressure depend on the thickness of the cuff.

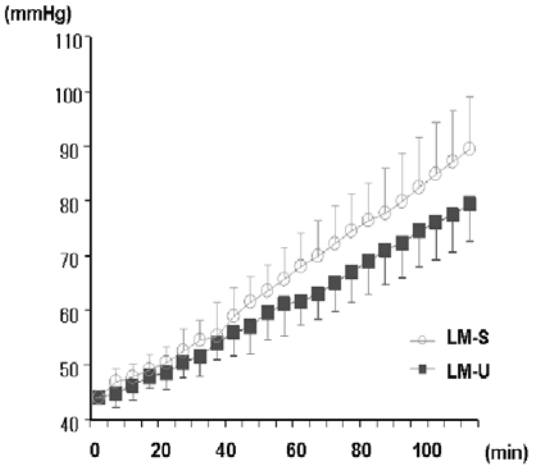


Fig.1 Changes of intracuff pressure

S-140.

THE USE OF THE LARYNGEAL MASK AIRWAY DURING GUIDE WIRE DILATATING FORCEPS TRACHEOSTOMY

AUTHORS: **D. Cattano**[1], S. Buzzigoli[2], C. Zoppi[2], E. Panicucci[1], S. Abramson[3], C. A. Hagberg[3];
AFFILIATION: [1]University of Pisa, Pisa, Italy, [2]AUSL 12 Viareggio, Lucca, Italy, [3]University of Texas, Houston, TX.

A tracheostomy performed percutaneously has become a common alternative to the classical open tracheostomy technique for convenience, cost effectiveness and decreased complication rate. Traditionally, percutaneous tracheostomies (PT) have been performed under endoscopic view through an endotracheal tube (ET) yet more recently laryngeal mask airway (LMA) have been utilized for these procedures. We retrospectively reviewed our intensive care practice of PT using a guide wire dilatating forcep technique (GWDF) with an ET, as compared to the Classic LMA (c-LMA). From 1998 to 2004, 274 patients underwent a tracheostomy procedure. Two hundred and fifty-four (92.7%) of these patients underwent a GWDF tracheostomy and 20 (7.3%) underwent a surgical tracheostomy. In the GWDF group, 188 (74%) were performed via c-LMA guided bronchoscopy, and 66 (26%) were performed through an ET. Acute complications (including bleeding, hypoxia, and pneumothorax) between the c-LMA and ET technique were significantly higher when utilizing an ET, (6/66 vs. 4/188, P=0.022 Fisher's exact test, Odds ratio=4.6) There was a significant difference in terms of acute (10/254 vs. 6/20, $p<0.001$, odds ratio=10.5) and chronic (tracheal stenosis) (0/254 vs. 4/20, $p<0.001$) complications between GWDF and surgical tracheostomy (ST) procedures. The endoscopic view obtained via the cLMA, as compared to the ET, was subjectively determined as better by the anesthesiologists. There were no ventilatory complications or reports of gastric aspiration. The c-LMA provides a safe and effective alternative to utilizing an ET for airway management during GWDF percutaneous tracheostomies in selected patients.

Anesth Analg 2004;99:1553-9
Br J Anaesth 1998; 8:608-9
Intensive Care Med. 2002; 28:63-7
Br J Anaesth 2000; 84:650-4SIAARTI Difficult Airways Task Force Minerva Anestesiol.2005 in press

S-141.

USE OF TWO ENDOTRACHEAL TUBE EXCHANGERS IS EFFECTIVE FOR ORAL TUBE EXCHANGE

AUTHORS: **M. Uraoka**, A. Suzuki, S. Sato;
AFFILIATION: Hamamatsu University School of Medicine, Hamamatsu, Japan.

Introduction: An endotracheal tube exchanger (TE) has been used as an aid for exchange from a double lumen endotracheal tube (DLT) to a single lumen tube. Exchanging the endotracheal tube is easy with a large diameter TE, but a thick TE cannot be used with a DLT. However, since a DLT has two lumens, it may be possible to use two thin TEs to facilitate exchange. The aim of this study was to compare the ease of laryngeal passage during a tube exchanger-guided endotracheal intubation using two thin TEs.
Methods: Thirty ASA 1-2 adult patients were randomly allocated for intubation either using one or two TEs. Patients were excluded if difficulty in ventilation or intubation was anticipated. A standard anesthesia protocol was followed, in which anesthesia was induced and maintained with fentanyl, propofol, vecuronium and sevoflurane, and routine monitoring was performed. An anesthesiologist inserted a TE into the trachea using a direct laryngoscope, and an additional TE was inserted in patients in the two-TE group. An endotracheal tube (7.5 mm ID) was advanced into the pharynx over the TE(s). A shortened TE cut at 20 cm from the tip, thereby giving it insufficient length to reach the trachea, was inserted into the endotracheal tube in patients in the one-TE group, for blinding. The blinded observer gently railroaded the endotracheal tube over the TE(s) into the trachea, and the difficulty of passage of the tube into the trachea was assessed using a four-point scale (grade 1: no difficulty passing the tube, 2: obstruction to passing the tube, relieved by withdrawal and anticlockwise rotation of 90 degrees, 3: obstruction necessitating more than one manipulation, 4: obstruction necessitating direct use of a laryngoscope).
Results: Twenty-seven patients completed the study, and the difficulty of passing the endotracheal tube into the trachea is shown for these patients in the table ($P < 0.05$, Mann-Whitney's test).
Discussion: Use of two TEs and anticlockwise rotation of the endotracheal tube through 90 degrees appears to be the best method for tube exchanger-guided intubation.
Conclusion: The use of two endotracheal tube exchangers may provide an advantage in exchange from a double-lumen to a single-lumen endotracheal tube.
References: Anesth Analg, 97, 285-8, 2003.

Difficulty of Passing an Endotracheal Tube into the Trachea

Level of Difficulty	One TE, n	Two TEs, n
1	1	10
2	5	4
3	1	0
4	6	0

S-142.

THE RELATIVE DELAY OF PULSE OXIMETER SATURATION TO ARTERIAL OXYGEN SATURATION DURING HYPOXIA UNDER DIFFERENT CONDITIONS

AUTHORS: **D. B. MacLeod**, K. Ikeda, J. Keifer, S. Grant, D. Breslin, G. Martin;
AFFILIATION: Duke University Medical Center, Durham, NC.

Introduction: Pulse oximeters demonstrate a delayed desaturation response time to hypoxia. Factors responsible include oximeter site, poor perfusion (vasoconstriction, hypothermia) and vasoactive drugs. In volunteer studies the desaturation response time is typically measured by determining the time for the pulse oximeter to show desaturation in response to a fixed point (i.e. change in inspired oxygen) rather than the true change in arterial oxygen saturation [ref]. It also fails to incorporate the behavior of the oximeter during the remainder of the hypoxic challenge and resaturation return to baseline. We sought to measure the delay between arterial oxygen saturation (S_aO_2) and pulse oximeter saturation (S_pO_2) at head and finger sites during different conditions by comparison of oxygen saturation curves.
Methods: With IRB approval 10 subjects completed the study. The subjects inhaled mixture of 11% oxygen in nitrogen for 3 minutes during which continuous pulse oximeter saturation data was collected from pulse oximeter sites (forehead, ear, 3 fingers). 16 ABGs were taken during each desaturation/resaturation sequence. The hypoxic exposures were conducted under 3 different conditions: normothermia/ vasoconstriction; mild hypothermia/vasodilatation; mild hypothermia/ vasoconstriction by use of peripheral and core cooling and nitroglycerine infusion [ref]. The arterial oxygen saturation values were linearly interpolated at 1 Hz to match the pulse oximeter sampling frequency, generating an idealized arterial saturation curve. This curve was compared to the pulse oximeter saturation curve. An autocorrelation method was used to determine the amount of shift along the x-axis necessary for maximum superimposition of the S_pO_2 upon the S_aO_2 curves.
Results: Delays are shown below (table).

Mean delay in seconds [range] between S_aO_2 and S_pO_2

	Head Oximeters			Finger Oximeters			
Condition	Nellcor Fore-head	Masimo Ear	Both	Nellcor	Masimo	Novame-trix	All
Normothermia / vasoconstriction	9 [5-16]	11 [6-22]	11	64 [41-115]	68 [49-109]	66 [40-136]	66
Mild hypothermia / vasodilatation	12 [5-23]	14 [9-28]	13	169 [59-241]	174 [49-295]	173 [50-251]	172
Mild hypothermia / vasoconstriction	13 [6-19]	16 [6-28]	14	154 [72-264]	154 [66-242]	148 [66-231]	152

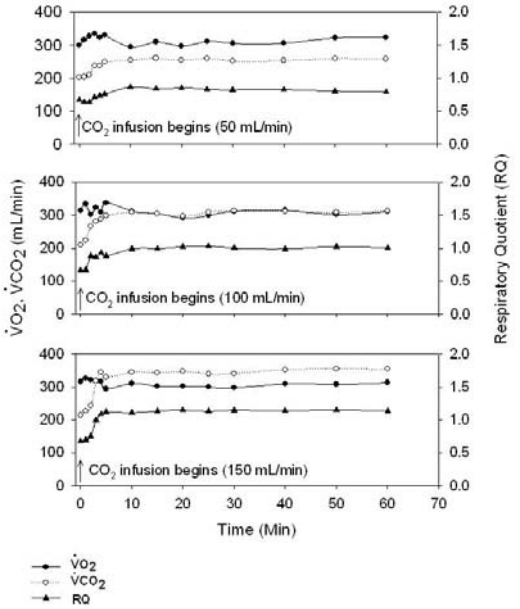
Discussion: In relation to the true S_aO_2 the forehead and ear oximeters consistently showed a small delay under all conditions. In contrast, the finger pulse oximeters exhibited a much greater degree of delay (range 40 - 295s). During normothermia/vasoconstriction the mean delay was 66s and was further extended to 152s in the presence of mild hypothermia. The increased delay of 172s during vasodilatation is the result of a shorter response in the rate of arterial oxygen desaturation which was detected by the head oximeters but not the finger oximeters. Thus the relative delay of the finger oximeters is increased. The delay of finger oximeters under states of altered perfusion may be considered clinically significant.
Reference: Anaesthesia 60:65-71 2005

S-143.

BYMIXER-FLOW MEASUREMENT OF O2 UPTAKE (VO_2) AND CO_2 ELIMINATION (VCO_2) CAN RAPIDLY DETECT METABOLIC DERANGEMENT DURING SPONTANEOUS VENTILATION (SV) IN THE ANESTHESIA CIRCLE CIRCUIT

AUTHORS: J. M. Cimbalo, H. C. Howard, P. H. Breen, **A. Rosenbaum**;
AFFILIATION: University of California Irvine Medical Center, Orange, CA.

Introduction: Fast response, online metabolic gas exchange measurement during anesthesia may allow detection of critical events noninvasively. We have previously reported[1] the rapid response of the bymixer[2]-flow measurements of VO_2 and VCO_2 in an open system during controlled ventilation, using the Haldane transformation. However, SV in the circle circuit presents additional technical challenges of variable FRC[3], low gas flow, and changes in humidity and heat. Accordingly, in a bench setup of SV in the circle circuit, we tested whether the bymixer-flow system can responsively detect changes in VO_2 and VCO_2 when anaerobic metabolism is simulated by infusion.
Methods: One lung of a mechanical lung simulator was connected in a circular manner to an airtight chamber, composed of a wickless burner, supplied by an ethanol syringe pump. The lung was connected to a semi-closed anesthesia machine (SV mode) with total flow of 2 L/min (FiO_2=0.5). SV was achieved by separately ventilation of the second lung which actuated the first lung with a coupling clip. PEEP was intermittently changed to create variable FRC, typical of spontaneous breathing[3]. An inspiratory and expiratory bymixer were incorporated into the circle circuit limbs. A fast response humidity sensor provided rapid STPD corrections. After baseline measurements (time zero), CO_2 was infused at rates of 50, 100 and 150 mL/min (RQ of 0.83, 1.0 and 1.16, respectively).
Results: The figure demonstrates the changes in VO_2, VCO_2 and respiratory quotient ($RQ=VCO_2/VO_2$) over 60 minutes. VCO_2 and RQ showed an immediate increase after CO_2 infusion. A new steady state was reached after 10 minutes. VO_2 remained relatively stable.
Discussion: Anaerobic metabolism during anesthesia is a critical event, requiring early detection and treatment. We have demonstrated that the bymixer-flow measurement can rapidly detect increasing VCO_2 and RQ in a bench model, even under the extreme conditions of spontaneous breathing in the anesthesia circle circuit. Surprisingly, VO_2 remained relatively stable despite the disruption of steady state (traditionally required for the Haldane transformation principle).
References: 1. Anesthesiology 2004; 100: 1427-37. 2. Anesth Analg 2003; 97: 1414-20. 3. J Appl Physiol 1973; 34: 670-676.

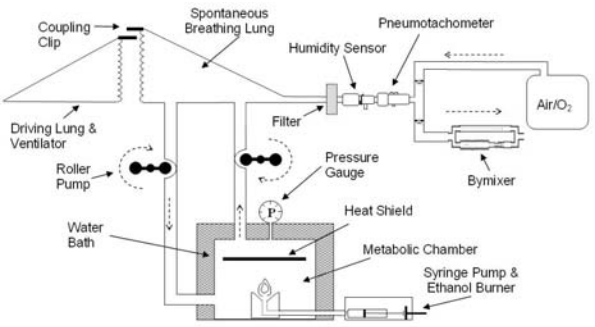


S-144.

ACCURATE MEASUREMENT OF O_2 UPTAKE AND CO_2 ELIMINATION DURING SPONTANEOUS BREATHING WITH VARIABLE FUNCTIONAL RESIDUAL CAPACITY (FRC)

AUTHORS: **A. Rosenbaum**, J. M. Cimbalo, H. C. Howard, P. H. Breen;
AFFILIATION: University of California Irvine Medical Center, Orange, CA.

Introduction: Preoperative evaluation is a cornerstone of anesthesia practice. The bed-side preoperative metabolic gas exchange measurement of O_2 uptake (VO_2) will provide a baseline to compare values obtained during anesthesia. Moreover, the detection of the anaerobic threshold, by measuring VO_2 and VCO_2 during exercise, may determine cardio-pulmonary anesthesia risk[1]. We have developed a new device, composed of a mixing chamber (bymixer)[2], sensitive flow-meter, and fast response humidity sensor, to measure VO_2 and VCO_2 in the awake patient. However, a major obstacle is variable FRC during spontaneous breathing[3], which can significantly degrade measurement of VO_2. Unstable FRC may also disrupt N_2 balance, required for the Haldane transformation.
Methods: We designed a bench setup (Figure) composed of a mechanical lung connected to an airtight chamber with an ethanol burner. The chamber was supplied by ethanol infusion that produced VCO_2 of 33.34-333.50 and VO_2 of 50.02-500.25 mL/min. The driving lung was ventilated with a mechanical ventilator. A coupling clip, connected to the driving lung, actuated the second lung to achieve a spontaneous breathing pattern (negative pressure inspiration). The device was composed in a Y-shape design, with a bymixer in the expiratory arm and one-way valves directing flow. The humidity sensor and pneumotachometer cuvette were placed at the airway opening. The system was supplied with 35% O_2. Variable FRC was achieved by changing PEEP to the driving lung. We designed a computer program, using the Haldane transformation, for data calculations.
Results: Average percent error (±SD) for VO_2 and VCO_2 were 1.47 ± 3.16% and -1.40±3.18%, respectively. Linear regression analysis showed excellent correlation; slope, Y-intercept, and R^2 were 1.01, 0.18, and 0.996 for VO_2 and 0.97, 2.23 and 0.996 for VCO_2, respectively. The ratio limit of agreements (mean ± 1.96 SD) were 1.01 ± 0.06 for VO_2 and 0.99±0.06 for VCO_2. 95% of all points lay within these limits.
Discussion: We introduce, for the first time, a portable, low-cost, accurate device for the measurement of metabolic gas exchange during spontaneous breathing, taking into account unstable FRC patterns. Our system demonstrated high accuracy and precision and can be used for both preoperative baseline and operative risk determination.
References: 1. Chest 1999; 116: 355-362. 2. Anesthesiology 2004; 100: 1427-37. 3. J Appl Physiol 1973; 34: 670-676.



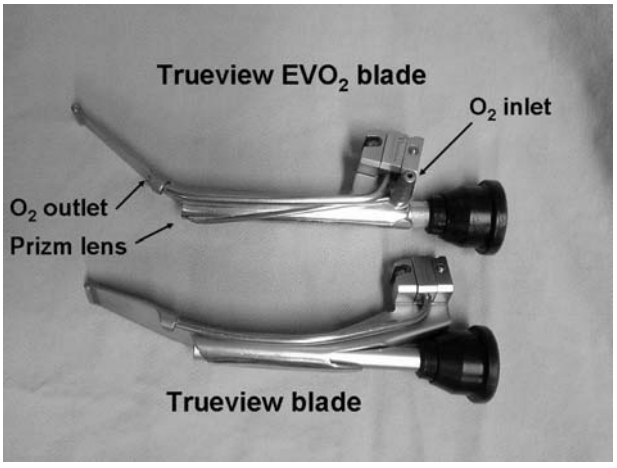
S-145.

TRUVIEW EVO_2® BLADE PREVENTS HYPOXIA IN SITUATION OF ENDTRACHEAL INTUBATION

AUTHORS: **Y. Tsujimoto**, S. Yamada, N. Matsuoka, M. Shizukuishi, I. Fukuda, T. Kazama;
AFFILIATION: National Defense Medical College, Tokorozawa, Saitama, Japan.

Introduction;
The optical system of the Truview® blade (Truephatek, Israel) improved laryngeal view grade. New type of Truview® blade (Truview EVO_2®) has prizm lens and O_2 outlet at blade tip. Prizm lens may facilitate intubation in situations of difficult intubation. O_2 outlet may be useful for preventing hypoxia. The aim of this study is to investigate the relations between laryngeal view grade and degree of oxygenation during endotrachel intubation using Truview EVO_2® blade.
Methods;
After approval of the institutional review board and written informed consent was obtained, 20 patients (age 20-70 years; weight 46-91 kg) undergoing routine minor surgery were enrolled in our study. After induction of propofol all volunteers were inserted Trueview EVO_2® blade with O_2 10 L/min. The laryngeal view of grade was assessed by the anesthesiologists. Cormack and Lehane classification of (I or II) patients were Group A. (IIIor IV) patients were Group B. After the best grade of laryngeal view achieved, PaO_2 were measured every 30 sec for 5 min until endotracheal intubation. If SpO_2 became 94 or below, measurement stopped and patients were reoxygenated. Data are presented as means±SD. Data were analyzed using Man-Whiney U test or two-way analysis of variance followed by post hoc comparisons by Bonferroni. $P<0.05$ was considered statistically significant.
Results;
Mean patients age, height and weight were not significantly different between the two groups. PaO_2 started decreasing after Trueview EVO_2® blade insertion in both groups. 3 patients in GroupB were eliminated because SpO_2 were 94 or below. ΔPaO_2 in Group A is significantly higher than that of Group B from 4 min or later after insertion(-53.4±8.57 vs -97.4±10.8;$p<0.05$)

Discussion;
In this study the Trueview EVO_2® blade prevents hypoxia among 5 min in situation of endotracheal intubation. New trueview blade might potentially be attributed to patients' safety.



S-146.

COMPARISON OF THE EAR AND THE CHEST PROBE AT TRANSCUTANEOUS MEASUREMENTS OF CARBON DIOXIDE TENSION DURING GENERAL ANESTHESIA

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Introduction: The measurement of transcutaneous carbon dioxide tension (PtcCO2) allows a useful estimation of PaCO2. Very little has been published, however, about the differences of PtcCO2 measurement at various body sites. The aim of this study was to evaluate the differences of PtcCO2 measurements at different body sites during general anesthesia in adult patients.
Methods: With approval of the ethical committee and informed consent from each subject, 68 (ASA 1 or 2) adult patients, aged 18 to 80 years, undergoing elective abdominal surgery under sevoflurane anesthesia were studied. The heated (42 degrees centigrade) miniaturized PtcCO2/SpO2 single ear sensor (TOSCA monitor; Linde Medical Sensors, Switzerland) was applied to the ear lobe with a special low ear clip and to the chest with a special attachment ring. Endo-tidal CO2 tension (PetCO2) measurements were compared with the values displayed by a standard capnometry (AS5; Datex-Ohmeda, Finland). PaCO2 values were measured by a calibrate blood-gas analyzer (288Blood Gas System; Ciba-Corning, USA). The simultaneously-obtained PtcCO2, PetCO2 and PaCO2 values were compared by linear regression analysis and Bland-Altman bias analysis.
Results: A total of 265 paired measurements were correlated. No skin lesions occurred. PtcCO2 were highly correlated with PaCO2 (PtcCO2 TOSCA ear = 1.27 * PaCO2 + 0.12, $p < 0.01$; PtcCO2 TOSCA chest = 0.88 * PaCO2 + 0.12, $p < 0.01$; PetCO2 = 1.46 * PaCO2 + 0.08, $p < 0.01$) in the PaCO2 range of 2.9 to 8.7 kPa. The bias (mean difference between values) and precision (standard deviation of bias) are shown in the Table.
Conclusion: Although the blood gas analysis is a gold standard for evaluation of ventilation, PtcCO2 monitor is a helpful add-on to non-invasive respiratory monitoring, even in adult patients. The PtcCO2 measurements at the ear lobe showed relatively high values compared with those at the chest.

Bias (mean difference between valures) and Presition (standard deviation of bias)

	bias	presition
PtcCO2 (TOSCA ear) - PaCO2; (kPa)	0.82	0.76
PtcCO2 (TOSCA chest) - PaCO2; (kPa)	0.52	0.64
PtcCO2 (TOSCA chest) - PaCO2; (kPa)	-0.29	0.61

S-147.

EVALUATION OF A NEW COMBINED SPO2/PTCCO2 EAR SENSOR (TOSCA) FOR VENTILATORY WEANING IN THE POSTOPERATIVE MANAGEMENT OF THE CARDIAC ICU PATIENT

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AFFILIATION: University of Arizona, Tucson, AZ.

INTRODUCTION: A recently introduced monitor, the TOSCA (Linde Medical Sensors AG, Basel, Switzerland), combines pulse oximetry (SpO_2) and transcutaneous carbon dioxide ($PtcCO_2$) into a heated ear sensor. To determine the potential reliability of the Tosca as a monitor of ventilation adequacy, we compared $PtcCO_2$ to arterial PCO_2 ($PaCO_2$) at sensor temperatures of 42°C and 44°C in postoperative cardiac surgery patients in the ICU.
METHODS: Following IRB approval, adult postcardiac surgery patients were monitored from the time of arrival in the ICU through the time of weaning from mechanical ventilation and extubation. In addition to routine monitoring, the Tosca sensor was placed on the patient's ear. Arterial blood gases (ABG's) were drawn as per ICU weaning protocol at which time the $PaCO_2$ and $PtcCO_2$ were recorded simultaneously. The mean and standard deviation of the $PaCO_2$ and the $PtcCO_2$ in addition to the bias and precision (SD of error) of the $PtcCO_2$ were calculated.
RESULTS: A total of 12 patients (4 males) were enrolled. The mean ($\pm$ SD) age and weight was 59.6 $\pm$ 14.8 years and 72.8 $\pm$ 17.7 kgs, respectively. All patients had a cardiac procedure, which included cardiopulmonary bypass (CPB).The procedures ranged from simple coronary bypass to heart transplantation or implantation of a total artificial heart, (CardioWest). A total of 49 ABG samples were taken (4.1 $\pm$ 1.4 samples per subject). Note there is no significant difference in performance regardless of the sensor temperature. The results are in the table below.
DISCUSSION: In this difficult to monitor patient population we found that the heated ear sensor had a close correlation between the $PaCO_2$ and the $PtcCO_2$ during all phases of the weaning process. Further study is needed to determine the value of this monitor in the management and weaning of mechanical ventilation in ICU patients.

Table 1. PaCO2 and PtcCO2 data including bias and precision.

	$PaCO_2$	$PtcCO_2$	$PtcCO_2$ bias	$PtcCO_2$ bias (44°C)	$PtcCO_2$ bias (42°C)
Mean	38.2	39.86	-1.6	-1.1	-1.8
Standard Deviation	7.31	8	2.8	2.7	2.9

S-148.

IMPACT OF MOTION AND LOW PERFUSION ON THE PERFORMANCE OF THREE NEW GENERATION PULSE OXIMETERS FOR SPO_2 AND PULSE RATE IN VOLUNTEERS

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AFFILIATION: [1]LBVAHS, Long Beach, CA, [2]University of California Irvine, Medical Center & LBVAHS, Long Beach, CA.

INTRODUCTION: The problem of accuracy of Pulse Oximeters (PO) during patient movement or in the presence of low perfusion states still persists. New generation PO manufacturers claim superior performance, hence we undertook the following study to compare three brands of POs during motion and low perfusion in volunteers.
METHODS: Following informed consent, 11 ASA-I volunteers (5F & 6M) between 18 & 40 were enrolled. POs tested were Masimo Radical V4.5, Nellcor N595 V3100 and Datex-Ohmeda TruSat. Sensors were randomly placed on index, middle, and ring fingers of left hand (test) and right hand (control) and optically shielded. The room temperature was 16-18ºC to reduce peripheral perfusion. A TOSCA ($PtcCo_2$ + Masimo Radical PO) placed on the right ear served as the control during hypoxia. During separate room air and desaturation (employing a disposable re-breathing circuit with a CO_2 abosorber to a SpO_2 of 75% on control PO and the subject was then given 100% oxygen until the control SpO_2 reached 100%) events, motion consisted of random tapping (with sensor disconnect / reconnect) and random rubbing. Motions were machine generated (MG) and self generated (SG). The sensors were rotated and tested on all three fingers during the room air events. A computer recorded SpO_2 & pulse rate (PR) data. Parameters analyzed were % of time when SpO_2 was off by 7% (off 7) and PR was off by 10% (off 10), performance index (PI) (Defined as % of time when SpO_2 was within 7% of control and PR was within 10% of control), and zero out (defined as % of time when the POs zero out SpO_2 and/or PR). A "Zero Out" is defined as when the monitor either displays "--" or a zero. ANOVA and Fischer's post hoc test was performed with $p<0.05$ considered statistically significant.
RESULTS: There were a total of 176 motion tests; 44 with desaturations and 132 on room air. For oximeters performance, see Table.

Off 7% (SpO2), Off 10% (PR), Zero Out and PI during MG and SG

Device		SpO_2			Pulse Rate		
Pulse Oximeter		Off 7 (%)	Performance Index %	Zero Out (%) (SpO_2)	Off 10 (%)	Performance Index (%)	Zero Out (%)(PR)
Masimo Radical (v4.5)	MG	1.0	99.0	0	5.8	94.2	0
Masimo Radical (v4.5)	SG	1.0	99.0	0	14.1	85.9	0
Nellcor N-595 (v3100)	MG	13.8*	84.8	1.4 *	25.3*	69.6	4.8 *
Nellcor N-595 (v3100)	SG	16.3*	79.0	4.7 *	25.8*	57.4	16.8 *
Datex-Ohmeda TruSat	MG	10.8*	89.2	0	17.8*	82.1	.1
Datex-Ohmeda TruSat	SG	7.5*	92.0	0.5	21.6*	77.9	0.5

p= <0.01 vs. Masimo Radical

CONCLUSION: Masimo Radical performed the best in this vigorous testing schedule for both SpO_2 and PR followed by Datex-Ohmeda TruSat and then Nellcor N-595. Furthermore, Nellcor N-595 performed inferiorly for detection of PR compared to SpO_2.

S-149.

INTUBATION USING THE GLIDESCOPE®: BLADE POSITIONING AND THE GRADE OF LARYNGOSCOPY ARE DETERMINING FACTORS FOR THE MOST OPTIMAL CONFIGURATION OF THE ETT

AUTHORS: **M. Dupanovic**, R. Jensen, T. V. Nguyen, D. Becks;
AFFILIATION: University of Rochester, NY, Rochester, NY.

Introduction: The GlideScope Video Laryngoscope® (GSVL)1 is an intubation device with a plastic blade angled 600 upwards. A video camera in the undersurface of the blade allows easy visualization of the glottic structures. A grade I view with GSVL laryngoscopy (GL), however, does not guarantee an easy intubation due to potential difficulty of inserting the ETT through the glottis and into the trachea. The manufacturer recommends a 600 angle of the tip of the styleted ETT to match the angle of the GSVL blade.1 Doyle recommends a 900 bend to help direct the ETT sufficiently anteriorly to enter the glottis.2 The purpose of this study is to determine the best conditions for a smooth intubation using the GSVL by utilizing an airway model.
Methods: To simulate different size adults the tip of the blade was positioned at four stations: (1) 2 cm proximal to the epiglottis, (2) at the tip of the epiglottis, (3) in the vallecula, (4) covering the epiglottis. 600 and 900 configurations of the styleted ETT were used for intubation. The images of the intubator's hands holding the GSVL blade and the ETT were recorded using a camcorder. The airway images, a grade of laryngoscopy and insertion of the ETT through the glottis and into the trachea were recorded from the GSVL camera. These two videos were then reviewed together.
Results: The smoothest intubation was performed at station 3 using a 600 angle of the ETT. Stations 3 and 4 provided a grade IIa3 view. Lifting the tongue at station 3 provided a grade I view offering more space for insertion of the ETT. Despite the adequate view at station 4, the blade underneath the epiglottis decreased the available space in the hypopharynx and limited maneuverability of the ETT. Positioning of the blade at stations 1 and 2 provided visualization of the arytenoids. The glottis was visualized only by levering the blade, which significantly decreased the room available in the pharynx to pass the ETT.
Discussion: The valecullar position of the GSVL blade and the grade IIa view were the most optimal for intubation using the GSVL in this study. The alignment of the camera/blade axis with the axis of the larynx allowed adequate visualization of the glottis and adequate room for an easy intubation using the matching 600 angle of the ETT. The grade I view with the blade positioned in the vallecula, while lifting the tongue, should provide conditions for intubation using an even less acute angle of the ETT.
These findings may warrant further investigation on human subjects.
References:
1. GlideScope®, System Operation & Service Manual (Saturn Biomedical Systems INC, Burnaby, BC, Canada).
2. Can J Anesth. 2004; 51:95.
3. Anaesthesia 1998; 53: 1041-4.

S-150.

COMPARATIVE EVALUATION OF BLOOD PRESSURE MEASUREMENTS USING NOVEL BPCARD TECHNOLOGY VS HP OSCILLOMETRIC TECHNOLOGY

AUTHORS: **M. De Valdenebro**, M. Kinsky, D. S. Prough, S. J. Funston, G. C. Kramer;
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Introduction: Most automated Non-Invasive Blood Pressure (NIBP) devices rely on the detection of pressure waves caused by blood volume fluctuations through an artery transiently occluded by an inflatable cuff (the oscillometric method). A novel NIBP apparatus (BPCard, QRS Diagnostics) can be used as a PCMCIA card in a PDA (Pocket PC) or laptop PC. BPCard uses microphones placed over the brachial artery to detect sound waves created by small arteries snapping open under varying cuff pressures. We compared the BPCard and our standard OR NIBP device Hewlett Packard Component Monitoring System Model 1046A Oscillometric Module M1008B (HP) to direct arterial pressure via radial artery cannulation.
Methods: Thirteen patients underwent NIBP and invasive arterial monitoring before, during and shortly after induction of general anesthesia. All patients had a radial arterial catheter that was properly damped and balanced, and a non-invasive cuff (BPCard or HP oscillometric device) placed on each upper extremity. The non-invasive cuffs were activated simultaneously, and transducer pressures were recorded when the cuffs finished cycling. The resultant data were recorded and evaluated using regression analysis supplemented by Bland-Altman plots with ± 10 mmHg inclusion guidelines set as an arbitrary measure of clinically acceptable accuracy.
Results: 13 patients produced 57 simultaneous BPCard vs transducer measurements and 52 HP vs transducer measurements. Resulting data form the BPCard or HP were compared to the corresponding transduced pressure recording as follows:

	BPCard Systolic	HP Systolic	BPCard Diastolic	HP Diastolic
Regression r^2 value	.8456	.6680	.7601	.3988
% of values ± 10 mm Hg of mean Δ	60%	54%	86%	52%

Discussion: We conclude that the BPCard non-invasive blood pressure monitor exhibits performance as good as or better than can be achieved with traditional oscillometric NIBPs. Hybrid PDA/ medical monitors using novel measuring algorithms may offer anesthesiologists a future tool for reliable, portable blood pressure monitoring. Superior portability combined with decreased interference from environmental factors suggest that the BPCard technology has promise and should be further evaluated as a method of routine non- invasive blood pressure monitoring.

S-151.

ACCURACY OF THE CONTINUOUS CARDIAC OUTPUT MEASUREMENT BY PULSECOTM AT A DIFFERENCE OF INSERTION SITE OF A RADIAL ARTERY AND DORSALIS PEDIS ARTERY

AUTHORS: **T. Nakagaki**, I. Fukuda, T. Ogura, R. Yonamine, Y. Tsujimoto, T. Kazama;
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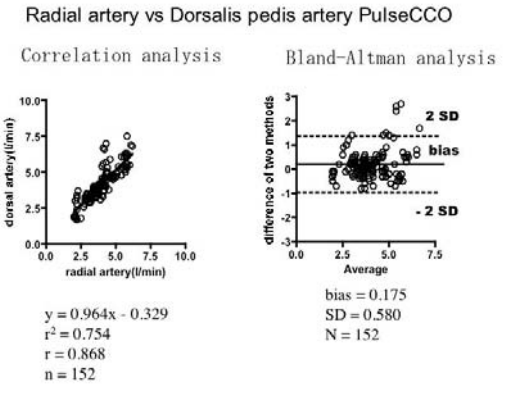
BACKGROUND: PulseCOTM (PulseCO Hemodynamic Monitor, LiDCO Co., London, England) is a new less invasive cardiac output monitor, which can measure cardiac output continuously from arterial pressure waveform. It is reported that PulseCOTM is high in accuracy under stable hemodynamic, but measurement site has not been determined and compared with different site. In this study, we evaluated cardiac output measured by PulseCOTM waveform which obtained from radial artery and dorsalis pedis artery continuously (PulseCCO) during perioperative state. We examined the accuracy and the availability of PulseCCO, which were compared with intermittent cardiac output (ICO) by standard thermodilution techniques with a pulmonary artery catheter.
METHODS: Eleven ASA physical status 1-2 patients undergoing abdominal surgery were involved in this study.
After the induction of anesthesia, arterial catheter was inserted into the left radial artery and left dorsalis pedis artery. Catheters were connected to each PulseCOTM systems (radial PulseCCO obtained radial arterial waveform and dorsal PulseCCO obtained dorsalis pedis arterial waveform) and calculated cardiac output from arterial waveform. Pulmonary artery catheter was inserted via the right internal jugular vein and was connected to cardiac output monitor, Vigilance CEDV monitor, and measured intermittent thermodilution cardiac output. Each PulseCOTM was calibrated by cardiac output measured with ICO technique when hemodynamics was stable. We compared with radial PulseCO, dorsal PulseCO and ICO. Correlation analysis and Bland-Altman analysis were used for statistical comparison.
RESULTS: Correlation analysis between radial PulseCCO and ICO gave an r = 0.830.
Bland-Altman analysis resulted in a bias of -0.185 L/min and confidence interval (bias ± 2SD) of -1.539 L/min to 1.169 L/min.
Correlation analysis between dorsal PulseCCO and ICO gave an r = 0.847.
Bland-Altman analysis resulted in a bias of -0.035 L/min and confidence interval (bias ± 2SD) of -1.350 L/min to 1.280 L/min.
Correlation analysis between radial and dorsal PulseCCO gave an r = 0.868.
Bland-Altman analysis resulted in a bias of 0.175 L/min and confidence interval (bias ± 2SD) of -0.962 L/min to 1.312 L/min. (Figure)
CONCLUSIONS: We evaluated PulseCCO in comparison with different site of artery. The results demonstrated that radial and dorsalis pedis artery had close correlation with ICO.
It was suggested that PulseCOTM was available as continuous cardiac output monitoring during perioperative state with independence of the measurement site.



S-152.

QUANTIFYING PULSE OXIMETER PERFORMANCE WITH CORRELATION COEFFICIENT AND LINEAR REGRESSION

AUTHORS: **K. Ikeda**, D. B. MacLeod, J. C. Keifer;
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Introduction: Techniques of waveform analysis can be applied to the oxygen saturation waveforms derived from pulse oximeters (S_pO_2) and arterial blood (S_aO_2). Four parameters describe how closely the S_pO_2 follows the S_aO_2: delay, linear dependence, ratio and offset. The equation describing the relationship is:
$Y = mX + b$ [where $Y = S_pO_2$, $X = S_aO_2$, $m = S_pO_2 / S_aO_2$, b = measurement offset]
Ideally the S_pO_2 would equal the S_aO_2, with ratio = 1 and offset = 0. We used this equation to compare S_aO_2 to S_pO_2 from different sites under different conditions.
Methods: With IRB approval 10 subjects completed the study. The subjects inhaled mixture of 11% oxygen in nitrogen for 3 minutes during which continuous pulse oximeter saturation data was collected from pulse oximeter sites (forehead, ear, 3 fingers). 16 ABGs were taken during each desaturation/resaturation sequence. The hypoxic exposures were conducted under 3 different conditions: normothermia/ vasoconstriction; mild hypothermia/vasodilatation; mild hypothermia/ vasoconstriction. The arterial oxygen saturation values were linearly interpolated at 1 Hz to match the pulse oximeter sampling frequency, generating an idealized arterial saturation curve. An autocorrelation method was used to determine the amount of shift along the x-axis necessary for maximum superimposition of the S_pO_2 upon the S_aO_2 curves, representing delay. The correlation coefficient, calculated with the autocorrelation method, was used to determine linear dependence.

Results: Correlation coefficient > 0.9 for all oximeters (adjusted for delay). Results of delay, ratio and offset shown in table. A negative offset connotes that the S_pO_2 read below the S_aO_2.

Waveform Analysis: Delay (s), **Ratio**, *Offset (%)*							
	Head Oximeters			Finger Oximeters			
Condition	Nellcor Forehead	Masimo Ear	Both	Nellcor	Masimo	Novametrix	All
Normothermia / vasoconstriction	9	11	11	64	68	66	66
	1.05	0.87	0.96	0.86	0.92	0.76	0.85
	-5	13	4	14	9	24	16
Hypothermia / vasodilatation	12	14	13	169	174	173	172
	1.07	0.96	1.01	0.96	0.96	0.76	0.89
	-7	5	-1	4	4	23	10
Hypothermia / vasoconstriction	13	16	16	154	154	148	152
	1.03	0.88	0.95	0.91	0.93	0.77	0.87
	-3	10	4	9	7	23	13

Discussion: The high correlation coefficient confirmed that the S_pO_2 was linearly dependent upon S_aO_2, indicating that oximeters accurately displayed the extent and duration of the hypoxic episode, albeit delayed more so in the finger sensors than the head sensors. The ratio of the head sensors was closer to unity, showing that the S_pO_2 of the head sensors tracked the S_aO_2 more closely. The offset of the head sensors was consistently smaller than the finger sensors. In summary, the head sensors provided more accurate estimate of the S_aO_2 than the finger sensors.

S-153.

THE ROLE OF CENTRAL VENOUS PRESSURE MONITORING DURING RIGHT HEPATECTOMY FOR FOR LIVING LIVER DONATION

AUTHORS: **M. Behrends**, J. Feiner, J. P. Roberts, N. Ascher, C. Niemann;
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Introduction: The aim of the study was to investigate the role of central venous pressure (CVP) monitoring during hepatectomy. It has been postulated that low CVP during hepatic surgery reduces blood loss. However, most studies combined different hepatic surgeries and surgical techniques, introducing confounding variables. Living right liver lobe donation is a standardized procedure and always performed by the same two surgeons at our institution. Hence, comparison of CVP use in this population is not likely to be influenced by surgical variables.
Methods: We reviewed all charts of living right lobe liver donors from May 2002 to August. During this period 51 right lobe donor hepatectomies were performed. Forty three charts (n=28 CVP, n=15 no CVP) were available for review. Intra-operative parameters (operating room (OR) time, estimated blood loss (EBL), fluid administration) were collected as well for the first 24 hr after surgery.
Results: Patient demographics were not different between groups. There was also no difference in OR time (357±75 (no CVP) vs. 373±61 min). EBL was less in the no CVP group (363±180 vs. 543±352 ml, p=0.05). There was a trend for less intravenous crystalloid administration in the no CVP group (2023±806 vs. 2791±1308 ml, p=0.08). Intra-operative urine output was not different between groups. The length of PACU stay was identical between groups and fluid administration as well as urine output was not different during the PACU stay. Similarly, there were no differences between groups after 24 hr.
Discussion: CVP monitoring may not be necessary for right lobe liver donation in experienced centers. Furthermore, the fluid restriction necessary to produce low CVP for hepatectomy does not require invasive monitoring. The cost of CVP monitoring, including equipment, OR time and postoperative CXR, may not be justified in this setting.

S-154.

EVALUATION OF SAFETY AND ACCURACY OF THE T-LINE™ TENSYMETER (CONTINUOUS NON-INVASIVE BLOOD PRESSURE MANAGEMENT DEVICE) VERSUS CONVENTIONAL INVASIVE RADIAL ARTERY TONOMETRY IN CLINICALLY OBESE SURGICAL PATIENTS

AUTHORS: **R. L. Marcus**, S. Ahmad, R. Glassenberg, P. Fitzgerald;
AFFILIATION: Northwestern University Feinberg School of Medicine, Chicago, IL.

Introduction: Automated, non-invasive BP (NIBP) monitoring (via upper arm cuff) perform poorly in obese patients with large, cone-shaped upper arms. Currently, obese patients are subject to intra-arterial cannulation (A-line) as a reliable alternative. Tensys Medical, Inc., has developed a continuous non-invasive BP management device, the (T-Line™) Tensymeter enabling physicians to circumvent the need for arterial cannulation when frequent blood sampling is unecessary.
Methods: Prospective cohort study to validate and compare T-Line™ systolic, diastolic and mean values to the pressures measured with an intra-arterial catheter in clinically obese patients (B.M.I. > 30 kg/m^2) undergoing surgery requiring intra-arterial catheter placement for blood pressure monitoring. The fidelity of the T-Line™ versus the A-Line waveforms were evaluated by plotting segments of data over time and analyzing the tracings and major "fidelity" markers, i.e. dichrotic notch to demonstrate that correlation. Informed consent was obtained. The T-Line™ was positioned on the subject's wrist opposite the radial A-line. Continuous, real-time BP data was recorded simultaneously from both the T-Line™ and the A-line using an L-Box signal splitter allowing both signals to be simultaneously recorded without interruption to standard monitoring. Data was stored in a Tensys laptop computer for analysis.

Results: Nine (9) female patients have been enrolled to date. Total recorded BP time was 1079 minutes (120 min per patient). The mean error and standard deviation of systolic, diastolic and mean BP is shown in Table 1.

Table. 1

	Aggregate Statistics		
	Systolic 10-beat Average Error	Diastolic 10-beat Average Error	Mean 10-beat Average Error
Mean	-1.6	4.2	3.3
STD	7.6	8.1	7.5
% within 5	46.0%	39.2%	44.6%
% within 10	71.1%	68.7%	77.0%
% within 15	83.2%	83.5%	88.4%

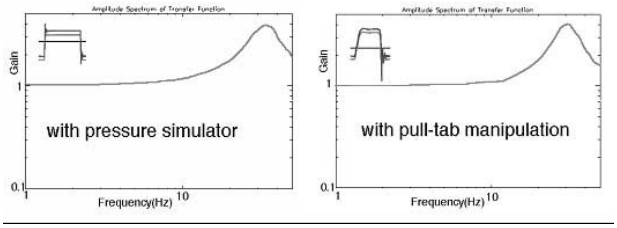
Discussion The T-Line™ provides an arterial waveform, systolic, diastolic and mean blood pressures that compare favorably to that of an invasive A-line. Its availability may circumvent the need for arterial cannulation in obese patients. Our data confirm excellent correlation between the T-line™ and A-line within a challenging patient population.

S-155.

RECOMMENDATION OF A NEW CLINICAL IMPULSE RESPONSE ANALYSIS FOR CATHETER CALIBRATION - LET'S EVALUATE YOUR PRESSURE MONITORING LINES IN THE OPERATING ROOM JUST AFTER PRIMING

AUTHORS: **H. Watanabe**[1], S. Yagi[2], A. Namiki[1];
AFFILIATION: [1]Sapporo Medical University, Sapporo, Japan, [2]Mesisei University, Tokyo, Japan.

Introduction: The dynamic responses of pressure monitoring lines are absolutely important to display the invasive blood pressure. The damping coefficient and natural frequency have been used clinically to evaluate the dynamic responses of pressure monitoring lines. But we demonstrated the defects of these parameters, and recommended drawing frequency response curves with our step response analysis.1) Recently we investigated more sophisticated method to drawing frequency response curves in the operating room even just after circuit priming. We will recommend our new clinical impulse response analysis method.
Methods: After priming of pressure monitoring line with transducer and flush device, additional transducer with sterilized three-way stopcock was connected to the distal end. Furthermore the pressure-releasing tube was connected near the proximal transducer. Then input a square wave into the line with the flush device's pull-tab manipulation, proximal (input) and distal (output) pressure waves were recorded with pressure amplifiers and then stored in the personal computer as text-file data. Frequency response curves (amplitude and phase) were displayed after analysis with our original computer program.
Results: Frequency response curves with pull-tab manipulation had similar results with pressure simulator. Amplitude frequency response curves were drawn like this figure. Input and output pressure wave traces are shown in upper left. These two curves were almost the same. Phase frequency response curves had the same result as amplitude curves.
Discussion: Our new clinical impulse response analysis can be used in the operating room, keeping sterilized condition even just after priming of pressure monitoring lines. We need only a personal computer, 2 channeled pressure amplifier and flush device manipulation. Our analyzing software is now provided through Becton and Dickinson Japan. Please contact to BD in your country.
Reference: 1) Watanabe H, et al. Eur J Anaesthesiol 2005; 22: Suppl 34, 20-21



S-156.

CENTRAL VENOUS CANNULATION- A COMPARISON OF 3 METHODS TO CONFIRM VENEPUNCTURE

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Introduction: Arterial injury at the time of central venous cannulation can lead to significant morbidity and mortality (1). Key to avoiding this complication is recognition of arterial puncture prior to vessel dilation (2). Tests to diagnose arterial puncture are not routinely practised (3). Ultrasound guided techniques do not eliminate the risk of inadvertent arterial puncture (4). Blood gas measurement, manometry and co-oximetery were compared as indicators of venepuncture or inadvertent arterial puncture.
Methods: Seventy two adult patients requiring central venous access were studied. All cannulations were performed in the operating room. Anesthesiologists chose between traditional landmark techniques or ultrasound guided techniques. Following perceived venepuncture and prior to guide wire insertion, tests to confirm venepuncture were performed sequentially. The cannulation needle was attached to a pressure transducer to observe the pressure waveform and obtain a pressure reading. Blood samples were then drawn for Blood gas analysis (Radiometer ABL 505, Copenhagen) and for hemoglobin oxygen saturation measurement using a co-oximeter [AVOXimeter 1000E, (AVOX systems, Texas)]. Data analysed included time to confirm correct needle location, perceived test difficulty (score 0-10) and complications. Differences between the tests were compared with the Kruskal-Wallis test. Data are median and p values.
Results: Seventy seven venous cannulations were performed in seventy two patients. See Figure 1 for Time (seconds) to vessel confirmation with overall p value of 0.0001 between the 3 tests. Median scores for test difficulty were 2.07, 1.69 and 1.09 respectively for manometry, blood gas analysis and co-oximetry with overall p value of 0.0001 comparing between the tests. Four inadvertent arterial punctures occurred. Three were recognised clinically and one was recognised using all three tests.
Discussion: Although all tests reliably confirmed venepuncture, co-oximetry and manometry were faster and easier to perform than blood gas analysis. Manometry may not be available on site and is technically difficult with an increased risk of needle tip displacement. Blood gas measurement may be limited by its possible location outside the operating room. The Co-oximeter test was the quickest and easiest to perform.
References:
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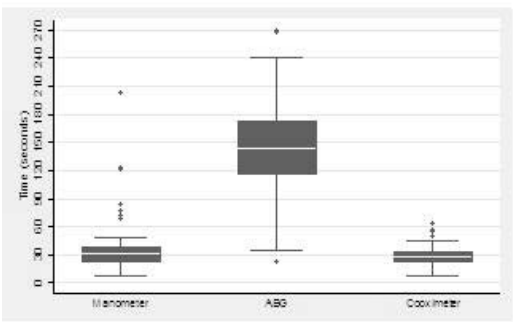
2. J Cardiothorac Vasc Anesth 1995 Aug; 9(4):425-28
3. J Cardiothorac Vasc Anesth. 1997 Dec; 11(7):851-5
4. J Cardiothorac Vasc Anesth. 2002 Oct; 16(5):567-71

Figure 1. Graph of Time to result for the 3 tests



Group	med(Time)	min(Time)	max(Time)	p25(Time)	p75(Time)
ABG	144	22	828	116	172.5
Cooximeter	28	7	63	22	33
Manometer	30.5	8	202	22	37.5

S-157.

COMPARISON BETWEEN ESCO AND INTERMITTENT THERMODILUTION MEASUREMENT OF CARDIAC OUTPUT

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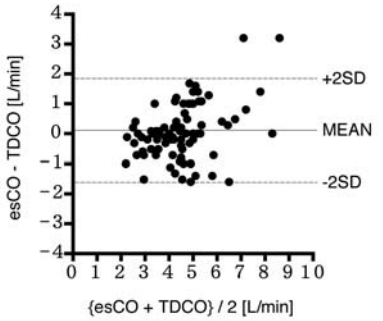
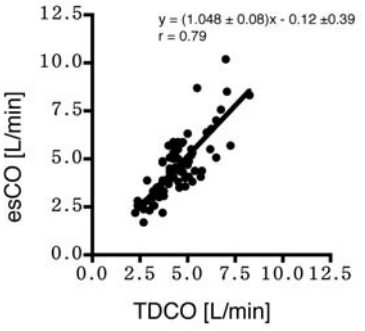
Background. Recently, less invasive methods have become available to measure continuous cardiac output (CCO), but they generally require additional probes or sensors other than the routine clinical monitor. EsCO (OPV-1510; Nihon Kohden, Ltd., Japan) is a new device that uses solely the routine clinical monitor to measure cardiac output (CO). It based on pulse-contour analysis combined with pulse wave transit time (PWTT). The purpose of this study is to compare esCO with intermittent thermodilution cardiac output (TDCO) in the operative period of non-cardiac surgery.
Methods. 15 patients (ASA physical status 2 and 3) without continued arrhythmias were studied. EsCO was computed using electrocardiogram (ECG) monitor, non-invasive blood pressure monitor and pulse-oximetry system. In the operative room, a pulmonary artery catheter was inserted. As esCO consistently requires a reference CO value utilizing another CO measurement system, esCO has been calibrated by using TDCO technique when the vital was steady before operation beginning. When the patient's hemodynamic status was stabilized after operation beginning, both esCO and TDCO measurements ware started. While operating, both sets of data were measured several times in the patient at intervals of one hour or more. Bland-Altman plots and correlation analysis were used for statistical comparison.
Results. 89 paired sets of data were obtained and compared. The difference between esCO and TDCO results (bias) was 0.09+/-0.92 L/min (mean+/-S.D.)(Figure 1), and there was a linear correlation between them (r = 0.79) (Figure 2). The limits of agreement were -1.71 to 1.89 L/min.
Conclusions. EsCO has a close correlation with the TDCO. EsCO method may have potential of being an alternative non-invasive cardiac output trend in the operative period of non-cardiac surgery.





S-158.

INTRAOPERATIVE MONITORING OF MOTOR FUNCTION USING H-REFLEXES AND TRANSCRANIAL MOTOR EVOKED POTENTIALS (TCMEPS)

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Introduction: TcMEP responses are commonly acquired during spinal surgery to monitor and prevent the loss of motor function. However, use of this technique is associated with several shortcomings including significant patient movement during response acquisition thus limiting when responses can be acquired. The acquisition of H-reflex responses causes no patient movement, can be continuous, and has been reported to be very sensitive to changes in spinal cord motor function [1-2]. As a result, their use may complement or replace TcMEPs if acquisition is reliable and correlates to clinical findings. The purpose of this study was to compare the ability to acquire both types of responses in the same patient population.
Methods: As part of routine monitoring protocol, the motor pathway function of eighteen patients undergoing surgery for various spinal disorders, generally scoliosis (n=13), was monitored with TcMEPs. With IRB approval, H-reflex testing was also performed in each patient as part of the clinical protocol. Anesthetic management included the use of muscle relaxants (Vecuronium or Rocuronium) and one MAC equivalent or greater of inhalational anesthetic agents (either Sevoflurane, Desflurane or Isoflurane and nitrous oxide). The degree of muscle relaxation was determined by train-of-four (TOF) stimulation of a peroneal nerve at the fibular head and recording of the resulting responses from the ipsilateral anterior tibialis muscle. Stimulation electrodes for eliciting TcMEPs were placed two centimeters anterior to the international EEG scalp locations C_3 and C_4. TcMEP responses were elicited by multipulse transcranial stimulation (7 pulses, 250 Hz, 400 microsecond duration, 80-160 volts) and recorded from the anterior tibialis and abductor hallucis muscles, bilaterally. Responses were acquired whenever clinically appropriate and feasible (between 3-12 times during surgery). H-reflex responses were continuously elicited throughout surgery by 0.1 Hz single pulse stimulation (1000 microsecond duration, 2-35 milliamps) of the posterior tibial nerves at the popliteal fossae and recorded bilaterally from the medial gastrocnemius muscles. Levels of inhalational agents, blood pressure, and degree of muscle relaxation were recorded each time an attempt was made to acquire TcMEPs.
Results: H-reflex responses were acquired from all 18 patients and were maintained throughout surgery when at least partial relaxation was present (TOF $\geq$ 1/4). TcMEPs could not be acquired from two patients throughout surgery. None of the patients exhibited new post-operative neurological deficits.
Discussion: TcMEPs represent the standard for monitoring motor pathway function. However, the ability to easily, reliably, and unobtrusively acquire H-reflex responses when TcMEPs could not be acquired makes them a potentially useful complement to the acquisition of TcMEPs. Further studies are needed to correlate H-reflex changes and post-operative outcome in order to establish the clinical significance of these responses.
References:
1.Muscle and Nerve 19:1373, 1996
2.The Spine Journal 5:115, 2005

S-159.

COMPARISON AMONG THE AUDITORY EVOKED POTENTIALS INDEX, BISPECTRAL INDEX, AND SPECTRAL EDGE FREQUENCY IN ISOFLURANE ANESTHESIA

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Background: During general anesthesia, many electroencephalographic (EEG) indices are used to monitor hypnotic component. The bispectral index (BIS) and spectral edge frequency (SEF) are derived from cortical EEG, while auditory evoked potentials index (AAI) is the EEG response to auditory stimuli. Present study was performed to compare BIS, SEF and AAI during isoflurane anesthesia.
Methods: After informed consent and institutional approval, 45 patients aged 40 to 70 years for general anesthesia were divided into three groups. After premedication with intramuscular midazolam 0.05 mg/kg and atropine 0.01 mg/kg (maximum 0.5 mg), anesthesia was induced with propofol 2 mg/kg and fentanyl 2 μg/kg. Tracheal intubation was facilitated with 0.15 mg/kg. Anesthesia was maintained with isoflurane and nitrous oxide 4 l/min and oxygen 2 l/min. During surgery, end-tidal isoflurane concentration was kept at 0.5% and 1.0% for 10 min before each measurement. The BIS (A-2000, Aspect Medical, Newton, MA), 90% SEF(SEF90)(pEEG, Draeger, Luebeck, Germany) or AAI (Alaris AEP, Alaris Medical, Hampshire, UK) were measured before induction, at 0.5 and 1.0% isoflurane, at the appearance of verbal response, and at extubation in 15 patients each.
Results: All three indices decreased significantly during isoflurane anesthesia compared to the control before induction, but no differences were observed between isoflurane 0.5% and 1.0%. The BIS and AAI significantly increased at the appearance of verbal command, but the SEF90 did not. The difference between the awake value and the value during anesthesia was the biggest with the AAI.

	Before induction	Isoflurane 0.5%	Isoflurane 1.0%	Verbal response	Extubation
AAI	80 (12)	18 (5)*	16 (4)*	64 (10)$^{+}$	75 (7)$^{+}$
BIS	85 (10)	59 (10)*	51 (9)*	73 (12)$^{+}$	85 (10)$^{+}$
SEF90	24.0 (2.5)	11.5 (2.0)*	12.0 (2.1)*	14.0 (3.2)*	24.5 (2.8)$^{+}$

*: $P < 0.05$ vs. Before induction, $^{+}$: $P < 0.05$ vs. Isoflurane 0.5% and 1.0%
Discussion: The SEF90 is not useful to detect the emergence from anesthesia because it did not increase when patients became awake. The AAI might be more useful than the BIS to differentiate awake and hypnotic state due to the bigger difference between the awake value and the hypnotic value.

S-160.

AEP AND ENTROPY RESPONSES TO MARKED CHANGES IN SEVOFLURANE CONCENTRATION - A CEILING EFFECT?

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Introduction: Level of consciousness monitors can distinguish between consciousness and unconsciousness during anesthesia induction and awakening (1-3). However, this distinction is rarely a problem, especially if muscle relaxation is not in use (4). Instead, we need intra-operatively an indicator of when the anesthetic depth comes close to awakening, or when it is too deep. We investigated the ability of the Alaris fast extracted AEP (AAI) and the GE Healthcare Spectral Entropy algorithm Response Entropy (RE) to detect marked changes in sevoflurane concentration during stable surgery.
Methods: Ten patients of both genders were enrolled after approval from the Regional Ethics Committee. A continuous epidural block was started and evaluated ahead of abdominal surgery. Propofol and remifentanil induced general anesthesia. Sevoflurane and an intermittent target controlled infusion of remifentanil were used for anesthesia maintenance. The concentration was altered between 0.5 to ≥1.5 age adjusted MAC. AEP-index was registered by an Alaris AAI monitor, version 4.2 (software version 1.61) (Danmeter, Odense, Denmark) (1). The recorded data were sampled every second in a sampling program, AAI Graph, version 2.0 for off-line analysis. Spectral Entropy EEG was registered by an Entropy Module in a Datex-Ohmeda S/5 monitor (GE Healthcare, Helsinki, Finland) (3). RE data were sampled every 5th second into Datex-Ohmeda S/5 Collect program, version 4.0. An instant change in sevoflurane concentration of ≥20% was considered as a test situation, undertaken during a period with no surgical stimulation, or during surgical stimulation blocked by the well functioning epidural block. A change in AEP- or Entropy index of ≥20% was considered as a response to the test.
Result: The response rate to 82 defined test situations was 22.0 and 58.5% with the AAI-and RE-monitors, respectively ($P<0.05$, Wilcoxon signed rank test). Indices oscillated constantly and strikingly.
Discussion: The sensitivity of both monitors was low, when considering a change in sevoflurane concentration of ≥20% as clinically interesting, and an index change of ≥20% as a response. A lower response limit might generate false positive response due to the marked oscillations. Alpiger also reported lack of graded response with changing sevoflurane concentrations with the AAI-monitor (5). In the current study most of sevoflurane concentration adjustments were undertaken before the start of intra-operative remifentanil, and in general no remifentanil was used at sevoflurane concentrations >1MAC. Thus, the results were probably not influenced by remifentanil per se. However, even as low as 0.5 MAC sevoflurane might give adequate anesthesia in conjunction with remifentanil and an effective epidural block. Then, the EEG reaction on "more than enough" might not change substantially - a ceiling effect?
References:
1. Acta Anaesthesiol Scand 2000;44:743-8.
2. Anesthesiology 2004;101:34-42.
3. Acta Anaesthesiol Scand 2004;48:145-53.
4. Acta Anaesthesiol Scand 2002;46:345-9.
5. Acta Anaesthesiol Scand 2002;46:252-6.

S-161.

COMPARISON OF THE ELECTROENCEPHALOGRAPHIC MONITORS OF ENTROPY AND NARCOTREND INDEX DURING PROPOFOL ANESTHESIA

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Introduction: Entropy and Narcotrend are two new electroencephalographic monitors designed to measure depth of anesthesia, but little information about the difference of consciousness prediction between these two monitors is available, therefore, we designed this study to compare their efficiencies of consciousness assessment during the induction of propofol and the period of tracheal intubation.
Methods: Eighteen patients of ASA I-II were inducted by target-controlled infusion (TCI) of propofol, target was set according to the effect compartment concentration (Ce), and stepwise increasing ($0.5\mu g \cdot mL^{-1}$) method was used, after the arrival of final Ce ($6\mu g \cdot mL^{-1}$), orotracheal intubation was performed. The changes of consciousness were evaluated by Observer's assessment of alertness/sedation (OAA/S) scale. Response entropy (RE), state entropy (SE), stages and values of narcotrend (NT), MAP and HR were recorded at each step of Ce, and the time-point of before, immediately, and 1 to 10min after tracheal intubation.
Results: Increases of Ce of TCI resulted in the decreases of OAA/S scale scores, while, Ce according to OAA/S score of 2 and 0 were $2.0\pm0.6\mu g \cdot mL^{-1}$ and $2.2\pm0.6\mu g \cdot mL^{-1}$, respectively. Values of RE, SE, and NT decreased gradually with the increases of Ce, especially the NT values. The Spearman rank correlation coefficients between Ce and RE, SE, NT values were -0.83,-0.80, -0.86 ($P<0.01$), respectively. Increase to $2.0\mu g \cdot mL^{-1}$ of Ce resulted in statistically significant decreases in RE, SE, and NT values, while, MAP decreased significantly at $3.0\mu g \cdot mL^{-1}$ of Ce ($P<0.01$). The changes of RE and SE had a well correlation with NT during the period of propofol induction. Compared to the values of before intubation, RE and SE of immediately after intubation increased significantly ($P<0.05$), while, MAP and HR at the time-point of 1min and 2min after intubation increased also ($P<0.05$), however, values and stages of NT had no obvious changes during the period of tracheal intubation.
Discussion: Both Entropy and Narcotrend indexes can reflect promptly the changes of consciousness during the induction of propofol, and they have a close correlation with the effect compartment concentration of propofol, especially the NT values, meanwhile, entropy index (RE and SE) and hemodynamic parameters (MAP and HR), but Narcotrend values, can reflect the stimulation of tracheal intubation.
Reference:
1. Time-frequency balanced spectral entropy as a measure of anesthetic drug effect in central nervous system during sevoflurane, propofol, and thiopental anesthesia. Acta Anaesthesiol Scand. 2004, 48: 145-53.
2. The Narcotrend: a new EEG monitor designed to measure the depth of anaesthesia. A comparison with bispectral index monitoring during propofol-remifentanilanaesthesia. Anaesthesist. 2001, 50: 921-5

S-162.

VALIDATION OF THE CAS ADULT CEREBRAL OXIMETER DURING HYPOXIA IN HEALTHY VOLUNTEERS

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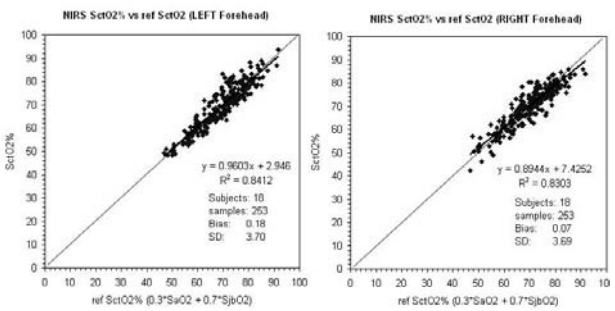
Introduction: Cerebral near-infrared spectroscopy (NIRS) is a non-invasive, optically-based technique to monitor brain oxygenation continuously by determining the cerebral tissue oxygen saturation ($S_{ct}O_2$). Light from the NIRS forehead sensor passes through extracerebral tissue and brain tissue, latter containing oxy- and deoxyhemoglobin within cerebral arterioles, capillaries and venules. $S_{ct}O_2$ is a mixed-vascular oxygen saturation parameter. The purpose of this study was to validate the non-invasive NIRS $S_{ct}O_2$ with a reference $S_{ct}O_2$ derived from simultaneous radial artery and jugular bulb venous samples.
Methods: With written informed consent, 18 adult ASA 1 volunteers were enrolled. Right internal jugular bulb catheter and left radial arterial line were inserted. Two prototype CAS NIRS sensors (CAS Medical Sysytems, Inc, Branford, CT, USA) were placed on the right and left forehead. A Sequential Gas Delivery system was used to deliver gas mixtures in stepwise decrements (21% to minimum 8% inspired oxygen) whilst maintaining normocarbia (end-tidal CO_2 tension of 40 mmHg). Upon completion the inspired concentration was increased to 100%. The protocol was stopped if the finger S_pO_2 value reached < 70%. Each step was maintained for 5 minutes. Blood samples were drawn simultaneously from the jugular bulb ($S_{jb}O_2$) and radial arterial (S_aO_2) catheters and analyzed for oxygen tension using a co-oximeter (IL-682). The reference $S_{ct}O_2$ was calculated from the following equation: reference $S_{ct}O_2 = 0.3xS_aO_2 + 0.7xS_{jb}O_2$ (ref) and was compared with the NIRS $S_{ct}O_2$ value displayed on the right and left forehead NIRS oximeters using linear regression.
Results: All 18 subjects completed the study protocol. 253 samples were analyzed. The results are shown in figure 1. The NIRS $S_{ct}O_2$ showed a strong correlation with the reference $S_{ct}O_2$ over the spectrum of S_pO_2 values between 70 and 100%. Normative NIRS $S_{ct}O_2$ values recorded from subjects breathing room air averaged 73.6% (range: 66.6 - 79.7).
Discussion: This study supports the feasibility of non-invasive NIRS $S_{ct}O_2$ as an estimate of cerebral tissue oxygenation during episodes of oxygen desaturation. There was a strong correlation with the global indices of tissue oxygen supply and demand, arterial and jugular bulb oxygen saturations respectively. Small differences between the reference $S_{ct}O_2$ and NIRS $S_{ct}O_2$ may reflect inter-individual variability and/or differences in the regional blood flow of the cerebral tissue.
Reference: Adv Exp Med Biol. 2005;566: in press.



S-163.

PROCESSED QUANTITATIVE EEG MONITORING REDUCES POSTOPERATIVE NAUSEA AND VOMITING IN NONSMOKING PATIENTS UNDERGOING LAPAROSCOPIC TUBAL LIGATION

AUTHORS: **S. F. Cassingham**, M. Khan, P. Alaniz, L. Munsterman, C. Smith, S. Kaji;
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Introduction: This study uses processed quantitative EEG (QEEG) monitoring to assess anesthetic depth during laparoscopic tubal ligation to determine the effect on postoperative nausea and vomiting. Previous studies have documented the efficacy of processed QEEG monitoring in decreasing anesthetic usage and minimizing complications, including postoperative nausea and vomiting (1). Unlike previous studies, this study includes only non-smoking patients.
Method: Following IRB approval, this study randomly assigned 19 ASA I or II non-smoking subjects to QEEG monitoring, group A, n=10, or control, group B, n=9. Group A received an Isoflurane/65% N2O/35% O2 anesthetic titrated by QEEG. Processed QEEG monitoring was performed with the Physiometrix PSA 4000. The PSA 4000 expresses the QEEG as the Patient State Index (PSI). PSI range from 0, indicating EEG burst suppression, to 100, indicating full consciousness. A PSI less than or equal to 50 is indicative of an anesthetic depth sufficient to ensure amnesia. Group B received an Isoflurane/65% N2O/35% O2 anesthetic titrated by standard clinical methods. Premedication, 0.04mg/kg midazolam, and induction agents, 4mg/kg sodium pentothal, 1.5mcg/kg fentanyl, and 1mg/kg rocuronium, were identical in both groups. Muscle relaxation was reversed with 0.05mg/kg neostigmine and 0.6mg atropine in all patients. Postoperative personnel were blinded to anesthetic titration methods.
Results: All subjects experienced an unremarkable operative course. All participants required postoperative analgesia, 2-6 mg morphine IV, in the recovery room. QEEG titration in Group A resulted in a 20% incidence of postoperative nausea and vomiting compared to 33% for the control group. Two of ten subjects from group A and three of nine controls in Group B experienced nausea followed by emesis. All patients who experienced nausea and vomiting responded to IV phenergan without further complaint. None of the remaining patients in either group experienced nausea without emesis. There were no complaints of nausea after discharge from the recovery room.
Discussion: This study is the first to exclude smoking as a confounding variable in assessing the efficacy of processed QEEG monitoring in reducing postoperative nausea and vomiting. To avoid the anti-emetic benefit of propofol, sodium pentothal was used as the primary induction agent. Preliminary results of this ongoing study reveal a 39% reduction of postoperative nausea and vomiting in subjects undergoing QEEG anesthetic titration compared to routine clinical titration methods. Comparing the QEEG titrated group to the 45% standard incidence of postoperative nausea in gynecological laparoscopic procedures (2,3) yields a significant 56% reduction in postoperative nausea and vomiting. These early findings support QEEG monitoring as a method to reduce postoperative nausea and vomiting. The utility of QEEG monitoring will be further investigated as this study achieves full enrollment.
References: 1) Nelskyla, Anesthesia and Analgesia. 93:1165-9, 2001; 2) Erickson, Acta Anaesthesiol Scand. 1995:39:377-80; 3) Gupta, Anesthesia and Analgesia. 99:1173-9

S-164.

VALIDATION OF THE CEREBRAL STATE INDEX (CSI) DURING CARDIAC ANAESTHESIA

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Introduction. The objective of this study was to show that the Cerebral State Index (Danmeter A/S, Odense, Denmark), could reliably assess the level of consciousness in anaesthetised patients during cardiac surgery. The CSI is defined using sub-parameters from the EEG as inputs to an adaptive neuro-fuzzy inference system (ANFIS). The advantage of ANFIS is that it does not assume an underlying mathematical function governing the causal relationship between the EEG values and the clinical state of the patient.
Methods. After Ethics Committee approval, informed consent was obtained from 20 ASA III-IV patients (55-78 years), scheduled for cardiac bypass surgery. Propofol infusion was initiated until the patient had no response to noxious stimuli, according to the Observer's Assessment of Alertness and Sedation scale (OAAS) had reached level 0 (OAAS 5= awake, OAAS 0=deep anesthesia). The OAAS level was estimated every 2 min. The anaesthetic procedure was identical for all patients, using a TCI-Diprifusor pump which calculated the propofol plasma concentration. Subsequently remifentanil was administered as well. Four EEG sub-parameters, derived from the EEG power spectrum and Burst Suppression, were used to define the inputs to the fuzzy system. The output of the fuzzy system is the CSI.
Results. The prediction probability (Pk) between the CSI and OAAS was 0.93. An almost linear relationship exists between the clinical signs of the OAAS scale and the CSI.
Discussion. The results show that during cardiac surgery, the depth of anaesthesia can be measured reliably by using the Cerebral State Index.
References. Acta Anaesthesiol Scand. 49(6):750-3; 2005.

S-165.

MONITORING DEPTH OF ANESTHESIA IN CHILDREN: BIS MONITOR AND CEREBRAL STATE MONITOR (CSM)

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Introduction. The aim of the study was to evaluate the performance of the Cerebral State Monitor (CSM) (Danmeter A/S, Odense, Denmark) for the monitoring of depth of anesthesia during sevoflurane induction in pediatric patients. The CSM calculates an index (Cerebral State Index or CSI) in a 0-100 range. The CSI values were compared with the bispectral (BIS pediatric sensor) index values (Aspect Medical Systems, USA) for both the awake and asleep states.
Methods. The study population was formed by ten male pediatric patients aged 2-11 years old, and weight(SD) 20(8)kg scheduled for elective herniorraphy or minor urologic surgery. Sevoflurane was administered for induction of anesthesia until loss of consciousness. In all cases the patient had both monitors attached. Penile or caudal block was completed after sevoflurane induction and laryngeal mask insertion. Anesthesia was fully maintained with sevoflurane and 50% N_2O/O_2. After surgery the gas was discontinued and the laryngeal mask removed on intolerance. BIS and CSI values were recorded for both the awake state (on arrival at the OR) and asleep state (just before laryngeal mask insertion). Results are noted as mean (range).
Results. The monitor index values for the awake state were CSI 93 (86-100) and BIS 94 (90-98). For the asleep state the index values were CSI 45 (40-62) and BIS 42 (23-61). The prediction probability (Pk) for index prediction of the awake/asleep states was 1 for both monitors. The correlation coefficient (R^2) between both indexes was 0.95.
Discussion. The CSI achieved good correlation values for monitorization of the awake and asleep states of anesthesia for this specific study population. This preliminary results are part of a broader study with a larger number of subjects and comparing more anesthetic states and drug consumption values, among other parameters.

S-166.

COMPARISON OF WATER BATH VERSUS DRY HEAT FLUID WARMERS

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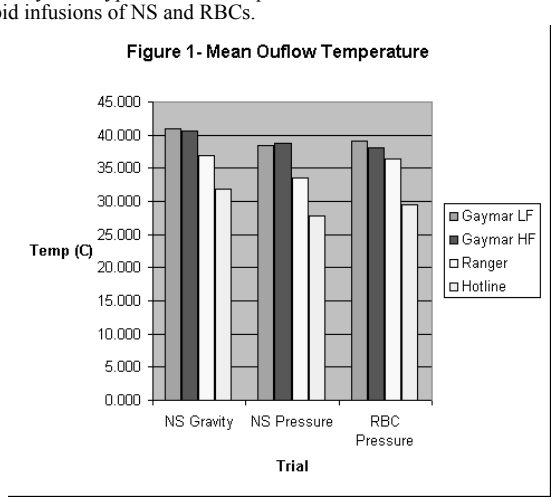
Introduction
Fluid warming devices are widely used in anesthesia to maintain normothermia in patients receiving IV fluid therapy. This study compares the efficacy of the Hotline (SIMS Level 1, Inc., Rockland, MA), a water bath warmer, versus the Ranger (Arizant Healthcare, Eden Prairie, MN) and the Medi-Temp III (Gaymar Industries, Orchard Park, NY), two dry heat warmers.
The study examines the average outflow temperature of each device with rapid infusions of room temperature NS and 4C degree packed RBCs.
Methods
In evaluating each warmer, we tested two different units, and two different disposables in each unit. For the Gaymar we tested both low flow (LF) and high flow (HF) disposables. For each disposable, we conducted two gravity infusions of NS, two pressurized infusions of NS and two pressurized infusions of RBCs.
To the inflow of each disposable we connected Y-type blood set IV tubing (Abbott Laboratories, Abbott Park, IL), and we connected the outflow to a 9F introducer (Arrow International, Reading, PA). We primed the entire setup with NS, leaving the drip chamber of the IV set half full. Each device was turned on and allowed to reach full operating temperature. We placed the introducer through the hole of a sealed Styrofoam cooler (adiabatic chamber) so the infusion could run into the cooler unobstructed. For the gravity trials, 1L bags of NS were raised to a height of 1m above the introducer. For the pressurized infusions, we pressurized either a burped bag of NS or an expired unit of packed RBCs to 300 mm Hg. Upon completion of each infusion, the cooler was opened and fluid temperature measured using two banjo-style temperature probes (YSI 401, Yellow Springs, OH) connected to a portable monitor. We emptied the cooler between infusions. All trials on a given disposable were done in sequence on the same day.
Results
Results are shown in Figure1. We used Tukey HSD to perform pairwise comparisons between warmers. Under all conditions, the Gaymar warmer had a higher mean output temperature than either the Ranger or the Hotline ($p<0.05$). Additionally, the Ranger had a higher mean output temperature than the Hotline under all conditions ($p<0.05$).
Discussion
The dry-heat type warmers outperform the water bath warmer with rapid infusions of NS and RBCs.



S-167.

ANALYSIS OF MONITOR ALARM EFFICACY IN THE OPERATING ROOM

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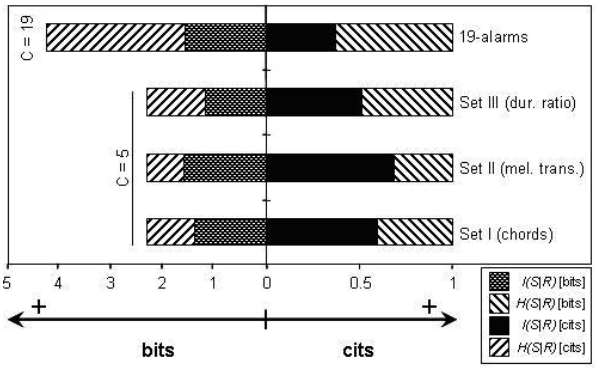
AFFILIATION: [1]University of Miami School of Medicine, Miami, FL, [2]University of Miami College of Engineering, Miami, FL.

Introduction: Monitors are important adjuncts to safe management of patients in acute care settings. However, numerous and disparate sensory distractions (i.e., alarms) are known to lead to process and cognitive failures. Analysis of 19 common alarms demonstrated that clinicians identified alarm sources correctly 34% of the time [1]. Recently, an approach was used to characterize the function of priority-encoded auditory displays [2]. Using this approach, we analyze the confusion-matrix data from [1] in terms of information transmission. We demonstrate that disparate alarms can be characterized and compared using this approach.
Methods: We entered data earlier published (see Table 1 from [1]) into a 15x19 stimulus-response matrix, excluding the "Don't know" column. The entries were divided by 1414 (total responses N) to give a matrix of joint probabilities $p(s_j,r_k)$, where $p(s_j,r_k)=N_{jk}/N$. The matrix of conditional probabilities $p(s_j|r_k)$ was then calculated where, $p(s_j|r_k)=N_{jk}/N_{\cdot k}$. The elements of the $p(s_j,r_k)$ matrix were multiplied by the log base two of the elements of the $p(s_j|r_k)$ matrix. Summation of the resulting matrix over all elements gave the equivocation or signal noise, H(S|R) where $H(S|R)=p(s_j,r_k)\log_2 p(s_j|r_k)$. The maximum theoretical transmission rate is $H(S)=\log_2 C$ where C is the number of alarms in the system. Actual information transmission or I(S|R) was calculated by subtracting H(S|R) from H(S) where I(S|R)=H(S)-H(S|R).
Results: The maximum transmission rate possible with a 19-alarm communication system (C=19) is 4.25 bits. The information transmission rate calculated here based on the clinician responses in [1] is 1.57 bits. This corresponds to a signal noise of 2.68 bits (see Figure left).
Discussion: The ability to characterize alarm efficacy in terms of information values may facilitate evaluation and cross-comparison of novel and existing alarm systems. For instance, the information values can alternatively be expressed in units of cits, short for c-nary digits by using the general equation, $H(S|R)=p(s_j,r_k)\log_c p(s_j|r_k)$. The maximum transmission rate would then be 1 cit since $H(S)=\log_c c$. The figure compares the results presented here with those from [2]-in which there were three sets of five audible alarms (C=5)-in terms of bits (left) and cits (right). This innovative analysis will help to improve the efficacy and patient safey of alarm systems.
References:
1. Anesthesia and Analgesia 1992;75:499-505.
2. Anesthesiology 2004;101:A562.



S-168.

INFLUENCE OF LEAK IN RESPIRATORY CIRCUIT TO MECHANICAL VENTILATION: AN EXPERIMENTAL STUDY USING PATIENT SIMULATOR

AUTHORS: **J. Tokumine**, K. Sugahara, T. Fuchigami, K. Nitta, S. Saikawa, K. Kamizato;
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Introduction: The presence of a leak in the anesthesia circuit may lead to hypoxia or awareness during anesthesia. We revealed the ability of detecting leak with the conventional breathing circuit system leak test[1)2)]. The leak test cannot detect small leak in respiratory circuit, especially leak value under 0.2 l/min[1)]. However, the clinical significance of such a small leak is still unknown. The aim of this study is to clarify the influence of leak in respiratory circuit on mechanical ventilation.
Methods: We used a patient simulator (model HPS, METI Co.) under mechanical ventilation (Excel 210 SE, Datex-Ohmeda Co.) with artificial leak in respiratory circuit. Minute volume (MV) and frequency of ventilation were settled at 500 ml/min, and 10/min, respectively. Gas mixture of oxygen and air administered was 1 and 3 L/min, respectively. Artificial leak producing devices were used to create leaks from 0.1 to 2.0 l/min. Compliance of lung and chest wall was settled arbitrarily three different degrees, which were high (peak 18 torr, plateau 8 torr), middle (peak 19 torr, plateau 15 torr), and low (peak 27 torr, plateau 22 torr). Under above conditions we measured MV, FiO_2, and $ETCO_2$ actually administered to the patient simulator with respirator monitor Capnomac Ultima-S (Datex Co.).
Results: MV measured was decreased following by increase of artificial leak (Fig.1). The reduction of MV of low compliance group was bigger than middle or high compliance group. Maximal decrease of minute volume was 10% under the condition with low compliance and leak 2.0 l/min. $ETCO_2$ was increased slightly following by increase of artificial leak, but FiO_2 was no changed.
Discussion: In this study, influence of leak in respiratory circuit on mechanical ventilation was decrease of MV and increase of $ETCO_2$, but not FiO_2. This influence became apparent at leak 0.5 l/min or more. The influence of compliance of lung and chest wall also became apparent from leak 0.5 l/min or more.
Influence of leak in respiratory circuit can be compensated by increase of MV. Therefore, monitoring of respiration is important to avoid hypoventilation and correct to appropriate ventilation for a patient.
References:
1) Anesth Analg 2005;100(4):1056-8
2) J Anesth 2000;14:191-3

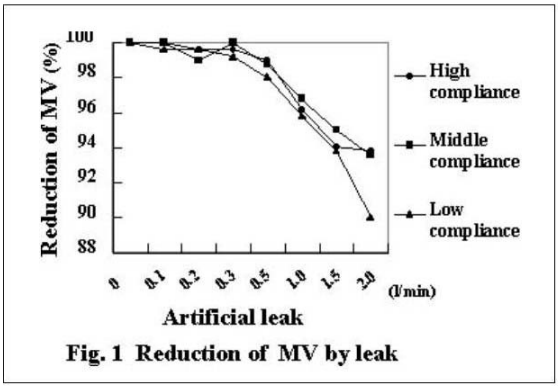

Fig. 1 Reduction of MV by leak

S-169.

EVALUATION OF A NEW COMBINED SPO_2/$PTCCO_2$ EAR SENSOR (TOSCA) AT 42ºC & 44ºC IN CARDIAC SURGICAL PATIENTS

AUTHORS: **D. T. Redford**, A. E. Azar, S. J. Barker;
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INTRODUCTION: A recently introduced monitor, the TOSCA (Linde Medical Sensors AG, Basel, Switzerland) combines pulse oximetry (SpO_2) and transcutaneous carbon dioxide ($PtcCO_2$) into one heated ear sensor. This study compares $PtcCO_2$ to end-tidal carbon dioxide ($PetCO_2$) and arterial carbon dioxide ($PaCO_2$) at sensor temperatures of 42ºC and 44ºC.
METHODS: Following IRB approval, adult patients undergoing cardiac surgery, requiring cardiopulmonary bypass, were enrolled prospectively. Prior to induction of general anesthesia, the TOSCA sensor was attached to one ear lobe and an arterial line was placed in all patients. The temperature of the TOSCA sensor was 42°C (n = 15 patients) and 44°C (n = 31 patients). Arterial blood gas (ABG), $PtcCO_2$ and $PetCO_2$ (North American Dragger 6000) readings were recorded simultaneously. The difference between $PaCO_2$ and $PetCO_2$ (P(a-et)CO_2), and the $PaCO_2$ and $PtcCO_2$ (P(a-tc)CO_2) were calculated. The mean (±SD) of these differences were compared at 42°C and 44°C using Student's t-test, $p<0.05$ considered significant.
RESULTS: 46 patients were enrolled. Patient age, weight and height were similar between the two groups (56.1±14.2 vs 58.9±15.7 yrs, 81.7±17.3 vs 80.8±19.4 kgs, 67.0±3.7 vs 67.6±5.2 cms). A total of 248 ABG samples (91 at 42°C and 157 at 44°C). There was no difference between the P(a-et)CO2 in these two groups however there was a significant difference (**) between Pa-tcCO2 at the two sensor temperatures, $p<0.001$. The mean and SD of data are presented in table 1 below.

Table 1. TOSCA Summary Data

Sensor at 42°C	$PaCO_2$	$PetCO_2$	$PtcCO_2$	Pa-etCO_2	Pa-tcCO_2
Minimum	19	14	24	-4	-42
Maximum	51	46	75	21	1
Mean	34.2	28.1	42	6	-7.8 **
Standard Deviation	7.4	7.8	10.6	4.5	7.3
Sensor at 44°C	$PaCO_2$	$PetCO_2$	$PtcCO_2$	Pa-etCO_2	Pa-tcCO_2
Minimum	27	20	26	-2	-16
Maximum	50	43	61	17	4
Mean	35.4	29.9	39.3	5.6	-3.8 **
Standard Deviation	5	4.4	6.2	3.1	3.2

DISCUSSION: In this population of adult cardiac surgical patients we demonstrated significantly improved performance of the TOSCA sensor at 44°C as compared to 42°C. The P(a-tc)CO_2 was significantly smaller at the higher sensor temperature. At this higher temperature there were no indications of blistering or burning at the monitoring site.

S-170.

TIDAL VOLUME CHANGES WITH AIR-COMPRESSOR SUPPLIED DRIVE GAS IN A FIELD ANESTHESIA MACHINE

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Introduction: Field anesthesia machines (FAM) have been designed for remote and austere environments in support of office-based, humanitarian, and military operations. They include pneumatically powered ventilators which can rapidly deplete oxygen cylinders (1,2). If the ventilator drive gas is supplied by an air compressor, then cylinder O_2 will be preserved for fresh gas. The purpose of this investigation was to determine changes in tidal volume (V_T) when drive gas was changed from cylinder O_2 to an air compressor.
Methods: Changes in V_T delivered by the Magellan-2200 FAM (Oceanic Medical Products, Atchison, KS) were measured with the RSS100-HR pneumotach (Hans Rudolph, Kansas City, MO). V_T was delivered via a semi-closed, circle breathing system connected to a calibrated test lung (TTL, Michigan Instruments, Grand Rapids, MI) with compliance set at 0.1 L/cm H_2O. Fresh gas flow rate was 1 L/min. V_T was initially set and measured with cylinder O_2 supplying the drive gas at 50 psig. The drive gas source was then switched to the Hi-Flow 70 air compressor (Vortran Medical Technology, Sacramento, CA) set to 50 psig, and V_T measurements were repeated. All measurements were made in quadruplicate with target V_T of 500, 750, and 1000 (± 30) ml. The changes in V_T for each target V_T were compared with independent samples t-tests. $P < 0.05$ accepted as significant. Data reported as mean (± SD).
Results: The V_T decreased when drive gas was switched from cylinder O_2 to the air compressor (Table). The decrease in V_T was more for the 500 and 750 ml V_T groups (133 and 161 ml, respectively) than in the 1000 ml group (6.8 ml).
Discussion: V_T decreases when drive gas is switched from cylinder O_2 to an air compressor in the Magellan-2200 FAM. When switching the drive gas to the air compressor, the ventilator settings must be adjusted to return to the previous V_T.

Target V_T (ml)	Cylinder O_2	Air compressor	P
500	530.8 (± 4.8)	397.3 (± 3.6)	< 0.001
750	747.8 (± 7.5)	587.3 (± 2.2)	< 0.001
1000	1023 (± 2.9)	1016 (± 2.4)	0.012

References:
1. Anesth Analg 2002;95:148-150.
2. Anesth Analg 2005;100:1713-7.

S-171.

MOTION GENERATED BY MACHINE VS BY VOLUNTEER - DOES IT AFFECT THE ACCURACY OF MOTION RESISTANT PULSE OXIMETERS?

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INTRODUCTION: "Motion resistant" Pulse Oximeters (PO) have been studied in volunteers with machine generated motion (MGM) and volunteer generated motion (VGM). It's unclear whether test methodology affects PO performance. This study evaluated the effects of MGM and VGM using three motion resistant POs, during normoxia and hypoxia.
METHODS: Following informed consent, 11 ASA-I volunteers (5F/6M) ages 18-40 were enrolled. We evaluated Masimo RadicalV4.5, Nellcor N595 V3100 and Datex-Ohmeda TruSat. Sensors were randomly placed on index, middle, and ring fingers of left hand (test) and right hand (control), and optically shielded. The room temperature was 16-18ºC to reduce peripheral perfusion. A TOSCA ($PtcCO_2$ + Masimo Radical PO) sensor was placed on the right ear as the control during hypoxia. During separate room air and desaturation (employing a re-breathing circuit with a CO_2 absorber to a SpO_2 of 75% on the control PO, followed by 100% oxygen until the control SpO_2 reached 100%), motion consisted of random tapping (with sensor disconnect/reconnect) and random rubbing. Motions were done both by MGM/VGM. The sensors were tested on all three fingers during normoxia. A computer recorded SpO_2 & PR data. Parameters calculated were % of time when SpO_2 was off by 7% (E7) & PR was off by 10% (E 10), % of time the POs Zero Out SpO_2 &/or PR (PO displays "--" or zero). Missed Event (ME) is defined as the inability of the PO to detect desaturation during hypoxia. False alarm (FA) during normoxia is defined as $SpO_2 \leq$ 90% during motion.Failure rates (FR) is the % of time POs were off by 7% for SpO_2 & 10% for PR. Recovery Time (RT) of SpO_2/PR was also calculated. ANOVA and Fischers post hoc test were performed with $p < 0.05$ considered statistically significant.
RESULTS: There were 176 total motion tests (88 during MGM & 88 during VGM) when POs could fail. We detected FAs 27 times with MGM vs 30 times with VGM. There were 13 ME with MGM and 17 with VGM. The table shows the remaining results. We did not find any statistically significant difference between MGM and VGM.
DISCUSSION/CONCLUSION: MGM was found to be similar to VGM, hence MGM can be utilized to study motion resistance of new POs.

Machine generated vs Volunteer generated motion effects on Pulse Oximeter Performance (mean +SD)

	Recovery Time SpO_2%(min)	Recovery Time PR (min)	E7 (min) SpO_2	E10 (min) PR	Zero Out (min) SpO_2	Zero Out (min) PR
MGM	0.31 ± 0.42	0.39± 0.55	2.35 ± 3.64	3.67 ± 4.65	0.18 ± 0.389	0.66 ± 1.36
VGM	0.21 ± 0.45	0.27 ± 0.45	1.58 ± 2.69	2.68 ± 2.30	0.41 ± 0.66	1.2 ± 2.2

S-172.

THE CAUSAL RELATION BETWEEN INCREASED INCIDENCE OF SUB-OPTIMAL FIBER-OPTIC LMA POSITION AND EPIGLOTTIS LENGTH IN CHINESE ADULT PATIENTS

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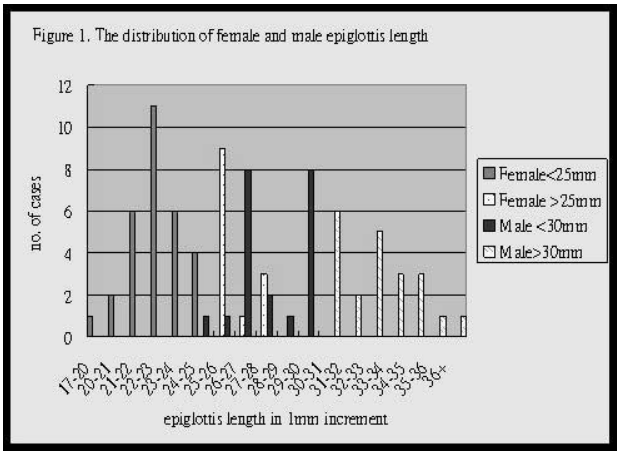
AFFILIATION: China Medical University Hospital, Taichung, Taiwan Republic of China.

Introduction: Laryngeal mask (LMA) has become a useful device for airway management nowadays. It was usually place at the pharynx with the aperture placing about 32mm (for LMA size3) and (36mm for LMA size 4) distance opposite the vocal cord[1] with its posterior rim supposed to press over the posterior epiglottis. If the appropriate device is properly placed, only the vocal cord or the vocal cord with the posterior epiglottis should be seen with a fiberoptic inspection through the LMA aperture[2]. For our patients who are mostly southern Chinese ethnic, we usually use size 3 LMA for female and size 4 LMA for male. But more than 50% of these patients had the tip of the epiglottis exposed in the fiberoptic view. For the epiglottis to be supported by the posterior rim of the LMA the length of the epiglottis should be more than 25mm for the size 3 LMA and 30mm for the size 4 LMA according to the in vitro measurement with the aperture 32mm and 36mm respectively away from the vocal cord. We postulate that the cause of more than 50% sub-optimal position may be due to the shorter epiglottis of our patient population than the Western counterpart who has a mean epiglottis length of 45mm in female and 50mm in male [3].
Material: 100 consecutive MRI images from adult patients presenting for neck pain were downloaded from the hospital PACS system after obtaining informed consent from the patients. The epiglottis length of these patients was measured from the tip of epiglottis to the centre of the vocal cord. Patients with coincidence upper airway diseases or image distortion were excluded.
Results: Altogether 43 female and 42 male images were eligible for the study. The length of epiglottis was stratified from shortest length with 1 mm increment and presented graphically. (fig.1)
Discussion: 30 out of 43 female had epiglottis length less than 25mm and 21 out of 42 male had epiglottis length less than 30mm. These measurement results strongly suggest that more than 50% of these patients wouldl have epiglottis tip exposed in the bowl of the LMA if they were intubated.
References: (1)Anaesthesia 48:667-669, 1993. (2) Anesth Analg 76:457, 1993. (3) Anesthesia 48(7):575-580, 1993.



S-173.

COMPARISON OF THE FACILITY OF INTUBATION TO BENT PORCINE TRACHEA AMONG THREE DOUBLE-LUMEN ENDOBRONCHIAL TUBES

AUTHORS: **R. Kato**, D. Sato, J. Sekishita, Y. Morimoto;
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Introduction: To intubate double-lumen endobronchial tubes (DLTs) is sometimes difficult due to the deviation or flection of trachea by the pulmonary lesions such as tumor. In this study, we used the bent porcine tracheal and bronchial model and compared the facility of Intubation among the three representative DLTs under the two different temperature condition.
Method: With approval of institutional animal care and use committee, three sets of porcine trachea and bronchi were prepared. They were bent in the middle of the glottis and bifurcatio tracheae at angles of 20, 40 and 60 degree, respectively, and fixed on the stand. Three types of DLTs (BronchoCahth (Mallinckrodt, St. Louis, Missouri), BronchoPart (Rusch, Duluth, Georgia), and BlueLine (Portex, Hythe, UK) were tested. The facility of intubation was assessed by 1) the time of intubation (the time from passing the tip of the tube at the glottis to the insertion of bronchial lumen in the left main bronchus firmly) and 2) the subjective impressions of intubation (5-point scales as "very easy", "easy", "normal", "difficult", and "very difficult") by 4 anesthesiologists. The experiments were performed under room temperature (25°C) and after warming tubes by 50°C water for 3 min. Preliminary study revealed that the tension necessary to bend each DLT at an angle of 90 degree decreased to approximately 40% of the control by warming. The time of intubation among the DLTs under each temperature was compared by one way ANOVA followed by Newman-Keuls test. Kruskal-Wallis test was used for the comparison of subjective impression. To evaluate the effect of warming, Paired-t test for the comparison of intubation time and Kendall's rank correlation coefficient for the comparison of subjective impression were utilized. Statistical significance was determined as $p<0.05$.
Results: Under the room temperature, intubation time was within 4 sec. in all the DLTs at 20 degree-angled trachea. At 40 degree-angled trachea, intubation time was significantly shorter by using BlueLine tube. At 60 degree-angled trachea, the tendency of the shortening intubation time was also observed in the same DLT. The facility of intubation by subjective impression was significantly superior in BlueLine tube in every angled trachea. By warming, the intubation time and subjective impression were not improved in all the DLTs and superiority seen in Blue line tube disappeared.
Discussion: Under the room temperature, there may be difference in the facility to intubate DLT into the bent trachea among the type of the tubes we used in this study. However, by warming the tubes (the plasticity became about 2.5 times), it did not improve the facility of intubation in all the DLTs and difference among the type of DLTs was not detected.

S-174.

THE STAIRCASE PHENOMENON: INFLUENCE OF THE TYPE OF CONTRACTION

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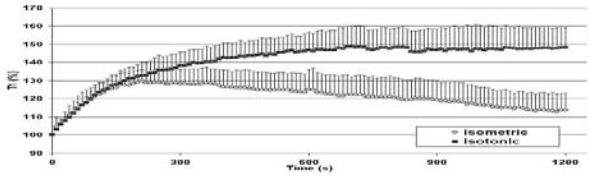
Introduction: Phonomyography (PMG) is a novel method to monitor neuromuscular blockade. It can be used interchangeably with mechanomyography (MMG). The staircase phenomenon plays an important role in neuromuscular research. The influence of the type of contraction has not been investigated yet. The purpose of this work is to determine the staircase effect at the adductor pollicis muscle (AP) during isometric versus isotonic contraction.
Methods: In 10 patients undergoing general anesthesia using a laryngeal mask airway without aid of neuromuscular blockade, one piezo-electric microphone was applied to each adductor pollicis muscle; the right hand was placed in a special cast, limiting movement of the index finger and the thumb to create an isometric contraction, the left thumb and index finger was allowed to move freely for isotonic contraction. Supramaximal stimulation at 1 Hz was used at both ulnar nerves. All signals were simultaneously recorded for 20 min. Data are presented as means (SD), comparisons were made using paired t-test, $P<0.05$.
Results: Phonomyography determines a positive staircase effect at the AP. There is a significantly higher maximum increase of signal height with isotonic contraction at 150% (11%) than with isometric contraction at 130% (9%) (Figure). Whereas the signals with isotonic contraction reach a plateau at 9 min after which the signal height is no longer significantly different from the amplitudes at the end of the observation period, signal potentiation with isometric contraction decreases slowly after reaching the peak at 5 min towards a final amplitude of 113% (9%) at 20 min.
Discussion: The staircase phenomenon is positive at the AP when monitored using PMG. The limitation of free movement of index and thumb (isometric contraction) causes a characteristic potentiation pattern: after the amplitude of the signals rises, similarly to isotonic contraction, to reach a maximum at 5 min, it then descends slowly towards the end of the observation period. Future studies are needed to explain the physiologic basis of this pattern.



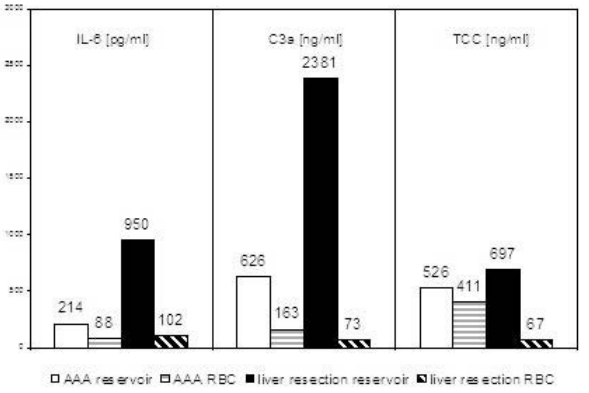
S-175.

IS CELL SALVAGE SAVE IN LIVER RESECTION? PILOT STUDY REGARDING CYTOKINES AND COMPLEMENT

AUTHORS: **A. Schmidt**, E. Siegel, H. C. Sues;
AFFILIATION: Johannes Gutenberg University, Mainz, Germany.

Introduction: Intraoperative cell saving (CS) is a well established, safe, and cost effective method to reduce homologous blood transfusion in orthopedic and especially vascular surgery (1,2). This should also apply to liver surgery. However, possible retrograde bacterial contamination, and bile itself could account for massive cytokine release and complement activation during liver resection. In this pilot study we determined the quality of CS blood in patients undergoing hemihepatectomy or aortobifemoral bypass (AAA) with regard to the release of inflammatory mediators.
Methods: With written informed consent, six patients undergoing hemihepatectomy or aortobifemoral bypass (control group) respectively, with an intraoperative blood loss of more than 800 cc were included in the study. According to the manufacturer s recommendations the washing procedure of collected blood was performed with 500 cc (AAA) and 1000 cc (liver resection) of normal saline. Blood samples were drawn from the CS-reservoir directly prior to processing in a Haemonetics Cell Saver 5, from the processed blood (RBC) within 5 minutes after termination of the washing procedure, and from the patient during the washing procedure. The inflammatory mediators determined comprised interleukin (IL)-6. IL-8, IL-10, TNF-α, and complement C3a and the terminal complement complex (TCC).
Results: Median values for TNF-α, IL-8, and IL-10 were between detection limits and a maximum of 40 pg/ml in the reservoir before processing in all patients. For results of IL-6, C3A, and TCC see graph.
Discussion: The CS-washing procedure eliminates cytokines and complement split products from collected blood effectively in both groups. Although individual values are higher in the liver group before processing, the reduction of mediators through the washing procedure is equal or even higher in the liver group. This is likely to be related to the larger washing volumes in the liver resection group, as all other variables were kept constant in our study. In conclusion, CS-blood in liver resection seems to be as safe for retransfusion as in aortic surgery regarding cytokine release and compliment activation. Before considering introduction into clinical practice the results of this pilot study have to be confirmed in a larger number of patients. However, one should consider to increase the washing volume to 1000 cc in sterile procedures like vascular surgery.

References: 1. Chest 1999; 115:113S-121S.
2. Anesth Analg 2002; 95:1312-1317.



S-176.

THE RELATIONSHIP BETWEEN HEPATIC VENOUS HEMOGLOBIN OXYGEN SATURATION AND SERUM GLUTATHIONE-S-TRANSFERASE IN PATIENTS UNDERGOING LIVER SURGERY

AUTHORS: **M. Kainuma**;
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Introduction: Monitoring of hepatic venous hemoglobin oxygen saturation ($Shvo_2$) is easy to accomplish and is valuable technique in evaluating the extent of hepatic ischemia during liver surgery. Recently, gluthathione-S-Transferase (GST-α is reportedly early drainaged from zone 3 in hepatic hypoxia and/or ischemia. We compared $Shvo_2$ and GST-α in patients undergoing liver surgery.
Methods: This study was approved by our institutional review board and informed consent was obtained from thirteen consecutive patients undergoing hepatic resection surgery. After anesthetic induction, a radial arterial cannula was placed and 7.5-Fr fiberoptic catheters (Opticath Model P7110-EH, Oximetrix) were placed in the pulmonary artery and the hepatic vein. Anesthesia was maintained with nitrous oxide and oxygen with sevoflurane. We continuously measured $Shvo_2$ during the surgery. Additionally, we measured arterial GST-α in each patient just after anesthetic induction (point 1) and at the time (point 2) when $Shvo_2$ showed the lowest value during the surgery. The results were expressed mean ± SD and the correlation coefficient was calculated by the least-square method. A p value of 0.05 or less was considered significant.
Results: $Shvo_2$ was 69.2 ± 10.4% at point 1 and significantly decreased to 34.7 ± 8.7 % at point 2. Arterial GST-α was 24.3 ± 15.7 ng/ml at point 1 and significantly increased to 79.7 ± 82.3 ng/ml at point 2. The correlation coefficient between Shvo2 and GST-α was 0.440 at point 1 (not significant) and 0.556 (significant) at point 2.
Discussion: The significant relationship was obtained between $Shvo_2$ and GST-α at the time when $Shvo_2$ showed the lowest value during the surgery. The measurement of arteral GST-α could be valuable method to detect hepatic ischemia and/ or hypoxia in patients without $Shvo_2$ monitoring.

Reference: Kainuma M et al: Hepatic venous hemoglobin oxygen saturation predicts liver dysfunction after hepatectomy. Anesthesiology 76:379-386,1992

S-177.

DO POSTOPERATIVE NAUSEA AND VOMITING EXPERIENCES DECREASE AFTER POST ANESTHESIA CARE UNIT (PACU)?

AUTHORS: **T. J. Gan**[1], A. S. Habib[1], A. Taguchi[1], X. H. Hu[2], Y. Chen[2];
AFFILIATION: [1]Duke University Medical Center, Durham, NC, [2]Merck & Co., Inc, West Point, PA.

Introduction: Postoperative nausea and vomiting (PONV) are frequent and unpleasant side effects following surgery. It is commonly thought that the incidence of PONV decreases after PACU discharge. The current study sought to determine the incidence of PONV after PACU in a standard practice environment in a high risk population.
Methods: Following IRB approval, data were collected prospectively and retrieved from the Duke Electronic Perioperative Anesthesia Database between January 1, 2005 and February 28, 2005. Patients were included in the study if they were age ≥ 18 years, had a pre-operative ASA status of I, II, or III; underwent general anesthesia; were at high risk for PONV with at least 2 of the following factors: female, previous history of PONV or motion sickness, non-smoker or use of postoperative opioid[1]. Descriptive analyses were performed to examine the frequency of anti-emetic use, the incidence of PONV during PACU and in 24 hours after PACU discharge. Multivariate logistic regression models were used to identify factors associated an increased risk of PONV post PACU discharge to 24 hours.
Results: A total of 1,333 patients were included in the analysis. The mean age was 54 (range 18-97) years, 70% were female, and 89% had prior general anesthesia. The mean duration of surgery was 223 minutes. Prophylactic antiemetics were administered to 71% of the patients. During PACU, 14% experienced either nausea or vomiting (13% nausea, 2% vomiting) and 22% used rescue anti-emetic medication. Within 24 hours after PACU discharge, 39% of the patients experienced either nausea or vomiting (39% nausea, 12% vomiting) and 28% received antiemetics. The incidence PONV and antiemetic use after PACU discharge was significantly greater in patients who experienced PONV during PACU compared to those who did not (65% vs. 35%, $p< 0.0001$ for PONV; 54% vs. 24%, $p< 0.0001$ for antiemetics). In multivariate analysis, factors associated with a significant increase in PONV risk post PACU discharge to 24 hours were greater number of risk factors at baseline and occurrence of PONV during PACU.
Discussion: The incidence of PONV and use of rescue antiemetic were significantly higher within 24 hours after PACU discharge compared to in the PACU. About 40% patients who underwent inpatient surgery experienced PONV and over 25% used anti-emetic after PACU discharge to 24 hours, despite frequent use of antiemetics to prevent and treat PONV in the PACU. Our findings suggest the need of longer acting anti-emetic regimens and a multimodal approach strategy to reduce the burden of PONV post surgery.
References:
1. Apfel CC, et al. A simplified risk score for predicting postoperative nausea and vomiting: conclusions from cross-validations between two centers. Anesthesiology 1999;91:693-700.

S-178.

THE ENTROPY INDICES CAN DETECT THE EEG SLOWING EFFECT CAUSED BY N_2O

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Background:
Nitrous oxide (N_2O) as a sole agent does not affect the bispectral index (BIS), however, at deeper propofol anesthesia N_2O has a depressant effect on BIS (1). Spectral Entropy, a measure of regularity of EEG, has been introduced and demonstrated to be a reliable predictor of the hypnotic states. The aim of this study was to compare BIS and Entropy indices to detect N_2O effect on EEG at various levels of propofol anesthesia.
Methods:
Seventeen patients who underwent lower abdominal gynecological surgery were enrolled in this study with written consents. Prior to induction, both BIS and Entropy sensors were placed simultaneously. After administration of epidural block via lower thoracic interspace using 1% ropivacaine, propofol (using Diprifusor) and vecuronium (0.1mg/kg) were induced, and an endotracheal intubation was conducted. Twenty minutes after the equilibration between plasma and effect site concentrations at 5 mcg/ml, the BIS values (XP, version 4.0, Aspect), the state Entropy (SE) and the response Entropy (RE) (Entropy Module, revision 0.1, GE Healthcare.) were recorded. N_2O was then added to the inspired gas mixture to achieve an end tidal concentration of 66%. Twenty minutes after the addition of N_2O, BIS, SE and RE were recorded again. Propofol concentration was then decreased to 4, 3 mcg/ml and the measurements were repeated as described above. Statistical analysis was made by paired t-test. $P<0.05$ was statistically significant.
Results:
Supplementing N_2O with all three effect site propofol concentrations decreased SE and RE, indicating that N_2O had a depressant effect on the central nervous system, while the addition of N_2O did not change BIS.
Conclusion:
This study indicated that the Entropy indices appeared as a better indicator to detect the EEG slowing effect caused by N_2O under propofol anesthesia.
Reference:(1) Masui (Jpn J Anesth) 2004; 53: 650

S-179.

OPINION REGARDING BISPECTRAL INDEX MONITORING: A SURVEY OF ATTENDING ANESTHESIOLOGISTS FROM MAJOR TEACHING HOSPITALS IN THE UNITED STATES

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Objective: To study the role of bispectral index (BIS) monitoring to help guide anesthetic administration among anesthesia community.
Methods: After IRB approval, a standardized questionnaire was developed electronically and posted on the UMMC website by using Perseus Survey Solutions software. Email addresses were collected from the AAMC website. Invitation emails were sent to 1,408 attending anesthesiologists in 33 US medical schools/teaching hospitals on May 26, 2005. A reminder email was sent out on June 1. The survey was closed on June 3.
Results: There were 225 responses (16.0%) in total. About 75% of the responses were from anesthesiologists with more than 10 years of practice experience. Most (84%) responses were from a hospital with more than 10,000 adult patients undergoing GA per year. 57% of those who responded to the survey said that they used BIS monitoring for less than 20% of their patients. 46% of them agree vs. 27% of them disagree of the effectiveness of BIS in preventing anesthesia awareness. More doctors disagreed that BIS reduces recovery room time, improves drug dosage, or improves sedation procedures. BIS related research (79%), ASA task force (62%) and JACHO (34.2%) have influences in using BIS monitoring on their patient care.
Discussion: Low percentages of patients undergoing GA were monitored by BIS. Almost half of anesthesiologists agreed that BIS monitoring plays an effective role in preventing anesthesia awareness. However, the role of BIS in improving sedation procedures, reducing recovery room time, and improving drug dosage are still not very convincing. BIS related research and ASA task force recommendation have more influence for anesthesiologists using BIS than JACHO recommendation.

S-180.

CLINICAL EVALUATION OF A DEVICE TO SPEED EMERGENCE FROM DESFLURANE ANESTHESIA

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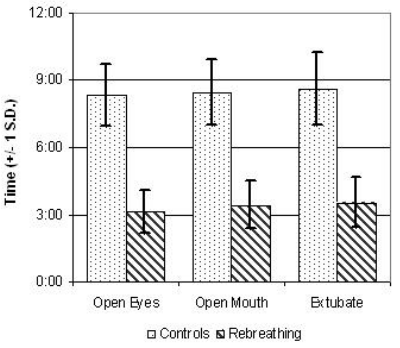
Introduction: Hyperventilation is vital to rapid removal of anesthetic gas from the lungs at the end of anesthesia. However, the resulting hypocapnia decreases respiratory drive as well as cerebral blood flow and can delay emergence from anesthesia. We evaluated a rebreathing device that allows simultaneous hyperventilation and hypercapnia during emergence.
The device placed between the patient and the breathing circuit uses partial rebreathing of CO2 to allow slight hypercapnia during hyperventilation. The device also incorporates an anesthetic adsorbent to scavenge volatile agents from the rebreathed gas before they are inhaled.
Methods: After IRB approval, 14 ASA class 1 and 2 patients scheduled for surgery were recruited for the study. Patients were randomly assigned to control and experimental groups. Anesthesia was maintained using 1 MAC of desflurane, 0.05-0.15 mcg/kg/min of remifentanil and pre-operative fentanyl. During maintenance, patients were ventilated at 8 breaths per minute and tidal volume was adjusted to maintain end-tidal CO2 at 33 mmHg. Emergence was initiated when the adhesive wound closure strips were applied. The emergence protocol for the control group was to turn off the vaporizer and increase the fresh gas flow to 10 L/min. For the experimental group, emergence was initiated by turning off the vaporizer, inserting the rebreathing absorber device in the breathing circuit, doubling the respiratory rate and increasing the fresh gas flow to 10 L/min. Times to eye and mouth opening in response to command and time to extubation were recorded.
Results: The average time to opening eyes and extubation for the control group was 8.05±1.22 minutes and 8.22±1.35 minutes. For the experimental group the average time to opening eyes and extubation was 3.05±0.57 and 3.31±1.06 minutes respectively. Experimental group patients received an average of 3.07 MAC-hours and control subjects received an average of 2.13 MAC-hours of desflurane. The average body mass index (BMI) for the control group was 24 and was 32 for the experimental group
Discussion: The rebreathing absorber device quickened emergence from desflurane anesthesia by 58% even though the control patients were leaner and spent less time under anesthesia. Although desflurane is recognized as having the fastest emergence profile of the volatile agents, it is clear from this data that emergence time can be significantly shortened, even with desflurane.



Neuroanesthesia

S-181.

ISOFLURANE PROVIDES SUSTAINED NEUROPROTECTION AGAINST MILD TRANSIENT FOCAL ISCHEMIA WITH RATS

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Introduction: It has been reported that isoflurane, when given during a severe focal ischemic insult, causes acute, but not enduring, reduction in ischemic injury (1). We hypothesized that the effect of isoflurane on delayed ischemic outcome is dependent upon the severity (i.e., duration) of ischemic insult.
Method: Male Wistar rats were anesthetized with isoflurane and mean arterial blood pressure (MAP) and pericranial temperature were monitored and regulated. Intraluminal middle cerebral artery occlusion (MCAO) was performed and rats were assigned to 1 of 4 groups (n=15 for each group): (1) 80min MCAO (awakened at onset of MCAO), (2) 80 min MCAO while anesthetized with 1.5 MAC isoflurane, (3) 50 min MCAO (awakened at onset of MCAO), or (4) 50 min MCAO while anesthetized with 1.5MAC isoflurane. Phenylephrine (2.5-15ug/kg/min was infused intravenously in the anesthetized groups to maintain MAP similar to awake rats. Rats were allowed to survive for 14 days after ischemia. Neurological deficits (0 = normal, range 0-48) and infarct sizes were then measured and compared by 2-way ANOVA.
Results: There was no significant difference in physiological values among the groups. Regional and total infarct size (mm^3)and neurological scores (mean±sd) are shown in the table. There was no effect of MCAO duration on ischemic outcome. In contrast, there was a main effect for isoflurane (versus awake) for both infarct size and neurologic score.
Discussion: Isoflurane provided long-term (2 week) neuroprotection against transient focal ischemia in this study where intra-ischemic MAP was controlled at values similar to animals subjected to MCAO while awake. This is held in contrast to prior studies that demonstrated only transient protection by isoflurane (1). In those studies, blood pressure was not controlled and this may have influenced the severity of the ischemic insult (2). We are not surprised, however, by the lack of overall effect of MCAO duration on ischemic outcome, as this has been previously reported (3). This data indicates, that at least under some experimental conditions, isoflurane provides enduring neuroprotection.
References: 1) Anesthesiology 2000;92;1335-42 2)J Cereb Blood Flow Metab 15:980-88 3) J Cereb Blood Flow Metab 16:195-201

	Infarct Size and Neurological Score			
	Cortex	Subcortex	Total	Neurological Score
80min MCAO (Awake)	110±81	49±23	160±97	11±6
80minMCAO (Isoflurane)	47±43	37±23	84±70	8±4
50minMCAO (Awake)	114±58	54±22	169±83	12±4
50minMCAO (Isoflurane)	39±45	26±19	66±60	5 ±5

S-182.

ANESTHETIC MANAGEMENT OF BLOOD BRAIN BARRIER DISRUPTION (BBBD). A RETROSPECTIVE REVIEW

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Background: Temporary disruption of the BBB allows delivery of chemotherapeutic agents to the brain in high concentration for treatment of certain brain tumors (1, 2). Our review highlights the problems we encountered during BBBD under anesthesia and in the postoperative period, as well as their management and outcome.
Methods: After obtaining IRB approval, we conducted a retrospective review of the charts of the patients who underwent BBBD from January 2002 thru December 2004. General anesthesia was admininstered according to a predefined protocol. Disruption of the BBB was acheived by injection of Mannitol 25% intra-arterially. That was followed by inection of intra-arterial methotrexate. Patients' charts were reviewed for adverse events during or after the procedure.
Results: 17 patients underwent 210 treatments under general anesthesia with a mean of 12.4±7.2 (mean ± SD) treatments per patient. Our patients were 13 females and 4 males with a mean age of 54±13.8 years. The principal diagnosis of all these patients was primary CNS lymphoma. Seizures occurred in 9 patients in 29 treatments (13%).They were typically focal motor (in 25 treatments), and occurred at variable times after disruption. Generalized motor seizures occurred in 4 treatment sessions in two different patients. The incidence of seizures was significantly higher when the internal carotid artery was used for injection; as opposed to the vertebral artery (20.8% and 6.02% respectively, P=0.0034). Sodium thiopental 30-50 mg was used for treatment. Tachycardia associated with ST segment depression occurred 9 times (4.3%) in three patients. Treatment was intravenous Esmolol 1-2 mg/kg. ST segment came back to baseline tracing after treatment in all cases. One patient had significant ST segment elevation (more than 1.5 mm) with no associated tachycardia which may suggest a central mechanism rather than a cardiac event in this particular patient. Postoperative EKG and cardiac enzymes in all affected patients were normal with no evidence of cardiac ischemic insult. Vasospasm was a radiological finding after Methotrexate injection in 9% of the cases. However, it was transient and did not require treatment. Despite prophylaxis against postoperative nausea and vomiting (PONV) with 20 mg of Ondansetron in all cases, the incidence of PONV was 11.9%. Following recovery, Lethargy and obtundation occurred in 7.6% of the cases with recovery to baseline mental status in less than 24 hours in all patients. The incidence of postoperative headache and reversible motor deficits was 6% and 3.8%, respectively.
Discussion: BBBD poses several challenges for the anesthesiologist. To our knowledge, this report is one of the first reviews addressing this issue.
References: 1-Treatment for primary CNS lymphoma: the next step. J Clin Oncol 2000; 18:3144-3150.
2- Development in the diagnosis and treatment of primary CNS lymphoma: a prospective series. Cancer 1986; 58:1609-1620.

S-183.

WITHDRAWN

S-184.

EFFECT OF ISOFLURANE ON SPATIAL MEMORY TASK IN ADULT MICE AFTER MODERATE HYPOXIA

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Introduction: Perioperative hypoxia as well as anesthetics may contribute to postoperative cognitive impairment. The relationship, however, has never been studied systematically. The purpose of this investigation was to determine whether hypoxia alone or in combination with isoflurane disrupts working memory in mice.
Methods: Following IACUC approval, 150 Swiss Webster, 35-45 g mice (6-9 wks) were assigned to 1 of 4 treatments for one hour: 1). O2, 21%, 2). O2, 21%+Isoflurane 1.2%, 3). O2, 8%, 4). O2, 8% + Isoflurane 1.2%. Mice breathed spontaneously throughout the experiment. Working memory was assessed by use of a Y maze (1).On the training trial entry to one arm was blocked and mice were permitted to run between the two open arms for 15 min and inspect the objects outside. On the test trial, carried out 1 hr later, all arms were open. Time spent in each arm and number of arm entries was automatically recorded by a camera and associated software. Mice with intact spatial memory spend approximately 60% of the time in the novel arm. Mice were tested 1, 4 and 7 days after anesthesia. A different arm was used as the novel arm for each test. Performance was analyzed with repeated measurements ANOVA and by post-hoc comparisons using Newman-Keuls test. P-value less than 0.05 were considered significant.
Results: Table 1 shows the percent of time which mice spent in the novel arm of the Y-maze. Animals subjected to hypoxia (8% O2 for 1 hour) spent significantly less time in the novel arm one day after the insult. The impairment, however, was transient. Hypoxic mice performance improved to the level of the control animals on the fourth post-treatment day. Mice subjected to hypoxia plus isoflurane exhibited no impairment and were comparable to the control group at all time points.
Conclusion: Hypoxia transiently impairs performance in a spatial memory task. This transient impairment is consistent with the hypoxia - induced inhibition of neurotransmitter synthesis, including acetylcholine. Isoflurane 1.2% prevented the deterioration, possibly by reducing cerebral metabolic requirements for high energy substrates and related decline in the level of acetylcholine.

TABLE 1. The percent of time spent in the novel arm of the Y-maze (N=15)

Group	Day 1	Day 4	Day 7
O2, 21%	63.8±3.2	62.3±3.3	57.8±3.8
O2, 21% + Iso 1.2%	62.7±4.1	58.1±3.9	55.4±3.9
O2, 8%	40.8±3.6	61.1±4.9	63.5±4.2
O2, 8% + Iso 1.2%	62.4±2.1	61.6±3.4	62.2±3.7

Data reported as Mean±SEM

References: F.Dellu, et al. Brain Res. 1992, 588, 132-139.

S-185.

EFFECT OF ANAESTHETIC AGENTS ON INTRAOPERATIVE MONITORING OF SOMATOSENSORY EVOKED POTENTIALS - A COMPARISION BETWEEN ISOFLURANE AND PROPOFOL

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INTRODUCTION
Intraoperative monitoring of SSEP provides the ability to monitor the functional integrity of sensory pathways in anaesthetized patients. Pharmacological factors especially the anesthetic agents cause significant changes in SSEP and therefore it is essential to quantify these changes in order to make intraoperative recordings of evoked potentials (EP) a useful monitor of neural damage. This study was undertaken to compare and quantify the changes caused by isoflurane to that of propofol on SSEP.
PATIENTS AND METHODS
Fifteen ASA I, II patients undergoing surgery for intracranial mass lesion were consented for the study. Anesthesia was induced with midazolam, fentanyl, propofol, and vecuronium, the anesthesia was maintained with oxygen - air mixture and propofol infusion.
Median and posterior tibial nerves were stimulated and EPs were recorded continuously. Once the steady state of propofol infusion was reached, baseline value of the latency and the amplitude of median nerve (Mo) and posterior tibial nerve (To) SSEP were noted. Isoflurane was added to the inspired gas mixture and EP wave form recorded at an ET isoflurane of 1% noted as M_{ISO-1} or $T_{ISO-1.}$ Nitrous oxide was then substituted for air and EP wave forms were recorded at an ET nitrous oxide of 50% as M_{ISO-N}, $T_{ISO-N.}$ Nitrous oxide was then discontinued and the wave forms recorded when the ET nitrous oxide was negligible were noted as M_{ISO-2} or $T_{ISO-2.}$ The amplitude and latency changes were analyzed statistically.
RESULTS
1% Isoflurane reduced the amplitude of the median nerve SSEP by 40% and prolonged the latency by 5% when compared to propofol. The absolute decrease in amplitude was 2.26 μ V and the increase in latency was 1 msec. The amplitude of posterior tibial nerve waveforms was reduced by 0.25 μV (30%), and the latency were increased by 2 msec (5%) when compared to propofol. The administration of nitrous oxide with isofurane decreased the amplitude of median nerve SSEP by 3.5 μV (63%) and increased their latency by 1.1 msec (7%) as compared to when only propofol was used. Nitrous oxide decreased the amplitude of posterior tibal SSEP by 0.8 μV (56%) and increased their latency by 3 msec (8%). The amplitude of the EP was highest and the latency least on propofol infusion.
DISCUSSION
Intraoperative monitoring of median and posterior tibial nerve somatosensory evoked potentials is best recordable with propofol. However with 1% isoflurane the morphology of the EP wave form is reproducible. The EP wave forms were lost when nitrous oxide is added to isoflurane, to the extent that it is advisable to avoid nitrous oxide when intraoperative monitoring is required. From this study we conclude that TIVA with propofol is a better anesthetic technique when intraoperative monitoring of SSEP is vital.

S-186.

A METHOD FOR MEASURING OCULAR PHYSIOLOGY IN THE PRONE POSITION USING A MODIFIED PRONEVIEW™ HELMET SYSTEM

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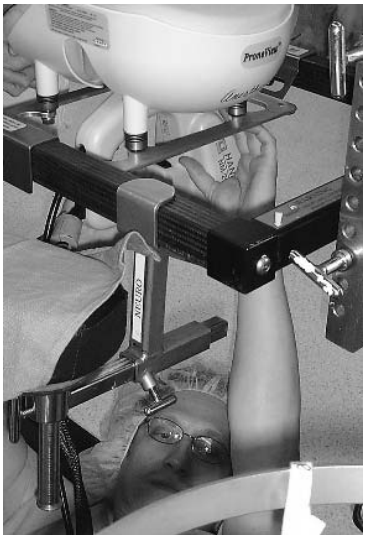
AFFILIATION: UMDNJ, Newark, NJ.

Introduction: Permanent perioperative visual loss is a rare but devastating complication of surgery. The majority of reported cases is associated with spine surgery conducted in the prone position (67%) and appears to be related to a change in retinal and/or optic nerve perfusion (1). The ultimate goal of our study is to create a feasible clinical model for the measurement of intraocular pressure (IOP), ocular perfusion pressure (OPP) and ocular perfusion (using retinal vessel imaging).
Methods: We have conducted three steps towards developing an access system for measuring ocular physiology. First, using the Dupaco Proneview™ Helmet System we established that a modified frame to support the foam headrest would allow unimpeded access to the eyes. After two engineering prototypes, access to ophthalmologic measurement during prone surgery was performed. Second, we assessed reliability and validity of instruments to measure intraocular pressure (IOP) in the prone position. This was conducted in two phases: 1) a comparison of handheld devices in the sitting, supine and prone position (n=10), and 2) upon establishing the more accurate IOP device, assessing accuracy under clinical conditions including retinal photography using the Nidek NM 200D, nonmydriatic digital camera [1.5 mega pixel resolution].
Results: The final engineered frame allowing unimpeded access to ocular physiology measurements is shown in Figure 1. Variability of measurements for IOP was least with the Tonopen XL. Clinical IOP measurement with orbit protection was optimized using a soft contact lens with intermittent lubrication with artificial tears. The Tonopen XL directly contacts the orbit contact lens in one eye. For retinal photography, the other eye receives pupillary dilation after induction of anesthesia using cyclogyl 1%. Ten volunteers have had prone retinal photographs over a one hour period in the prone position. These photographs allow assessment of venous congestion and optic cup/disc ratio as indicators of posterior optic perfusion.
Discussion: Our results indicate that measurement of ocular physiology is possible in the prone position. Clinical measurements, repeated hourly, will include IOP and retinal photography.
References:
1. Anesth,85(5):1020,1996.
Figure 1: Taken from underneath the Jackson spinal table, an ophthalmologist is capturing photographs of the optic disc and retina using the Nidek NM 200D, nonmydriatic digital camera of a volunteer in the prone position using the Proneview™ Helmet System with the modified table platform.



S-187.

FREQUENCY-DOMAIN NEAR INFRA-RED SPECTROSCOPY: A NEW QUANTITATIVE APPROACH TO MEASSURE BRAIN TISSUE OXYGENATION

AUTHORS: **R. Gatto**[1], W. E. Hoffman[1], V. L. Baughman[1], W. Mantulin[2], E. Gratton[1], F. Charbel[1];
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Introduction: It has previously been shown using continuous wave near infra-red spectroscopy (NIRS) that brain oxygenation does not decrease in dead subjects. A frequency-domain NIRS device (Oxiplex, Champaign, IL) hacan measure absolute values of cerebral oxyhemoglobin and deoxyhemoglobin without interference of superficial tissue. The purpose of this study was to determine oxyhemoglobin and deoxyhemoglobin concentration in dead subjects and compare it to control measures in volunteers.
Methods: Five patients that died in the hospital were evaluated by NIRS in the morgue up to 24 hours after death was confirmed. One patient had intracranial hemorrhage in the right hemisphere indicated by a computed tomography scan. Brain oxyhemoglobin, deoxyhemoglobin, oxygen saturation, and total hemoglobin were determined bilaterally in each patient using the Oxiplex according to manufacturer's instructions. The probe was placed 2 cm above the eyebrow and 1 cm lateral from the midline on the forehead and was shielded from outside light during the measure. Ten control measures in awake volunteers were performed with the subject in supine position. An unpaired t-test was used for statistical comparison between groups.
Results. Brain oxyhemoglobin and oxygen saturation were decreased and deoxyhemoglobin was increased in dead patients compared to volunteers (table 1). Total hemoglobin concentration was not different between dead and volunteer subjects. There was no difference between the right and left side in volunteers and 4 of the dead subjects. In the patient with intracranial hemorrhage, oxyhemoglobin was 3.0 uM, oxygen saturation was 11%, deoxyhemoglobin was 22.6 uM and total hemoglobin was 25.6 uM contralateral to hemorrhage. Ipsilateral to hemorrhage, oxyhemoglobin was 28.7 uM, oxygen saturation was 52%, deoxyhemoglobin was 26.9 uM and total hemoglobin was 55.6 uM. The data in the hemisphere with intracranial hemorrhage was not included in the averages for dead subjects.
Discussion: These results indicate that oxyhemoglobin decreased and deoxyhemoglobin increased but total hemoglobin did not change in dead patients compared to live volunteers. Depletion of brain oxygen that may occur at the time of death and/or be progressive in dead subjects. Brain hemorrhage altered the measurement but this can be identified by an increase in total hemoglobin.
Table 1: Brain hemoglobin in live volunteer (control) and dead subjects

Group	n	Age (y)	Oxygen Saturation (%)	Oxyhemo-globin (uM)	Deoxyhemo-globin (uM)	Total Hemoglobin (uM)
Control	10	36 ± 9	63 ± 7	24.0 ± 9.1	13.8 ± 3.2	37.8 ± 10.3
Dead	5	63 ± 21*	6 ± 5*	1.5 ± 1.0*	26.3 ± 9.3*	27.8 ± 9.2

Mean ± SD, * = P < 0.05 compared to control

S-188.

NEUROTOXICITY OF PROPOFOL ON GROWTH CONES AND NEURITES OF GROWING NEURONS IN VITRO

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Introduction: During the last 10-15 years, extensive in vivo and in vitro studies have reported that propofol is a safe anesthetic agent, with relatively slight side effects. However, there have been several reports of neurological sequelae (convulsions) following prolonged sedation with propofol in children[1]. Metabolic acidosis and renal, liver and heart failure [2,3,4] have also been reported in children and adults. Although safe administration of propofol to neonates was reported in a case study [5], in vitro studies, propofol neurotoxicity has been demonstrated in several cell culture systems [6]. This study was undertaken to determine whether propofol has neurotoxic effects on peripheral and autonomic neurons and which neurons are particularly liable to be injury by propofol.
Methods: Primary-cultured dorsal root ganglia (DRG), retinal ganglion cell layers (RET), and sympathetic ganglion chains (SYMP) were isolated from age-matched chick embryos and cultured for 20 h with a wide range of propofol concentrations (5-300μM) to investigate the effects of propofol on these three types of neuronal tissue. Quantitative morphological changes were examined and growth cone collapse assay was performed microscopically. Propofol concentrations were measured using HPLC.
Results: Propofol induced growth cone collapse and neurite destruction(Fig.1). The three types of neurons tested exhibited significantly different dose-response relationships at 2 h after the application of propofol ($P < 0.001$) but not at 24 h after application. The ED50 values (mean ± SD) at 2 h were 99.35± 4.2 μM for DRG, 81.6 ±11.4 μM for RET, and 63.5 ±4.6 μM for SYMP. While those at 24 h were 43.51 ±11.4 μM for DRG, 55.34 ±3.4 μMfor RET, and 57.76 ±1.2 μM for SYMP. The growth cone collapsing effect was at least partially reversible in all three types of neurons after exposure to 100 μM propofol up to 6 h, but reversibility was not observed after 24 h exposure.
Conclusion: Extended exposure to propofol may have cellular neurotoxic effect even in the range of clinical dosages. This accumulating body of in vitro evidence provides a rational basis for in vivo investigation.
References:
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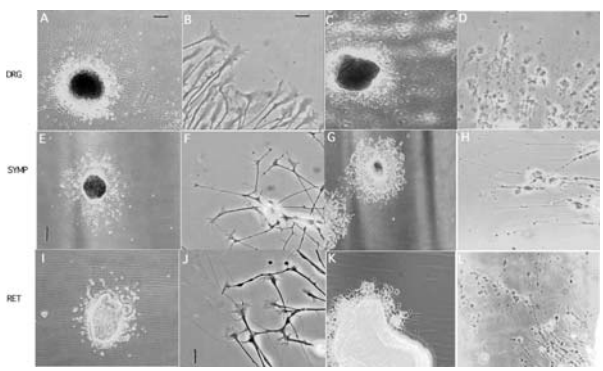
2- Intensive Care Med 29:1417-25; 2003
3- Am J Kidney Dis 44: 98-101; 2004
4- BMJ 305: 613-16; 1992
5- aesthesia 49: 1058-60;1994
6- Anesthesiology 92:1408-17; 2000



S-189.

INCIDENCE OF DIFFICULT INTUBATION IN PATIENTS FOR PITUITARY ADENOMECTOMY: A 13-YEAR RETROSPECTIVE STUDY

AUTHORS: J. Lo, D. **C. Kramer**, K. Post, I. P. Osborn;
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Introduction:
Pituitary adenomas may be classified based on their secretory status. Tumors that secrete GH produce acromegaly, while those, which secrete ACTH, produce Cushing's syndrome. Patients who have GH or ACTH producing tumors may exhibit morphologic changes, including changes to the airway[1]. Difficulty in intubating the trachea of acromegalic patients, for example, has been attributed to these anatomic changes. The incidence of difficult intubation in this group has been reported as 10 - 30% [2, 3]. There is a scarcity of literature regarding the implications of Cushing's syndrome to airway management. To investigate the effects of pituitary tumor secretory status on difficulty of intubation, we performed a retrospective chart review of patients undergoing pituitary adenomectomy over the past thirteen years at a 1,200-bed tertiary-care teaching hospital. This is the largest study of its type.
Methods:
After Institutional Review Board approval, a database of patients who have undergone pituitary adenomectomy between July 1991 and May 2004 was reviewed. Patients were classified as GH-secreting, ACTH-secreting, or Non-GH/Non-ACTH-secreting based on serologic testing. Overall airway scores (OAS) were assigned based on Mallampati classification, thyomental distance, neck mobility, mouth opening and anesthesiologists' general impressions of each patient. The airway was classified as easy, intermediate, or difficult to intubate. The chart was then reviewed for difficulty of intubation.
Results:
One thousand two hundred forty eight anesthetics were evaluated, which included 1135 patients over a thirteen-year period representing 97% of charts that could be reviewed.

	Acromegaly GH-secreting$^{\wp}$	Cushing's syndrome ACTH-secreting$^{\wp}$	Non-GH/ Non ACTH-secreting
Patients	199	194	680
Age (Mean)	47.13	39.83	48.37
Gender (% Males)	45	22	43
BMI (Mean)	29.0	30.9	28.25
Difficult OAS (%)	9.05	2.58	1.47
Difficult OAS (p*)	t value = 2.78, p <0.05	t value = 2.78, p <0.05	
Difficult Intubation (%)	17.3	3.19	3.98
Difficult Intubation (p^{Ψ})	p <0.001	p < 0.001	
Emergent Surgical Airway	1	0	0
Probability Ratio	4.37	0.80	

* student t test, $^{\Psi}$ chi-squared, ratio of percent difficult intubation to percent in Non-GH/Non ACTH-secreting group, $^{\wp}$values compared to Non-GH/Non ACTH-secreting patients

Discussion:
Our review confirms that patients with acromegaly are more likely to have airways that appear to be, and are 4.4 times more difficult to intubate, despite the presence of modern airway equipment. Although patients with ACTH-secreting tumors had higher OAS than Non-GH/ Non ACTH-secreting patients, they were not more difficult to intubate. This analysis highlights the importance of knowledge of secretory status in the airway management patients with pituitary lesions.
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S-190.

THE INCIDENCE OF INTRAOPERATIVE BRADYCARDIA, POSTOPERATIVE ELECTROLYTE ABRNORMALITIES, AND DELAYED PACU DISCHARGE IN PATIENTS UNDERGOING ENDOSCOPIC THIRD VENTRICULOSTOMY WITH LACTATED RINGER'S SOLUTION IRRIGANT

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Introduction: The choice of irrigation fluid, normal saline versus lactated Ringer's solution, may influence the incidence of intraoperative bradycardia and postoperative electrolyte abnormalities in patients undergoing endoscopic third ventriculostomy (ETV). [1,2] El-Dawlatly et al., for example, reported a 41% incidence of bradycardia during ETV with normal saline irrigant, and noted a decrease in postoperative serum K+.[1,3] In contrast, Anandh et al. reported increased postoperative serum K+ following ETV with lactated Ringer's irrigant, but the study was limited to 20 patients.[4] Our objective was to better define the incidence of intraoperative bradycardia, postoperative electrolyte abnormalities, and delayed PACU discharge in patients undergoing endoscopic ETV with lactated Ringer's irrigant.
Methods: Medical records of 172 patients who underwent ETV were reviewed. All ETVs were performed under general anesthesia using lactated Ringer's solution as irrigation fluid. Patient age, preoperative blood chemistries, intraoperative intravenous fluids, and postoperative electrolytes were recorded, as was the occurrence of intraoperative bradycardia. The duration of anesthesia, which was used as a surrogate for irrigation time, and the time needed to meet PACU discharge criteria were also collected.
Results: The 172 patients studied underwent 191 ETVs. The mean age at time of operation was 36 ± 22 years (range= 1 month to 90 years), and the mean duration of anesthesia was 2.8 ± 0.7 hours. PACU discharge criteria were met within one hour by 159 patients, while 17 patients required more than one hour. No relation was found between age or duration of the procedure and the time to reach the PACU discharge criteria. The incidence of bradycardia during ETV was 21.6% (40/189).
Preoperative serum Na+ and K+ mean values were 140 ± 3 mEq/L (n=183) and 4.3 ± 0.5 mEq/L, respectively. Postoperative serum Na+ and K+ mean values were 139 ± 4 mEq/L and 4.0 ± 0.4 mEq/L (p=0.07). Abnormal serum Na+ was documented in 14 patients postoperatively (9 patients >145 mEq/L, 5 patients <135 mEq/L), and abnormal serum K+ was documented in 29 patients postoperatively (2 patients >5.5 mEq/L; 27 patients <3.5 mEq/L). Patient age, elevated serum creatinine concentration, preoperative serum Na+ and K+ concentration abnormality, and type of intraoperative intravenous fluids were not significantly associated with development of postoperative electrolyte abnormalities.
Discussion: In contrast to the postoperative hyperkalemia after ETV with lactated Ringer's irrigant that has been reported previously[4], our study shows a trend towards hypokalemia that was neither statistically significant nor clinically important. This result suggests that irrigation with lactated Ringer's solution should not be avoided because of concerns about hyperkalemia.
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2. Minim Invas Neurosurg 2003; 46: 198-201
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S-191.

THE SAFETY OF DEXMEDETOMIDINE AS A PRIMARY SEDATIVE FOR AWAKE CAROTID ENDARTERECTOMY

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Introduction: A recent study evaluated the effectiveness and safety of dexmedetomidine (DEX) for awake carotid endarterectomy (CEA) (1). Patients sedated with DEX had superior sedation profile and lower incidence of postoperative hypertension than patients in the control group. However, patients in the DEX group had higher incidence of intraarterial shunting (19% versus 6%) Although the difference did not reach statistical significance, some authors suggested not using DEX in patients undergoing CEA, until further research established it's safety in this patient's population (2,3). The objective of this study was to establish incidence of shunting in consecutive cases of awake CEA performed in our institution from 05/04 till 05/05 using DEX as a primary sedative.
Methods: Data were prospectively recorded for 151 patients who underwent CEA during the study period. Patients thought to be at risk of an intraoperative stroke were treated with prophylactic intraarterial shunting. These patients as well as patients who required general anesthesia were excluded from the final analysis. General anesthesia (GA) was selected for patients with language barrier, patient's preference for GA, or recent stroke and inability to follow instruction. Cervical plexus block was performed in all other patients. DEX supplemented by midazolam and/or fentanyl was used for sedation. An initial loading dose of 0.5 mcg/kg was given over 15 minutes followed by an infusion of 0.1 to 0.5 mcg/kg/hr. Patients who demonstrated signs of cerebral ischemia with test clamping were treated with intra-arterial shunting. We reported patients' demographics, perioperative medications, and hemodynamic variables as medians and the interquartile range (as a measure of dispersion).
Results: One hundred forty one and 10 patients underwent CEA under regional (RA) and GA respectively. One hundred twenty three patients were sedated with DEX. Eighteen patients were sedated with midazolam/fentanyl for medical or logistical reasons. Twenty eight patients were shunted electively (10 under GA, 18 under RA). Six patients demonstrated signs of ischemia and were shunted selectively. Four of them were sedated with DEX. No patient in the RA group developed stroke or any other serious complication.
Discussion: Contrary to the previous results, the use of dexmedetomidine as a primary sedative agent for CAE does not increase incidence of intraarterial shunting (3.3%).
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S-192.

COMPARISON OF ATENOLOL AND CLONIDINE PREMEDICATION ON HAEMODYNAMIC RESPONSE OF NASAL SPECULUM INSERTION DURING TRANS-SPHENOIDAL RESECTION OF PITUTARY TUMOURS: A PROSPECTIVE, RANDOMINIZED, DOUBLE BLIND, CONTROLLED TRIAL

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Introduction:
Severe cardiovascular reactions in form of tachycardia and hypertension have been reported despite adequate depth of anesthesia, caused by speculum insertion during trans-sphenoidal pituitary surgery (1). We planned this controlled study to compare the effects of Clonidine and Atenolol premedication over hemodynamic responses during trans-sphenoid surgery.
Material and Methods:
After ethical committee approval and consent from the patients, 39 patients of ASA grade I-III, age 25-65 years for elective surgery were divided into three groups. Patients with history of coronary artery disease, acromegaly and those already taking Atenolol and Clonidine were excluded from the study. Group I were given Placebo, group II Tablet Clonidine 5µg/kg and group III Tablet Atenolol 0.5mg/kg, two hours prior to anesthesia along with Tablet Lorazepam 2 mg. Anesthesia was standardized in all. Hemodynamic variables were recorded. Rescue analgesia with intravenous fentanyl 1mcg/Kg was given if systolic blood pressure increased ≥ 20% of the baseline value. BIS value > 50 was treated with boluses of Propofol.
Results:
Demographic data, Baseline HR and MAP were comparable amongst the groups. More hemodynamic response was seen in group 1 as compared to group 2 and 3 during the laryngoscopy (P>0.05). There was increase in heart rate in group 1 and 2 as compared to group 3 at 5and 10 minutes following insertion of nasal speculum (p<0.05). There was significant higher rise in MAP after nasal speculum insertion in group 1 as compared to other groups (p>0.05). The requirement of intravenous Fentanyl and Propofol was high in the group 1 compared to other groups (p<0.05).
Discussion:
Premedication with oral clonidine at doses of 4 to 7 µgm per kg has been reported to blunt the increase in catecholamine plasma concentration during major surgery (2). Oral atenolol effectively prevent tachycardia during carotid endarterectomy (3). We Concluded that Clonidine and Atenolol premeditations blunt the hemodynamic responses during trans-sphenoidal surgery where as Atenolol is more effective in preventing tachycardia during nasal speculum insertion.
References:
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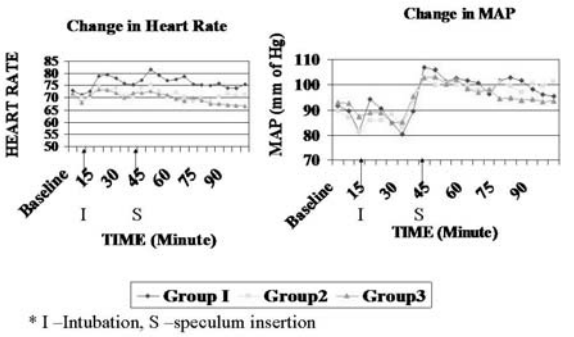

* I –Intubation, S –speculum insertion

S-193.

BRAIN OXYHEMOGLOBIN AND DEOXYHEMOGLOBIN CONCENTRATION DURING DESFLURANE ANESTHESIA AND EC-IC BYPASS

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Introduction: Previous studies have shown that when desflurane was maintained at concentrations to produce burst suppression, tissue oxygenation increased in ischemic brain. Little is known how this treatment may affect brain hemoglobin concentration ipsilateral and contralateral to ischemic brain. We measured brain oxyhemoglobin (OxyHb) and deoxyhemoglobin (DeoxyHb) in 3 patients undergoing extracerebral to intracerebral (EC-IC) bypass and compared this to 3 control patients undergoing anterior cervical disk surgery.
Methods: This study was approved by the institutional review board for clinical research. Values of brain oxyhemoglobin, deoxyhemoglobin, oxygen saturation, and total hemoglobin were determined bilaterally in each patient using an Oxiplex TS (ISS, Champaign, IL) according to manufacturer's instructions. The probe was placed 2 cm above the eyebrow, 1 cm lateral from the midline on the forehead and was shielded from outside light during the measures. Entropy electroencephalogram (EEG) sensors were placed below the Oxiplex sensor contralateral to ischemia. Measures were made in awake patients and during steady state desflurane anesthesia to maintain Entropy at a value of 45. In EC-IC patients, measures were also made during desflurane anesthesia titrated to produce burst suppression EEG. Phenylephrine infusion was given to maintain mean blood pressure above 90 mmHg during burst suppression. Measures were compared between groups by t-test.
Results: There was no difference in OxyHb or DeoxyHb between EC-IC and control patients during awake measures (table 1). Desflurane concentration was 5.5 ± 0.5% during steady state anesthesia and 10.5 ± 1.3% during burst suppression. During desflurane anesthesia, OxyHb increased in ischemic patients, more in the contralateral than the ischemic side.
Discussion: These results show that desflurane produced vasodilation that was greater in ischemic than control patients. The vasodilatory and oxygenation effect of desflurane was further enhanced by increasing the desflurane concentration to produce burst suppression.
References:
1. Comparison of the effect of etomidate and desflurane on brain tissue gases and pH during prolonged middle cerebral artery occlusion. Anesthesiology 1998;88:1188-94.
Table 1: Brain oxygen saturation (Oxy), OxyHb, DeoxyHb and total hemoglobin during desflurane anesthesia. Measures in EC-IC patients were made in the ischemic (Isch) and contralateral (Cont) hemisphere. In Control patients measures were made in right (R) and left (L) hemisphere. Mean ± SD, * = P < 0.05 compared to control.

Group	Treat	Isch Oxy (%)	Cont Oxy (%)	Isch OxyHb (uM)	Cont OxyHb (uM)	Isch Deox-yHb (uM)	Cont Deox-yHb (uM)	Isch TotHb (uM)	Cont TotHb (uM)
EC-IC	Awake	51 ± 4	50 ± 2	20 ± 4	19 ± 1	19 ± 2	19 ± 2	39 ± 7	39 ± 2*
	Desfl	62 ± 1	64 ± 17	28 ± 2	35 ± 8*	17 ± 2	19 ± 9	45 ± 3	66 ± 15*
	Bur Sup	65 ± 1	73 ± 13	31 ± 6	44 ± 5	17 ± 3	16 ± 9	49 ± 9	72 ± 14
		R Oxy	L Oxy	R OxyHb	L OxyHb	R DeoxyHb	L DeoxyHb	R TotHb	L TotHb
Control	Awake	50 ± 7	50 ± 5	15 ± 4	14 ± 3	15 ± 2	15 ± 1	30 ± 5	28 ± 3
	Desfl	50 ± 5	49 ± 4	14 ± 5	14 ± 3	14 ± 2	15 ± 1	29 ± 4	29 ± 8

S-194.

TARGET CONTROLLED INFUSION OF PROPOFOL AND REMIFENTANIL FOR AWAKE CRANIOTOMY AND BIS MONITORING: TWO CASES REPORT

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Introduction Several anesthetic techniques have been suggested for awake craniotomy. Propofol and remifentanil target controlled infusions (TCI) or manual infusions modulated by pharmacokinetic (Pk) simulations have been suggested 1, 2. We describe two cases reports in which an asleep-awake-asleep technique, with propofol and remifentanil target controlled infusions and BIS monitoring, was used.
Case 1 A 49-year-old, 79-kg, 170-cm man was scheduled for a left craniotomy for resection of a tumor localized close to the Broca area. RugloopII® software (M Struys, De Smet T, Ghent, Be) was used to control the two pumps for TCI of remifentanil and propofol, and collect data from Datex AS3 monitor and AspectA2000XP monitor every 5 seconds. Arterial invasive pressure and central venous pressure were monitored. A LMA was placed and controlled ventilation was used until dural opening; scalp block was performed, using 0.25% bupivacaine with adrenaline; during this phase, mean predicted mean effect site (ES) concentration of propofol and remifentanil were 5.1±0.8 ¼g/ml and 2.35±1.2 ·g/ml; mean BIS was 42±8.1. After craniotomy, target concentrations were reduced, the LMA was removed and the awake phase followed; neurological and speech testing were performed during 220 minutes, with mean ES concentrations of propofol and remifentanil of 1.25±0.46¼g/ml and 1.97Â±0.3·g/ml, respectively; mean BIS was 89±10. The last phase, closure, lasted 193 minutes, mean ES concentrations of propofol and remifentanil were 0.96±0.09¼g/ml and 1.4±0.15·g/ml; mean BIS was 54±7.
Case 2 A 29-year-old 75 kg, 165 cm woman was scheduled for left frontal craniotomy for resection of a tumor localized between the Rolando sulcus and the pre-frontal gyrus. TCI of remifentanil and propofol were delivered by a Fresenius Orchestra pump. Aspect A2000XP monitor was used for BIS monitoring. Tivatrainer 7.5® software (GuttaBV, Aerdenhout, NL) was used for Pk simulation and storing the changes in target concentrations of both drugs. Loss of consciousness occurred with ES concentrations of propofol and remifentanil of 4¼g/ml and 2.5·g/ml; scalp block was performed with 40 ml of 0.2% ropivacaine. Recovery of consciousness (ROC) and LMA removal occurred with ES concentrations of propofol and remifentanil of 1.6¼g/ml and 2·g/ml, respectively, allowing the beginning of neurological testing and tumor resection. The awake phase lasted 332 minutes; ES target concentrations were kept. For closure, ES target concentrations were increased to 2¼g/ml and 2.5·g/ml for propofol and remifentanil respectively. ROC occurred with ES concentrations of propofol and remifentanil of 1.5¼g/ml and 1.2·g/ml, with BIS of 96.
Conclusions TCI of remifentanil and propofol, with BIS monitoring, seems a good anesthetic technique for tumor resection with awake craniotomy. ES concentration of both drugs and BIS values had a good correlation with the clinical course of surgery.
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S-195.

HEART RATE TONE-ENTROPY CHANGES DURING PROPOFOL SEDATION AND DESFLURANE ANESTHESIA

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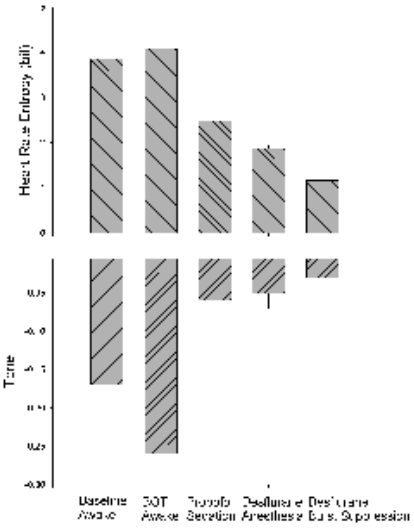
Introduction: Tone-entropy provides real time determination of sympathovagal balance and is an alternative to conventional spectral analysis. Tone provides a mathematical average of accelerating and decelerating heart periods to indicate sympathetic or parasympathetic dominance. Entropy indicates the variability of beat to beat measures. The purpose of this study was see if tone-entropy is affected by propofol sedation and desflurane anesthesia.
Method: Nine patients were evaluated during neurosurgical procedures. After placement of electrocardiogram and electroencephalogram (EEG) electrodes, baseline measures were made with the patient awake for 5-10 minutes. One patient remained awake during a balloon occlusion test. Two patients required propofol sedation (50 ug/kg/min) for minor surgical procedures. Seven patients were anesthetized with desflurane for anterior cervical disk surgery (n = 3) or superficial artery to middle cerebral artery (STA-MCA) bypass (n = 3). End-tidal desflurane concentrations was 4-6% for surgery or 9-12% for burst suppression EEG at the time of bypass. Heart periods were transformed into a percentage index (PI) time series. The tone is the average of the PI time series. A positive number represents sympathetic acceleration and a negative number represents vagal inhibition. Entropy of the PI distribution was determined using Shannon's formula: $- \Sigma P(i) \log_2 P(i)$, and provides the same results as a variance determination.
Results: In awake patients, tone was negative indicating baseline vagal tone and heart rate entropy was similar to levels reported by Oida et al. Neither tone nor entropy changed in the awake patient during the 2 hour balloon occlusion procedure. In 2 patients receiving propofol sedation tone and entropy decreased, indicating a decrease in autonomic tone. In patients anesthetized with desflurane, tone and entropy were decreased more than with propofol sedation and by increasing the desflurane concentration for burst suppression.
Discussion: In awake patients there is vagal dominance indicated by negative tone. Heart rate entropy and tone decreased in a dose dependent manner during sedation and anesthesia indicating a decrease in autonomic activity.
Reference
Figure 1. Heart rate tone and entropy changes as a function of sedation and anesthesia. Baseline measures were performed in all patients. One patient received a balloon occlusion test while awake, 6 patients were measured during desflurane anesthesia and 3 patients when desflurane was increased to produce burst suppression EEG.



S-196.

RECOVERY AFTER INTRACRANIAL PROCEDURES: WHAT'S THE EVIDENCE?

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INTRODUCTION: As continuous neurological assessment after intracranial procedures is essential in the postoperative period, anesthesia should allow for rapid recovery of consciousness after neurosurgery. However, overly rapid emergence may lead to detrimental hemodynamic instability in this setting. We therefore tried to identify the optimal neuroanesthetic technique with regards to speed of recovery and hemodynamic stability.
METHODS: Searches in MEDLINE (1994-3/2005, English abstracts only) including the terms "wake-up, extubation, recovery, or awakening, and neurosurgery, neuroanesthesia or brain surgery" were conducted. Related articles and relevant reference lists were also searched. Prospective, randomized, controlled trials in adult patients were included; abstracts, letters, case reports, or unpublished data were not.
RESULTS: We identified 25 articles which met quality criteria; on further inspection, 17 were relevant. Only a few trials compared immediate vs delayed awakening. In one trial, delayed, in contrast to immediate extubation was associated with increased stress markers (1). This may indicate that striving for immediate emergence is preferable. Regarding anesthetic drugs, most trials compared remifentanil with other approaches. Emergence was consistently faster after remifentanil than isoflurane anesthesia (2). In comparison to fentanyl-based anesthesia, the benefit of remifentanil was inconsistent; however, faster wake-up was attained when remifentanil/morphine was used for transitional analgesia after craniotomy than with use of intraoperative fentany (3). In several trials, propofol was shown not to be associated with faster emergence as compared with isoflurane (4) or sevoflurane (5). Remarkable was the absence of studies investigating the properties of sufentanil in neurosurgical patients, as well as a relative paucity of data on sevoflurane. In one trial, clonidine did not affect emergence, degree of sedation, or hemodynamics after supratentorial surgery (6).
DISCUSSION: The available evidence indicates that (a) striving for immediate emergence after intracranial procedures is likely preferable to delayed awakening; (b) remifentanil-based anesthesia moderately improves time to awakening as compared with other anesthetic approaches; and (c) there appear to be no significant differences in this regard among isoflurane, sevoflurane, and propofol. Further studies should investigate the effects of sufentanil, because its context-sensitive half-time profile is better than that of fentanyl and because its lasting analgesic effects makes transitional analgesia as required for remifentanil largely unnecessary.
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Obstetric Anesthesia

S-197.

COMPARISON OF PROPOFOL AND SEVOFLURANE ON THE INCIDENCE OF POSTOPERATIVE NAUSEA AND VOMITING WITH GYNECOLOGICAL LAPAROSCOPIC SURGERY

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Introduction Women, laparoscopic surgery, non-smoker and motion sickness and/or previous history of postoperative nausea and vomiting (PONV) are known as risk factors for PONV(1). In gynecological laparoscopic surgery, two of these factors always exist. Therefore, anesthesia which causes less PONV is desirable. We compared propofol and sevoflurane on the incidence of PONV with gynecological laparoscopic surgery.
Methods One hundred patients, ASA physical status 1 or 2, who underwent gynecological laparoscopic surgery, were enrolled. On the day before surgery, after obtaining written informed consent, we took their history of smoking habits, motion sickness and PONV at the previous surgery. They were randomly divided into two groups (group S and group P). In the group S, anesthesia was introduced with thiopental 4mg/kg, fentanyl 100mcg and maintained with sevoflurane. In the group P, anesthesia was introduced with target controlled infusion (TCI) of propofol at 5 mcg/ml, fentanyl 100mcg and maintained with propofol with TCI level at 2-5mcg/ml. All patients were intubated and artificially ventilated with 35% oxygen. In both groups, BIS was monitored and the concentration of inhaled sevoflurane or TCI level of propofol was adjusted to maintain BIS level between 30 and 60 during surgery. In both groups, fentanyl was given 100mcg before skin incision and then given 50 mcg every 1h thereafter. Flurbiprofen axetil 50 mg was given at the end of surgery. We investigated the incidence of PONV within 6h and 24h after surgery by interview.
Results Within 6h after surgery, PONV occurred in 22 cases in group S and in 13 cases in group P. Between 6h and 24h after surgery, PONV occurred in 6 cases in group S and in 3 cases in group P. Analysis with multivariate logistic regression model (dependent variable: PONV, Covariates: anesthetic method, previous history of PONV or motion sickness, smoking habits, duration of surgery, amount of infusion, amount of fentanyl and body mass index) revealed that only anesthetic method was significant variable for the incidence of PONV within 6h and 24h after surgery(SPSS Ver.11.0).
Discussion Difference of anesthetic method (propofol or sevoflurane) is significant factor which influences the occurrence of PONV within 6h and 24h after gynecological laparoscopic surgery. Propofol is preferable to sevoflurane from the view of preventing PONV with gynecological laparoscopic surgery.
References (1)Anesthesiology, 91,693-700, 1999

S-198.

EFFECT OF REMIFENTANIL ON HEARTRATE AND BLOOD PRESSURE OF PARTURIENTS AND APGAR SCORE OF NEONATE IN ELECTIVE CESAREAN SECTION UNDER GENERAL ANESTHESIA

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Introduction: One of the most important complications cesarean in the effects of anesthetic drugs on the fetus. On the other hand preventing the use of them could also be really dangerous to the mothers. It has been shown that sedative drugs with short acting effect could be helpful in this issue. This study was conducted to evaluate the effect of remifentanil on blood pressure and pulse rate of the mothers and the APGAR score changes in fetus of those who underwent elective cesarean.
Methods: In this double blineded randomized clinical trial, of the 18 - 35 years old pregnant women, who where candidated for elective cesarean in Loghman Hospital, 60 were selected sequentially. The study population was divided into two randomized equal number of patients in case and control groups. Remifentanil was used for cases. Homodynamic factors and APGAR score were evaluation in both groups.
Results: Comparison of the mean mothersHeart rate changes before and controls (5.4 $\pm$ 61.5 per minute vs. 29.5 $\pm$ 13.6 per minute, P< 0.05). Mean systolic blood pressure changes before and after induction also showed significant difference between cases and controls (3.8 $\pm$ 18.4 mmHg, vs. 20.0 $\pm$ 16.3 mmHg, $p < 0.05$).mean diastolic blood pressure changes before and after induction also showed significant difference between cases and controls (3.8 $\pm$ 11.8 mmHg, vs. 20.9 mmHg, $p < 0.05$) Mean MAP changes before and after induction showed significant difference between cases and controls showed significant difference between cases and controls(3.8 mmHg, vs. 23.3$\pm$ 11.9 mmHg, $P < 0.05$), but mean MAP before and after fundal maneuver did not show any significant difference between these groups. Mean of firs minute APGAR score did not show any significant difference, where as mean of fifth minute APGAR score did not show any between these groups (9.9 $\pm$ 0.3 vs. 10.0 $\pm$ 0.0 mmHg, P<0.05).
Discussion: Considering the results of this study and comparing with other studies it seems that remifentanil can prevent hemodynamic changes during cesarean section. It also will not change the APGAR score. BY conducting more research studies, it may be possible to state that remifentanil is suitable for cesarean section.
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S-199.

EPIDURAL SETUP AND MAINTENANCE PRACTICES IN NEW JERSEY HOSPITALS

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Background: Epidural analgesia is routinely used for post-surgical and labor patients. At UMDNJ-RWJUH, (our institution), cases involving post-operative epidural analgesia are prepared and maintained by nursing/pharmacy staff, while labor epidural setup is exclusively performed by anesthesia providers. We hypothesized that this was contrary to the practice of other hospitals in our service area. Therefore, this survey was designed to assess current practice standards for preparation and maintainence of epidural analgesia in NJ hospitals.
Methods: After IRB approval, surveys with pre-addressed, stamped envelopes were mailed to the anesthesia departments of the 63 acute care hospitals that provide post-operative and labor epidurals. Surveys included questions regarding epidural solution preparation, setup, programming, management, and dosing practices.
Results: 63 surveys were mailed and 23 were returned (37% response). This response rate is typical for physician surveys (1). The data revealed that pharmacy staff prepared epidural solutions in 83% of post-operative cases, as opposed to 58% for labor analgesia. Infusion pump programming was performed by anesthesia staff for approximately 50% of post-operative epidurals and for 70% of labor epidurals. Initial epidural dosing was almost exclusively given by anesthesia providers. Subsequent doses of epidural medication for post-operative analgesia were given by nursing care staff in 21% of hospitals surveyed, while for labor epidurals subsequent doses were almost exclusively administered by patients or anethesia staff.
Discussion: The most striking finding was the significant variation that exists in practice customs among the respondents. Several hospitals employed multiple health care providers to prepare infusion solutions, program pumps and to administer subsequent doses. In addition, significant differences in practice patterns were seen with regard to infusion pump programming and maintenance, as well as in dosing of subsequent boluses. This variation in medication preparation has also been observed in NJ hospitals with regard to vasoactive drugs in cardiothoracic surgery (2). With the increased interest of the JCAHO and the Anesthesia Patient Safety Foundation regarding Medication Administration Standards, further study is required to assess whether these practices represent a potential risk to patients and/or a deviation from the standard of care (3).
References:
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For Labor Epidural Analgesia	Anesthesia Staff	Nursing Staff	Pharmacy Staff	Other Staff	Patient
Anesthetic solution is prepared by	42%		58%		
Infusion pump programmed by	70%	30%			
Infusion pump maintenance (solution bag changed, etc.)	61%	39%			
Initial epidural bolus administered by	100%				
Subsequent doses administered by	69%	4%			27%

For Postoperative Epidural Analgesia:	Anesthesia Staff	Nursing Staff	Pharmacy Staff	Other Staff	Patient
The anesthetic solution is prepared by	17%		83%		
Infusion pump programmed by	50%	46%	4%		
Infusion pump maintenance (solution bag changed, etc)	43%	57%			
Initial epidural bolus administered by	96%	4%			
Subsequent doses administered by	59%	20%			20%

S-200.

INCIDENCE OF EPIDURAL ABSCESS IN OLMSTED COUNTY, 1990-2000

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Introduction: Epidural abscess is a rare cause of spinal pain and neurological deficit. While the incidence of iatrogenic epidural abscess has been determined in specialized patient groups[1-3], the incidence of spontaneous epidural abscess in the general population remains undetermined. The primary objective of this study is to determine the population-based incidence of spontaneous epidural abscess.
Methods: The records-linkage system of the Rochester Epidemiology Project was used to identify incident cases of epidural abscess in Olmsted County, Minnesota, from 1990 through 2000. Inclusion criteria included patients 18 or older diagnosed with spinal epidural abscess with radiographic or surgical confirmation. Exclusion criteria included spine surgery and penetrating trauma within six months preceding the diagnosis of an epidural abscess. Patients with spinal injections or placement of epidural catheters were not excluded. The incidence rate was calculated assuming that all residents 18 years of age or older in Olmsted County, Minnesota during 1990-2000 were at risk. The denominator for this period was estimated using decennial census data.
Results: Seven patients, including six women and one man, were identified. The age- and sex-adjusted incidence was 0.77 per 100,000 person-years (95% CI 0.20,1.34). The mean age was 56 years (range 40 to 80). The median time from symptom onset to diagnosis was 18 days (inter-quartile range: 4,30). Five patients presented with spinal pain and one presented with focal neurological deficits. Potential risk factors were identified in all seven patients, including nonspinal infections, diabetes mellitus, immunosuppression, and intravenous substance abuse. Two patients, one of which presented with neurological deficits, received surgery and five received medical treatment. Staphylococcus aureus was cultured in five patients and streptococcal species were cultured in two patients. One of two patients treated surgically and one of five patients treated medically had residual neurological deficits. One patient, who was immnosuppressed and received medical treatment, died of pneumonia.
Discussion: This is the first published report of the population-based incidence of spontaneous epidural abscess and it is anticipated that these findings could serve as a reference point for further epidemiological research related to this uncommon infection.
References:
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2. Anesthesiology 1999;91:1928-36.
3. Acta Anaesthesiol Scand 1995;39:872-880.
Table 1: The incidence (per 100,000 person-years) of epidural abscess in Olmsted County, 1990 - 2000.

	Number	Population	Incidence (per 100,000)	95% Confidence Interval
Female	6	476,100	1.26	0.25-2.27
Male	1	431,480	0.23	0.00-0.69
Total (Age- and sex-adjusted)	7	907,580	0.77	0.20-1.34

S-201.

A SAFE AND RELIABLE METHOD FOR INFUSING DEXMEDETOMIDINE IN POSTOPERATIVE GYNECOLOGICAL PATIENTS

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Introduction: Dexmedetomidine (DEX) is an effective sedative in intensive care patients. However, loading dose of DEX sometimes causes excessive hypertension or bradycardia. We hypothesized that giving DEX without any loading dose would provide adequate and safe postoperative pain management in the general ward. Our infusion method is novel; first since there is no loading infusion, less homodynamic complications, second the Syrinjector pump is driven with negative pressure and therefore economical.
Method: 40 gynecological patients were randomly and double-blindly allocated into two groups: placebo and DEX. Anesthesia was induced and maintained with propofol TCI and fentanyl with the off-line pK calculation method. During anesthesia, propofol was titrated to maintain BIS at 50 and fentanyl was titrated to maintain BP and HR within 20% of baseline values. Once the patient was extubated, we started an IV DEX infusion with the Syrinjector infusion pump (Daiken Co. LTD., Osaka, Japan) at a rate of 6 mL/hr without any loading. The patients remained on the Syrinjector for 20 hours. The placebo group received 120 ml saline vs. DEX group recieved 120 μg of DEX and 108 ml saline. We measured NIBP, HR, and SpO2; we also recorded verbal rating scale (VRS) for pain and Ramsay Scale score for sedation at every 30 min after extubation till 2hr in PACU and every 3 hr thereafter in general ward. DEX plasma concentration was measured at 2 hr after start of infusion.
Results: We had 20 patients in each group. Demographic and morphometric data were similar in the groups, and there were no significant side effects in either group. Patients were given IV NSAID, IV pentazosine, IV hydroxyzine, or rectal NSAID for supplementary pain treatment as necessary. The total dose of each drug was significantly less in the DEX group than in the placebo group: IV NSAID (250 vs. 1000 mg), IV pentazosine (15 vs. 285 mg), IV hydroxyzine (125 vs. 325 mg), and rectal NSAID (0 vs. 475 mg). Mean Ramsay score was significantly greater in the DEX group (2.9 vs. 2.1), and mean VRS for pain was significantly less in the DEX group (1.5 vs. 2.8). The plasma concentration of dexmedetomidine at two hours after the start of infusion was 0.50 ± 0.24 ng/mL; comparable with previous reports of a Ramsay score of three.
Discussion and Conclusion: Dexmedetomidine was effective and safe for postoperative pain management after gynecological surgery in the general ward. This infusion method, thus, appears to be an economical and safe way to infuse DEX in the general ward. As it was shown here our given DEX dose was safe itself, however it might be necessary to have moderate DEX dose group for futhermore evaluation.

S-202.

THE KINETICS OF MIDAZOLAM TRANSFER INTO BREAST MILK

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Introduction: Lactating women undergoing operations requiring general anesthesia are advised to pump and discard their milk for 24 h after the procedure. Limited data on midazolam transfer into milk are available from a postpartum study. (1) The present study determined the pharmacokinetics of midazolam transfer into milk in order to provide anesthesia caregivers with clinically relevant information regarding the safety of breast milk after midazolam administration.
Methods: Five lactating women participated in this study after providing institutionally-approved written informed consent. Patients were premedicated with midazolam, 2 mg IV, 5 min before induction of anesthesia with fentanyl, 100 μg IV, and propofol, 2.5 mg/kg IV. Anesthesia was maintained with potent volatile anesthetics. Milk was collected using an electric breast pump before and 5, 7, 9, 11, and 24 h after drug administration. Venous blood samples were collected before and at intervals up to 7 h after drug administration. Plasma and milk midazolam concentrations were determined by liquid chromatography-tandem mass spectrometry after sample preparation by solid-phase extraction. Midazolam plasma pharmacokinetics were modelled with SAAM II using a standard 3-compartment model. The pharmacokinetics of midazolam transfer into breast milk were modelled simultaneously with the plasma pharmacokinetics using the cumulative amount of the drug in milk just as urinary drug excretion is modelled, albeit with a pharmacokinetic delay.
Results: Plasma midazolam pharmacokinetics (Table) were consistent with those we and others have reported. (2,3) In the 24 h of milk collection only 0.005 (± 0.005)% of the midazolam dose was collected in milk, representing 0.009 (± 0.005)% of the midazolam elimination clearance, with a pharmacokinetic delay of approximately 9 h (Table).
TABLE. Midazolam pharmacokinetic parameters, Mean ± S.D.

Volumes (L/kg)				Clearances (ml/min/kg)			Milk	Delay
V_C	V_F	V_S	V_{SS}	Cl_F	Cl_S	Cl_E	% Cl_E	(min)
0.1	0.3	0.7	1.2	31	6	5	0.009	537
±0.1	±0.1	±0.2	±0.3	±12	±4	±1	±0.005	±220

Discussion: The amount of midazolam appearing in breast milk over 24 h after administering a single dose is very small and therefore unlikely to affect a healthy term infant. Consistent with the reports of others for methohexital, meperidine, and diazepam (4) and our recent report for propofol (5), the amount of midazolam excreted into breast milk in the first 24 h after use as an anesthetic premedication provides insufficient justification for interruption of breast feeding.
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S-203.

THE RELATIONSHIP BETWEEN MORPHINE AND METABOLITE PLASMA CONCENTRATIONS AND THE TIMING AND GENDER DIFFERENCES IN NAUSEA FOLLOWING A MORPHINE INFUSION

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Introduction: Gender related differences have been documented in the side effects from morphine, with increased nausea and vomiting seen in women.[1,2] The cause of this difference has not been explained. Also, a decrease in nausea has been found when M6G is administered compared to morphine, but the reason for this difference is not fully explained.[3,4] This study investigates the gender differences in nausea following a morphine infusion along with the morphine and metabolite plasma concentration profiles at the time nausea occurs.
Methods: After IRB approval, 10 male and 10 female subjects, ages 18-40, were recruited for this two-period crossover study. During one session, subjects receive 50 mg of ranitidine IV 30 minutes before the session. Ranitidine has been shown in both in vitro and in vivo studies to inhibit the formation of M3G and enhance the production of M6G.[5] This is followed by a target controlled infusion of morphine to achieve a fixed plasma concentration of 10 ng/mL of morphine, maintained for 1 hour. The target concentration of morphine was increased to 50 ng/mL and held for 1 hour. At the end of this session, measurements of morphine and metabolite concentrations are made during the washout period. In the crossover session, each subject receives a saline infusion rather than the ranitidine dose. The target concentration levels are replicated in both sessions and the times of nausea and vomiting were recorded.
Results: Four male subjects experienced nausea during the study with none vomiting. Nine female subjects experienced nausea and six vomited. These episodes occurred at the end of the study during the washout phase when morphine levels were very low. Morphine and M3G AUCs differed significantly between males and females for a given session, but the M6G AUCs were not different between males and females. The AUC of morphine was higher for males and the AUC of M3G was higher for females. Lower levels of metabolites were formed during the ranitidine session.
Discussion: A difference in the side effects, nausea and vomiting, caused by morphine was seen between men and women. The nausea and vomiting occurred at the end of the study when the plasma concentration of morphine was very low and primarily only metabolites remained. The nausea in this study appears to be related to the presence of M3G since M6G has been shown to produce less nausea than morphine. The higher M3G levels in the females may explain the gender difference in degree of nausea.
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2. Nurs Crit Care. 2003 Sep-Oct;8(5):187-96.
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S-204.

MINIDOSE SPINAL FOR TRANS-VAGINAL-TAPING (TVT): A DOSE FINDING STUDY

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Introduction: Minidose spinal has been used for cervical[1] and other, (hip arthroplasty [2]) procedures.To date little is known of the dose required to produce anaesthesia in the operative field for TVT. We aim to determine the ED50 of intrathecal levobupivacaine 0.25% in patients presenting for TVT.
Methods: Forty women scheduled for TVT offered informed written consent and were allocated isobaric levobupivacaine 0.25%. Dosage 1.75-3.0ml was determined by random up-down sequential blind allocation.The objective, loss of temperature discrimination in or beyond the dermatomes S3-T12, 5 minutes after intrathecal injection. A probit model (SPSS) was used to analyse data obtained.
Results: Demographic data (mean) for age (50.6yr), weight (67.9kg) and height (160cm) was normaly distributed.Six groups were formed by random allocation.The ED50 was 1.63mls, 4.075mg.
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Pain - Basic Science

S-205.

THE EFFECT OF GABAPENTIN IN HUMAN EXPERIMENTAL PAIN MODELS

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Introduction: The antidepressant drugs imipramine and venlafaxine relieve clinical neuropathic pain (1) and have been shown to increase thresholds for temporal pain summation in humans using repetitive electrical sural nerve stimulation (2,3). If this pattern of effect in experimental pain models reflects potential efficacy in clinical neuropathic pain, the pain model may be used to identify new drugs for such pain conditions. Gabapentin has effect in several clinical neuropathic pain conditions (4), and on experimental cutaneous hyperalgesia in humans but not heat or cold pain (5,6). The aim of this study was to test the analgesic effect of gabapentin in a sural nerve stimulation pain model including temporal pain summation and the cold pressor test.
Methods: 18 healthy volunteers completed a randomized, double-blind, cross-over trial with medication of 600 mg gabapentin orally dosed three times over 24 hours against placebo. Pain tests were performed before and 24 hours after medication included pain detection and tolerance to single sural nerve stimulation and pain summation threshold to repetitive stimulation (3Hz). Peak pain intensity and discomfort were rated during a cold pressor test.
Results: Compared against placebo, gabapentin significantly increased the pain tolerance threshold to single electrical sural nerve stimulation (P=0.04), whereas the pain detection threshold to single electrical sural nerve stimulation tended to be increased (P=0.06). Gabapentin had a highly significant effect on pain summation to repetitive electrical sural nerve stimulation (P=0.009). No significant differences were found between gabapentin and placebo on pain ratings during the cold pressor test (P>0.1)
Discussion: This study shows that gabapentin increases the threshold for temporal pain summation during electrical nerve stimulation in humans. In contrast to some other anticonvulsants, gabapentin is without effect on pain induced by the cold pressor test (7). The lack of effect of gabapentin in the cold pressor test has been shown in a previous study (6), whereas the effect from gabapentin on temporal pain summation has not been demonstrated previously. This leads further evidence for the use of an experimental human pain model of temporal pain summation to identify drugs with a potential effect in neuropathic pain.
Conclusion: Gabapentin has a hypoalgesic effect in a human experimental pain model on temporal pain. Gabapentin has no impact on pain during the cold pressor test.
Acknowlegdement: This study was financially supported by Pfizer Denmark, Odense University Hospital and University of Southern Denmark.
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7. Pain 1998;76:357-63.

S-206.

MONITORING SKIN CONDUCTANCE DURING GENERAL ANAESTHESIA FOR DETECTION OF NOCICEPTION

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Introduction
Unconsciousness during general anaesthesia may be seen as the balance between the CNS depressive effect of hypnotics and the excitatory effect of surgical stimuli. Current EEG-based devices monitor the hypnotic component of anaesthesia and detect inadequate levels of analgesia indirectly from its influence on the level of consciousness. However, earlier detection of the responses to nociceptive stimuli could be enabled by the observation of the sympathetic nervous system response. When a nociceptive stimulus occurs, skin conductance (SC)[1] fluctuates due to emotional sweating. In this work we study the relationship between SC, sedation and pain response during general anaesthesia.
Methods
15 patients (age 66 ± 12 yrs, males 11, females 4) scheduled for endoscopic exploration were enrolled in the study. Anesthesia was induced and maintained with TCI remifentanil (target: 2ng/ml) and propofol (target: 1-5 µg/ml). SC was registered using three electrodes positioned on the palm of the hand. SC and the derived parameter, Number of Fluctuations in Skin Conductance (NFSC) were registered before and after applying the nociceptive stimulus. Patient state was evaluated by means of the Ramsay Sedation Score[2], presenting six different levels depending on how arousable the patient was. A score of 1 corresponds to a patient totally conscious and a score of 6 to a patient with no response to noxious stimuli. The SC was validated using the Prediction probability, Pk[3], while the NFSC was validated using a Mann Whitney U test between levels 5 and 6 (the mean of NFSC for all levels 5 and 6 were calculated befored applying the Mann Whitney U test) of the Ramsay scale, as those are the levels corresponding to response / no response to noxious stimuli.
Results
The ability of the skin conductance (SC) to predict the Ramsay Sedation score was tested using prediction probability, resulting in a Pk of 0.728 (0.05). The median (range) of the NFSC was 0.50 (0.20-0.70) for Ramsay 5 and 0.13 (0.00-0.4) for Ramsay 6, resulting in a significant difference ($p<0.05$).
Discussion
This preliminary study suggests that the SC correlates well to the level of sedation. The NFSC was significantly different between patients responsive/non-responsive to noxious stimuli during general anaesthesia.
References
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2 British Medical Journal 1974; 2: 656-659.
3 Anesthesiology 1996; 84: 38-51

S-207.

THE INCIDENCE OF CHRONIC PAIN SYMPTOMS FOLLOWING TOTAL ABDOMINAL HYSTERECTOMY

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Introduction: Approximately 633,000 hysterectomies are performed in the US each year. Although more than ¼ of US women will have had the procedure by the time they are 60 years of age, the occurrence of visceral phantoms and chronic pain following the hysterectomy has not been well studied. In general hysterectomies are performed to improve the quality of life rather than cure life-threatening conditions. Neuropathic pain has distinct symptoms including spontaneous pain, allodynia, and hyperalgesia that if untreated or inadequately treated can progress to chronic pain that significantly impacts quality of life. The purpose of this study was to determine the frequency of clinical characteristics experienced by women that had abdominal hysterectomies 2 to 4 years prior to the study.
Methods: Following IRB approval women that had total abdominal hysterectomies (TAH) at Prentice Women's Hospital at least 12 months but not more than 48 months were studied. Subjects were mailed a letter describing the study and asked to complete 3 questionnaires: the McGill pain questionnaire short form (McGill-SF) (1); the Leeds assessment of neuropathic symptoms (LANNS) (2); and the Hospital Anxiety and Depression Scale (HADS) (3) as they related to their experience following TAH. They were aslo requested to provide written consent. The McGill-SF was used to evaluate the scores from this group with values that have been described in other chronic pain conditions. The LANNS scores >12 has been shown to correlate with neuropathic pain, and HADS values help to identify the clinical caseness of the disorder. The correlation between the scores identified by the three questionnaires was made using Pearson correlation coefficients.
Results: Completed surveys were obtained from 136 of the 974 subjects (14%) surveyed. McGill-SF scores consistent with chronic pain conditions (>15) (such as fibromyalgia and post-herpetic neuralgia) were found in 16.7% of those surveyed. LANNS scores suggesting that neuropathic pain mechanism were likely to contribute to the chronic pain were found in 6.7% of cases and in all cases in which the McGill scores were > 15. HADS values suggested that 11.6% of subjects had clinical caseness consistent with anxiety and 6.1% with depression. Significant correlations ($P<0.01$) were found between the three questionnaires.
Discussion: Despite the limited sample size, this study suggests that chronic pain symptoms following total abdominal hysterectomy many impact a significant number of women. Even assuming a substantial bias in the returned questionnaires, our study would suggest that symptoms consistent with chronic pain may exist in 5 to 16% of women undergoing this procedure. These results may have important implications in devising preemptive analgesia in this group of patients.
References: 1.) Anesthesiology 2005; 103:199-202. 2.) Pain 2001; 92:147-157.
3.) http://www.nfer-nelson.co.uk

S-208.

FLUOROSCOPIC EVALUATION OF THE SPREAD OF BLOCK SOLUTION DURING MEDIAL BRANCH BLOCKS

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Introduction
The facet joints are paired posterior articular structures supporting adjacent vertebrae. During rotation and extension, facet arthropathy causes nonradicular pain in the back, buttocks, or proximal thighs. Radiographic changes are not consistently present on CT, radiographs, MRIs, or bone scan and may be found irrespective of symptoms. Diagnostic blocks are therefore utilized to confirm a diagnosis of facet arthropathy prior to medial branch rhizotomy provides prolonged relief. Medial branch blockade alone infrequently provides significant improvement when measured at 1 and 3 months[1] compared to RFTC that provides most patients (45-60%) with significant (>50%) pain relief for a prolonged period (>1yr) [234]. Despite these data, anecdotal evidence has demonstrated patients that have on occasion obtained significant relief (up to 6 months or longer) with MBB, or poor relief after RFTC despite good response to diagnostic MBB. Intraarticular injection of a block solution is known to enter into neighboring structures, particularly the epidural space[56]. This lack of specificity makes confirmation of facet arthropathy with this technique suspect. Our goal was to investigate whether MBB solution similarly spreads to adjacent structures, and provide guidelines for constructing further investigations. If it does, this may provide an explanation for anecdotal RFTC nonresponders or MBB superresponders, and to provide guidance for potential further studies.
Methods
15 patients scheduled for medial branch blocks (MBBs) were approached and offered inclusion in this study. If they agreed, their MBB was performed with diluted Isovue M-300 contrast added to the block solution. Needles were placed at the union of the superior articular process with the transverse process at the appropriate levels. Lateral fluoroscopic images confirmed proper needle placement. Block was performed with Bupivicaine and Depo-Medrol mixed with Isovue M-300 contrast in a 2:1 ratio. Post block fluoroscopic images (AP, oblique, and lateral) were obtained. These were evaluated for spread by 2 separate pain practitioners.
Results
54 medial branch blocks were performed in 15 patients. A characteristic intramuscular posterolateral spread was noted. Although transient vascular uptake on one occasion was noted there was no epidural, perineural, or intrathecal spread observed.
Discussion
Studies suggesting inconsistent outcomes with medial branch rhizotomy after diagnostic blocks are not the result of inadvertent blockade of confounding neural structures.
Further studies are necessary to investigate the importance of vascular uptake of block solution, and to study the significance of intramuscular block solution spread. If a large quantity of block solution was drawn intravascularly, this may represent a cause of a false negative result to diagnostic medial branch blocks.
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(2) Pain. 1994; 57: 77-83.
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(4) Spine. 25(10):1270-1277, May 15, 2000.
(5) Radiology 1982; 145:321-5.
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S-209.

THE ANTI-INFLAMMATORY EFFECTS OF INTRAVENOUS ANESTHETICS ON SUBSTANCE P-INDUCED CYTOKINES IN U373 MG HUMAN ASTROCYTOMA CELLS

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Background: The neuropeptide substance P (SP) is an important mediator of neurogenic inflammation within the central and peripheral nervous system. SP has been shown to induce the expression of proinflammatory cytokines such as interleukin (IL)-6, which might to be implicated in the etiopathology of several human brain disorders. Previous study showed ketamine suppressed production of IL-6, but the effects of intravenous (IV) anesthetics on SP receptor (SPR) are not clear. In this study, we investigated the anti-inflammatory effects of IV anesthetics on SPR function in the human astrocytoma cell line U373 MG cells which express high levels of SPR and chosen as an astrocytoma in vitro model to investigate. We examined the anti-inflammatory effects of IV anesthetics such as ketamine, pentobarbital, and propofol on SP-induced cytokines expression in U373 MG cells.
Methods: U373 MG human astrocytoma cells were preincubated with ketamine, pentobarbital or propofol (10μM) for 30 min. Therefore, cells were treated with 10 nM SP for 12 h at 37°C. Culture supernatants were harvested, and levels of IL-1β, IL-6, IL-8, and tumor necrosis factor alpha (TNF-α) in the media were measured by ELISA according to the manufacture's instruction. Experiments were conducted in triplicate. Data were analyzed by one-way ANOVA, $P < 0.05$ was considered significant.
Results: No IL-1β and TNF-α were found in the supernatant. The significantly increased levels of IL-6 and IL-8 were detected in the culture supernatants as early as 3 h after SP stimulation and the responses peaked at 12 h for IL-6 and IL-8. Ketamine, pentobarbital, and propofol slightly inhibited SP-induced IL-6 and IL-8 expression at 6 h.
Conclusions: Our result suggests that the anti-inflammatory effects of ketamine, pentobarbital, and propofol on U373 MG cells are thought to be partially realized by inhibiting the expression of IL-6 and IL-8. Further studies are warranted to assess the anti-inflammatory benefit of IV anesthetics.

S-210.

EFFECTS OF SEVOFLURANE AND LIDOCAINE ON CAPSAICIN INDUCED CURRENT IN RAT SINGLE DORSAL ROOT GANGLION NEURON

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Introduction: Nociceptive pathway in the peripheral nerve system plays a major role for both of acute and chronic pain development. And transient receptor potential vanilloid receptor 1 (TRPV1) is greatly involved in this pain signaling mechanism. TRPV1, a kind of cation channel, is activated by capsaicin, and produce itching, pricking, and burning sensations initially. And because prolonged exposure of capsaicin causes desensitization, TRPV1 becomes insensitive to capsaicin as well as to other noxious stimuli[1]. Hence, capsaicin has been used as an analgesic since ancient times. Sevoflurane and lidocaine are general and local anesthetics and are known to increase the thresholds of stimli. We carried out experiments to clarify the effects of these anesthetics on TRPV1.
Methods[2]: Adult male Sprague-Dawley rats (250-350 g) were anesthetized with sodium pentobarbital (60 mg/kg). Dorsal root ganglia were dissected bilaterally from L1 to L6 segment of spinal cord and were treated with collagenase and trypsin. After single neurons were obtained, they were plated on a poly-L-ornithine-coated 35mm Petri dishes. Isolated cells were maintained in an incubator at 37°C with 95% O_2/5% CO_2 and were used for electrophysiological experiments within 24 h. Under the inverted microscope, the cultured dish was perfused by Tyrode solution. Fire-polished glass micro electrode (3-5MΩ) was inserted by way of whole-cell voltage clamp method. Cells were held at -40 mV and capsaicin (10^{-5} M) was applied from a nozzle placed by the examined cell. Sevoflurane (2-6%) was applied to bathing solution by bubbling after vaporized with oxygen. Lidocaine HCl (10^{-6}-10^{-5} M) was applied by dissolving into bating solution. All experiments were performed at room temperature.
Results: Brief application of capsaicin (10-15 sec) induced transient inward current (2-8 nA) in the control condition. Sevoflurane (2-6%) inhibited these inward currents (2%: 23%, 4%: 35%, 6%: 63% mean, n=5) in a reversible manner. But lidocaine did not affect capsaicin-induced current.
Discussion: Capsaicin is supposed to present analgesic effect by desensitizing TRPV1. Sevoflurane may present analgesic effect by inhibiting TRPV1 activation. Lidocaine may not show analgesic effect via the pathway including TRPV1.
References: 1. Nature 389, 816-24, 1997. 2. Neuro Report 15, 2601-5, 2004.

S-211.

THE EFFECT OF THE CANNABINOIDS, ANANDAMIDE AND WIN 55,212-2, ON MU OPIOID RECEPTORS EXPRESSED IN XENOPUS OOCYTES

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Introduction: Cannabinoids are increasingly being used therapeutically. They are useful for appetite stimulation and the treatment of anxiety, dystonia, glaucoma, nausea and vomiting after chemotherapy, and pain. Their effectiveness as analgesic agents is especially important to understand since the sensation of pain is complex and incompletely understood. A functional link between cannabinoid and opioid receptors has been proposed based on supporting data from both in vivo and in vitro studies. Indeed, studies have shown that the analgesic effects of cannabinoids can by blocked by opiate receptor antagonists. In order to explore this possible functional link between cannabinoids and opioid receptors in more detail at the receptor level, we tested the hypothesis that cannabinoids directly interact with mu opioid receptors.
Methods: Experimental procedures were in accordance with the APS/ NIH guidelines and were approved by our Animal Care and Use Committee. Mature Xenopus laevis frogs were anesthetized and oocytes removed. Capped cRNA transcripts encoding the mouse G protein-activated inwardly rectifying potassium channel GIRK2 (Kir3.2) and either the rat mu opioid receptor MOR-1 or the human cannabinoid receptor CB1 were injected into the oocytes following standard techniques. In neurons, and likewise in this expression system, ligands for MOR-1 and CB1, both G-protein coupled receptors, in turn activate GIRK2 channels. GIRK2 currents were measured in high potassium solutions with two-electrode voltage clamp. Data were fit with Prism (GraphPad) and statistical significance was tested with a two-tailed, unpaired t test.
Results: In control experiments with cells expressing MOR-1 receptors and GIRK2 channels, the peptide mu opioid receptor agonist, DAMGO, at 10 nanomolar, activated the receptor. However, neither the synthetic CB1 receptor agonist, WIN 55,212-2, at 10 micromolar, nor the endogenous cannabinoid, anandamide, at 14 micromolar, activated the receptors. In control experiments with cells expressing the CB1 receptor and GIRK2 channels, both WIN 55,212-2 and anandamide activated the receptors. Neither cannabinoid had any effect on the activation of the mu receptors by DAMGO. None of the agonists had any effect on control cells not injected with cRNAs.
Discussion: Cannabinoids and opioids have many functional similarities including activation of specific G protein-coupled receptors, inhibition of adenylate cyclase, and modulation of ion channel activity. In addition, both classes of drugs are used as analgesics and cause bradycardia, hypotension, reduced locomotor activity, tolerance, and dependence (Manzanares et al., 1999). Here we tested for direct effects of cannabinoids on opioid receptors by expressing mu opioid receptors in oocytes. The data do not support the hypothesis that cannabinoids directly interact with mu receptors. The inhibition of cannabinoid analgesic effects by opioid receptor antagonists likely involves indirect modulation of endogenous opioid mechanisms by the cannabinoids.
References:
Manzanares et al., TIPS, 20:287, 1999.

S-212.

THE EFFECT OF KETAMINE ON GLUTAMATE-INDUCED APOPTOSIS OF RAT CO-CULTURED SPINAL CORD DORSAL HORN NEURONAL AND GLIAL CELLS

AUTHORS: **Q. Zhou**[1], Q. Li[2], J. Liu[2];
AFFILIATION: [1]Department of Anesthesiology, Renmin Hospital of Wuhan University,, Wuhan, China, [2]The Department of Anesthesiology of Tai-He Hospital affiliated to Yunyang Medical College, Shiyan, China.

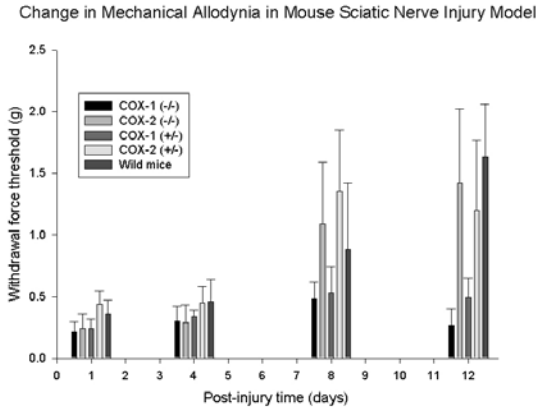
Objective: To observe the effect of ketamine on the apoptosis in spinal cord dorsal horn neuronal-glial culture cells and the changes of interleukin-1 peptide(IL-1β) and tumor necrosis factor alpha (TNFα) that are induced with glutamate and also to explore the mechanism of ketamine inhibiting the apoptosis in such conditions.
Method: The primary T_{11}-L_5 spinal cord dorsal horn neuronal and glial cells were taken from Wistar rat born 1 - 3 days-old, and co-cultured in poly-ethyleimine-coated cover slip inserted in 24 well plates for 2 weeks. Then the cells were divided randomly into 6 groups (8 well per group). Control group (C): wash with Hanks solution; Glutamate group (G): glutamate at 100 μM was administered; Ketamine group (K): 1mM of ketamine was given; Group GK_1-GK_3: glutamate at 100 μM was added first, and 30 minutes later ketamine at 0.1, 1 or 10 mM was then superposed. After being co-cultured for 48 hours, the culture medium was harvested and the concentrations of IL-1β and TNFα were measured. The apoptotic neuronal and glial cells were analyzed with flow cytometer.
Result: Apoptotic cells death was significantly increased in Group G when compared with Group C (25+/-2 vs 11 +/- 1, $p < 0.01$). The concentrations of IL-1β and TNFα were also significantly increased in Group G when compared with those in Group C. The apoptotic neuronal and glial cells, the concentrations of IL-1β and TNFα were significant lower and the glial cells show no significant growth or swelling in the GK_2 group than in Group G. No effect of 1mM ketamine itself was found.
Conclusion: Ketamine at 1mM inhibits glutamate receptor overactivation-induced apoptosis of spinal cord dorsal horn neuronal and glial cultured cells and the mechanism of its effect may be due to the inhibition of synthesis and release of IL-1β and TNFα from glial cells.

S-213.

TIME COURSE OF MECHANICAL ALLODYNIA IN COX-1 AND COX-2 KNOCKOUT FEMALE MICE FOLLOWING SCIATIC NERVE INJURY

AUTHORS: **J. S. Kroin**, E. Y. Chen, A. Buvanendran, D. E. Watts, J. H. Kordower, K. J. Tuman;
AFFILIATION: Rush Medical College, Chicago, IL.

Introduction: The role of the cyclooxygenase-1 (COX-1) and cyclooxygenase-2 (COX-2) isoforms in the development and maintenance of neuropathic pain is still controversial. In one rat neuropathic pain model, with injury to the L5 and L6 spinal nerves, there was an 2-fold increase in dorsal spinal cord COX-2 protein at 1 day after surgery, which returned to baseline level by 3 days (Neuroscience 2000;97:743). In addition, in the same model, a 4-fold increase in COX-1 immunoreactivity in the superficial dorsal horn was seen beginning at 4 days (Anesthesiology 2003:99:1175). However, in another model, with injury to the peroneal and tibial nerves causing hindpaw allodynia, only small short-lived increases in COX-2 mRNA and protein were seen in the spinal cord (Neuroscience 2004;124:891). The objective of this study is to examine if deletion of the COX-1 or COX-2 gene (knockout mice) blocks the development and maintenance of mechanical allodynia following injury to the sciatic nerve.
Methods: Following IACUC approval, experiments were performed on 30 female 129/C57Bl/6 mice (25-30 g;n=6/group): wild, COX-1 homozygous knockout (-/-), COX-2 homozygous knockout (-/-), COX-1 deficient heterozygous (+/-), and COX-2 deficient heterozygous (+/-) (Biochem Pharm 1999;58:1237). Mechanical allodynia was produced in the left plantar hindpaw by cutting the peroneal and sural nerve under isoflurane anesthesia (J Pain 2003;4:465). Mechanical allodynia was assessed using calibrated von Frey filaments applied to the left plantar hindpaw to determine a withdrawal force threshold (grams) in the left leg. Testing for mechanical allodynia (decrease in withdrawal threshold from pre-surgery level) was performed up to 12 days post-surgery. Pre-surgery data were analyzed by ANOVA, and post-surgery data were analyzed with repeated measures ANOVA and LSD hoc testing.
Results: Pre-surgery, there was no difference in withdrawal to von Frey filaments among the 5 mice groups (mean for all groups=2.62 g). Following nerve lesion, mechanical allodynia was greatest ($p<0.05$) in COX-1 (-/-) mice compared to wild or COX-2 (+/-) mice (Figure). For example, at 12 d post-surgery withdrawal force threshold was 0.27 g in COX-1 (-/-) mice versus 1.63 g in wild mice.
Discussion: Surprisingly, COX-1 homozygous knockout mice (-/-) had more severe mechanical allodynia following peroneal and tibial nerve injury than wild mice. This finding may be due to central nervous system compensation for the long-term effects of COX-1 deficiency.

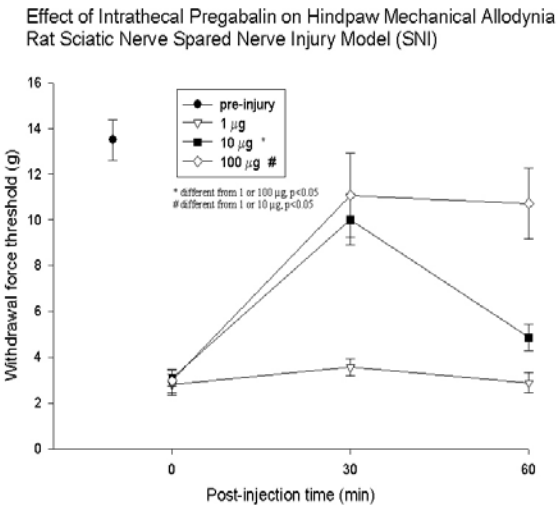


S-214.

INTRATHECAL PREGABALIN REDUCES MECHANICAL ALLODYNIA IN THE RAT SPARED NERVE INJURY PAIN MODEL

AUTHORS: **J. S. Kroin**, A. Buvanendran, D. E. Watts, K. J. Tuman;
AFFILIATION: Rush Medical College, Chicago, IL.

Introduction: The anticonvulsant pregabalin administered orally reduces hyperalgesia in rat models of pain, including diabetic neuropathy (Pain 80:391, 1999), and neuropathic pain (Pain 83:303, 1999). There have been studies demonstrating the efficacy of gabapentin in animal models of long-term post-thoracotomy pain (Anesth Analg 99:1453, 2004) and arachnoiditis pain (Spine, in press, 2005). Since pregabalin appears to be more potent than gabapentin in the rat (Br J Pharm 121:1513, 1997), this could result in equivalent efficacy at lower drug doses, which should reduce dose-related side-effects. This study examines the effect of intrathecal pregabalin in the rat spared nerve injury (SNI) pain model.
Methods: Following IACUC approval,10 male Sprague-Dawley rats were anesthetized with 1.5% isoflurane and an intrathecal catheter chronically implanted, with the tip at the lumbar enlargement. One week later, animals were again anesthetized and the peroneal and tibial branch of the left sciatic nerve lesioned, to produce neuropathic pain in the sural nerve distribution (Pain 87:149, 2000). Six days later rats began receiving intrathecal injections of pregabalin (1-100 µg), at 2-3 day intervals. Animals were tested pre-injection, and at 30 and 60 min post-injection for mechanical allodynia (withdrawal force to von Frey filament stimulation to the lateral edge of the ipsilateral plantar hindpaw). Data were compared with repeated measures ANOVA, and the LSD post hoc test.
Results: Preinjection, all animals were allodynic with a low withdrawal threshold (about 3 g, compared to14 g before nerve lesion). Intrathecal pregabalin reduced mechanical allodynia in a dose-dependent manner (figure).



Discussion: Pregabalin, given intrathecally, reduces mechanical allodynia in the rat SNI neuropathic pain model. Our results suggest that pregabalin produces effects directly at the spinal level, and oral pregabalin is probably effective clinically due to its action in the spinal cord.

S-215.

DHEA REDUCES MECHANICAL ALLODYNIA IN NEUROPATHIC PAIN RATS

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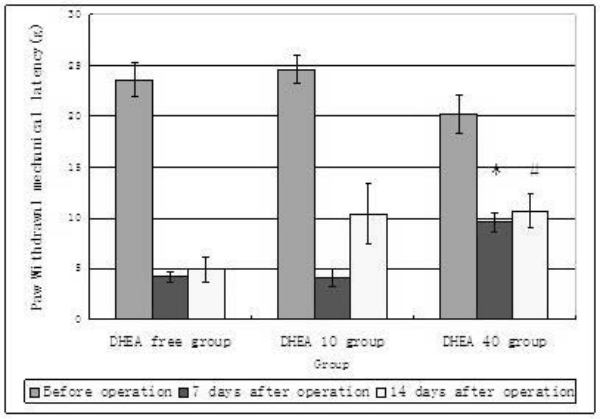
Introduction: DHEA and its ester sulfate metabolite(DHEAS) are steroids mainly secreted by the adrenal cortex, but they also exist in the brain where they are considered as neurosteroids. DHEA replacement therapy may be effective in treating patients with adrenal insufficiency, HIV, advancing age, perimenopausal symptoms, depression. However, there was no reports of its effects on pain. Therefore, we studied its effect on reduction of pain in rats with neuropathic pain.
Methods: According to the method of Bennet and Xie, the CCI model was prepaired by unilateral ligation loosely with 4.0 catgut suture at section of the sciatic nerve in Sprague Dawley rats (the first day). Twenty-four rats were allocated randomly to four groups (each N=6). Control group: They had no ligation of the sciatic nerve. DHEA-free group: They only had the ligation of the sciatic nerve. DHEA 10 group: They received DHEA 10mg/Kg.d. DHEA 40 group: They received DHEA 40mg/Kg.d. DHEA was administered everyday. Mechanical sensitivity on the plantar surface of the ipsilateral foot was tested using Von Frey hairs to determine the force required to elicit 50% of maximum responses (EF50). Measurement were done before operation and on 7 and 14 days after operation. Data were summarized as mean±sem and compated using t-test.
Results: DHEA-free group rats increased responsiveness to mechanical stimuli in the ipsilateral paw. DHEA 10 group rats did not reduce responsiveness to mechanical stimuli statistically. DHEA 40 group rats reduced responsiveness to mechanical stimuli on both 7 and 14 days after operation statistically.
Discussion: This study suggested that DHEA 40mg/Kg.d reduced the mechanical allodynia in neuropathic pain model.
References: Pain,1998,12:256-268.405-410.

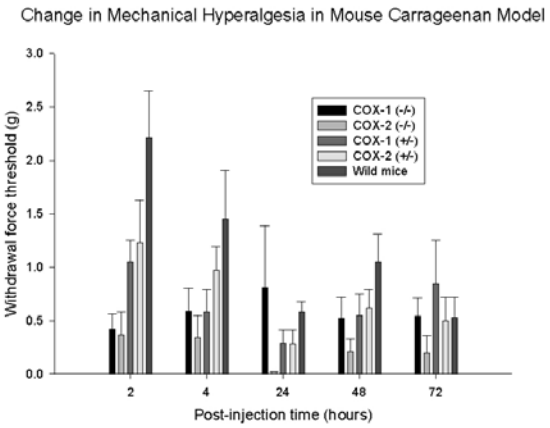


S-216.

TIME COURSE OF MECHANICAL HYPERALGESIA IN COX-1 AND COX-2 KNOCKOUT FEMALE MICE FOLLOWING CARRAGEENAN INJECTION

AUTHORS: **J. S. Kroin**, E. Y. Chen, A. Buvanendran, D. E. Watts, J. H. Kordower, K. J. Tuman;
AFFILIATION: Rush Medical College, Chicago, IL.

Introduction: The role of the cyclooxygenase-1 (COX-1) and cyclooxygenase-2 (COX-2) isoforms in the development and maintenance of inflammatory pain have not been fully elucidated. After plantar hindpaw injection of the inflammatory stimulator carrageenan in normal rats, there is upregulation of COX-2 in the paw tissue and in lumbar spinal cord (PNAS 1994;91:12013; Neuroreport 1997;8:12490). The objective of this study is to examine if deletion of the COX-1 or COX-2 gene (knockout mice) blocks the development and maintenance of mechanical hyperalgesia following plantar hindpaw injection of carrageenan.
Methods: Following IACUC approval, experiments were performed on 30 female 129/C57Bl/6 mice (25-30 g;n=6/group): wild, COX-1 homozygous knockout (-/-), COX-2 homozygous knockout (-/-), COX-1 deficient heterozygous (+/-), and COX-2 deficient heterozygous (+/-) (Biochem Pharm 1999;58:1237). An injection of 0.3% carrageenan (20 µL volume) was made in the left plantar hindpaw (Pain 2004;109:319). Mechanical hyperalgesia was assessed using calibrated von Frey filaments applied to the left plantar hindpaw to determine a withdrawal force threshold (grams) in the left leg. Testing for mechanical hyperalgesia (decrease in withdrawal threshold from pre-injection level) was performed at 2 h, 4 h, 24 h, 48 h, and 72 h post-injection. Pre-injection data were analyzed by ANOVA, and post-injection data were analyzed with repeated measures ANOVA and LSD hoc testing.
Results: Before carrageenan injection, there was no difference in withdrawal to von Frey filaments among the 5 mice groups (mean for all groups=3.29 g). Over the 72 h post-injection period, mechanical hyperalgesia was greatest ($p<0.05$) in COX-2 (-/-) mice compared to any other group (Figure). For example, at 24 h post-injection, withdrawal force threshold was 0.02 g in COX-2 (-/-) mice, and higher than 0.25 g in all other groups. In addition, wild mice had the least mechanical hyperalgesia of any group ($p<0.05$).
Discussion: Surprisingly, mechanical withdrawal thresholds following carrageenan injection were lower in all mice with COX-1 and COX-2 deficiencies than in wild mice. COX-2 homozygous knockout mice (-/-) had the most severe mechanical hyperalgesia of any group. This may reflect compensation within the central nervous system for the long-term effects of COX-deficiency, especially the complete lack of the COX-2 gene.

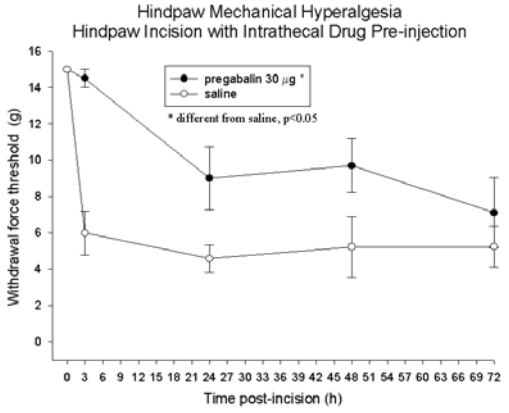


S-217.

PRESURGICAL ADMINISTRATION OF INTRATHECAL PREGABALIN REDUCES POSTOPERATIVE HYPERALGESIA IN RATS

AUTHORS: **J. S. Kroin**, A. Buvanendran, D. E. Watts, K. J. Tuman;
AFFILIATION: Rush Medical College, Chicago, IL.

Introduction: Pregabalin is an anticonvulsant that has antihyperalgesic properties in rat models of pain, including postoperative pain when given subcutaneously (JPET 282:1242, 1997). In humans, it has shown efficacy in postoperative dental pain (Eur J Pain 5:119, 2001). Since pregabalin appears to be more potent than gabapentin (Br J Pharm 121:1513, 1997), this could result in equivalent efficacy at lower drug doses, which should reduce dose-related side-effects. The present study examines the antihyperalgesic effects of pregabalin in a postoperative pain model, using intrathecal drug administration.
Methods: Following IACUC approval,12 male Sprague-Dawley rats were anesthetized with 1.5% isoflurane and an intrathecal catheter chronically implanted, with tip at spinal lumbar level. One week later, animals were given an intrathecal injection of 30 µg pregabalin (n=6) or saline (n=6), and 60 min later a 1-cm long incision was made in the left plantar hindpaw to produce postoperative hyperalgesia (Pain 64:493, 1996). Animals were tested pre-injection, and at 3, 24, 48, 72 h post-injection for mechanical hyperalgesia (withdrawal force to von Frey filament stimulation) and thermal hyperalgesia (withdrawal latency to plantar heat application). Responses were compared over the postoperative time period with repeated measures ANOVA.
Results: Animals receiving intrathecal pregabalin before surgery had less mechanical hyperalgesia during the postoperative period than saline control animals (figure). Presurgery, all animals had the same high (15 g) withdrawal threshold. The pregabalin group also had less postoperative thermal hyperalgesia. Presurgery, for both groups of animals, there was no difference in thermal withdrawal latency between the contralateral and ipsilateral hindlegs. At 48 h post-surgery, in control animals the thermal withdrawal latency in the operated leg was 4.02 sec earlier than in the contralateral unoperated limb, while in the pregabalin group the thermal withdrawal latency in the operated leg was only 0.58 sec earlier than in the contralateral unoperated limb ($p<0.05$).
Discussion: Pregabalin, given intrathecally just before the start of surgery, reduces postoperative hyperalgesia. Therefore, early drug action at the alpha-2 delta subunit of calcium channels (the high affinity binding site for both pregabalin and gabapentin) in the spinal cord may produce a reduction of postoperative pain over days.

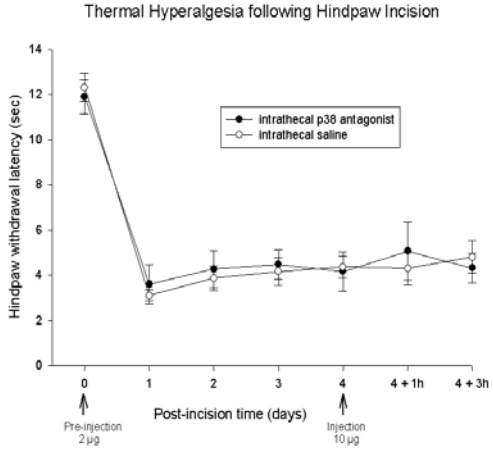


S-218.

P38 MITOGEN-ACTIVATED PROTEIN KINASE DOES NOT CONTRIBUTE TO POST-OPERATIVE PAIN IN THE RAT

AUTHORS: **J. S. Kroin**, A. Buvanendran, M. Takatori, D. E. Watts, K. J. Tuman;
AFFILIATION: Rush Medical College, Chicago, IL.

Introduction: Mitogen-activated protein kinases (MAPK) transduce extracellular stimuli into intracellular responses (Neuron 2002;36:57). In particular, p38 MAPK can be phosphorylated and activated by diverse stimuli (Crit Care Med 2000;28:N67). Intrathecal treatment with a specific p38 inhibitor SB203580 has been shown to block hyperalgesia in both inflammatory and neuropathic pain models (Neuron 2002;36:57;J Neurochem 2003;86:1534;J Neurosci 2003;23:4017). The objective of this study is to determine if intrathecal SB203580 can block hyperalgesia or allodynia in a rat postoperative pain model.
Methods: Following IACUC approval, 12 male Sprague-Dawley rats (300 g) were implanted with bolus intrathecal catheters, with tip adjacent to the lumbar enlargement. One week later, animals were injected intrathecally with 2 µg SB203580 or saline vehicle, n=6/group, and 30 min later a left plantar hindpaw incision was made to produce postoperative hyperalgesia using the model of Brennan et al (Pain 1996;64:493). A second intrathecal injection of 2 µg SB203580 or saline was made 8 h later, and 2/day injections continued for 3 more days. Thermal hyperalgesia (foot-withdrawal latency from heated glass surface) and mechanical allodynia (calibrated von Frey filaments applied to the plantar hindpaw to determine a withdrawal force threshold in grams) were evaluated prior to the initial intrathecal injection, and then before each day's injections. On the 4th day after incision, withdrawal tests were performed, and animals were given a single 10 µg SB203580 or vehicle injection, and hyperalgesia measured at 1 and 3 h after. The doses used in this study were the same as in a previous neuropathic pain study (J Neurosci 2003;23:4017). Pre-injection data were analyzed by ANOVA, and post-injection data were analyzed with repeated measures ANOVA with post hoc LSD test.
Results: Before initial intrathecal injection, there was no difference in the withdrawal measurements between SB203580 and vehicle groups. Over the next 3 days there was no difference in the severity of thermal hyperalgesia (Figure) or mechanical allodynia between the SB203580 and vehicle groups. The single large drug injection on the last day did not show any difference in withdrawal response between SB203580 and vehicle groups.
Discussion: Unlike neuropathic and inflammatory pain models, blocking of phosphorylated p38 MAPK at the spinal level does not affect the development of postoperative pain in rats, nor is established postoperative pain reduced by p38 blockade.



S-219.

NOCICEPTOR ACTIVATION BY MECHANICAL STIMULI

AUTHORS: **M. A. Schumacher**, H. Eilers;
AFFILIATION: University of California, San Francisco, San Francisco, CA.

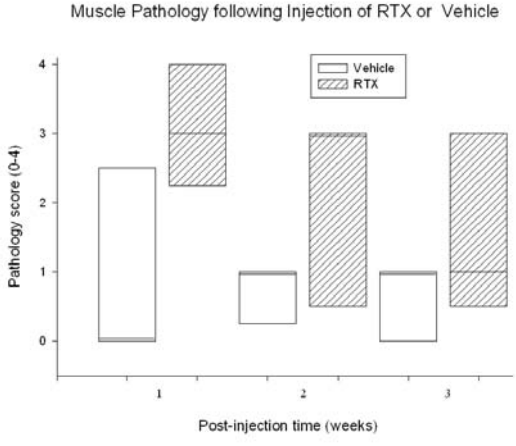
Introduction: Activation of small-diameter, primary afferent sensory neurons in the pain pathway (peripheral nociceptors) initiates the perception of pain and development of hyperalgesia. Ion channels in peripheral nociceptors are gated by different noxious stimuli (heat, chemical, and mechanical) that lead to nociceptor activation. Clinically, intramuscular injection of hypertonic saline produces pain, most likely due to direct (hypertonic) activation of peripheral nociceptors. Therefore, we have used changes in extracellular osmolarity to produce forces within the cell membrane (stretch and shrinkage) as an in vitro model for the mechanical activation of nociceptors. We are investigating the hypothesis that a variant of the capsaicin receptor (now known as TRPV1, VR1) functions as a transducer of hypertonic-induced nociceptor activation.
Methods: Following approval from the UCSF Committee on Animal Research, dorsal root ganglia (DRG) were harvested from multiple spinal levels from Sprague-Dawley rats and enzymatically dissociated. Primary neurons were studied using patch clamp techniques in whole cell configuration. Recording solutions: (mM) pipette KCl 140, NaCl 2, MgCl2 3, EGTA 5, HEPES 10; bath NaCl 130, KCl 3, MgCl2 0.6, CaCl2 2.5, HEPES 10, glucose 10, pH 7.4, 290 or 390 mOsm, adjusted with sucrose.
Results: In voltage clamp mode (Vhold -60 mV), small and medium diameter DRG neurons in culture showed a reproducible and reversible inward current response when challenged with an increase in extracellular osmolarity from 290 to 390 mOsm. The increase in extracellular osmolarity leads to a ~25% decrease in cross-sectional area of the cells as measured by simultaneous videomicroscopy. Using depolarizing current pulses in current clamp mode, hypertonic challenge also increased the excitability (evoked action potentials) of the studied neurons. An antagonist of TRPV1 (ruthenium red) blocked the increase in nociceptor excitability under hypertonic conditions.
Discussion: The observed inward currents demonstrate a direct activation of primary sensory neurons by increases in osmolarity known to induce cell shrinkage. We hypothesize that this current represents direct activation of a shrinkage activated ion channel. Ongoing biophysical studies and pharmacologic characterization is focused on determining if a splice variant of TRPV1 can be shown to direct the hypertonic-induced inward current response.
Acknowledgment: Research was supported by the IARS Frontiers in Anesthesia Research Award to MS.

S-220.

MUSCLE TOXICITY IN MICE OF RESINIFERATOXIN, A POTENTIAL THERAPY FOR MYOFASCIAL PAIN

AUTHORS: **J. S. Kroin**, E. Cochran, A. Buvanendran, D. E. Watts, A. D. Ivankovich;
AFFILIATION: Rush Medical College, Chicago, IL.

Introduction: Muscle trigger point pain (myofascial pain) is a medical syndrome of unknown etiology (J Appl Physiol 2003;94:2494). Although attempts at alleviating the pain have involved treating the muscle with massage, acupuncture, even botulism toxin, another long-term approach is to block pain fibers locally at the muscle site. Resiniferatoxin (RTX) is a capsaicin analog that produces long-term blockade of nerve C-fibers in animals (Neuroscience 1989;30:515). However, before clinical use of this compound for focal injection into muscle to block myofascial pain, it must first be determined if there are any adverse effects on muscle fibers.
Methods: Following IACUC approval, 30 male CD-1 mice were anesthetized with 1.5% isoflurane and were given a slow injection of 50 µl of either RTX (100 ng dose) (n=15) or 0.25% Tween-80 in saline vehicle (n=15) in the left tibialis anterior muscle, using an insulin syringe with 28-gauge needle. This injection volume has previously been shown to distribute injected protein throughout the entire tibialis anterior muscle in the mouse (J Immunol 2000;165:2850), and we also verified with dye injection that this volume completely stained all of the fibers. Ten animals (5 in each group) were sacrificed at 1, 2 and 3 weeks post-injection by cervical dislocation, and the injected muscle, along with the contralateral un-injected tibialis anterior muscle, removed. Transverse muscle strips (4 mm wide) were immersion-fixed in 10% buffered formalin. Muscle cross-sections were embedded in paraffin, cut into 5 µm sections, and stained with hematoxylin and eosin. Slides were evaluated by a pathologist blinded to the injection drugs. Pathological findings are presented as a 0-4 scale (with 0=normal, and 4=atrophy and regeneration). The Mann-Whitney U-test was used for statistical comparison of the RTX-injected versus vehicle-injected muscle pathology scores (all weeks combined).
Results: The intramuscular RTX group had higher pathology scores (median [IQR], 3 [1-3]) compared to the vehicle group (1 [0-1]) (p=0.014). This included atrophic fibers and evidence of regenerating fibers. The pathology scores over 3 weeks are shown in the figure. The contralateral un-injected side in all 30 animals was normal (0 rating).
Discussion: Intramuscular RTX causes pathological changes in muscle fibers at one-to-three weeks post-injection. Since RTX has been shown to affect C-fibers and perhaps A-delta nerve fibers, the origin of these pathologic changes is unknown.



S-221.

THE EFFECTS OF 24 HOURS OF SLEEP DEPRIVATION ON TAIL FLICK LATENCY IN RATS

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Introduction: Sleep deprivation precipitates adverse physiological effects and may even cause death. It is well established that pain threshold is influenced by numerous physiological changes but there are minimal reports on the effects of sleep deprivation on pain threshold. Through a blinded, cross-over, randomized controlled design, we compared the change in tail flick latency in rats with 24 hr of sleep deprivation and with previously adequate sleeping.
Methods: Twenty rats weighing 355±25g (mean±SD) were randomly allocated into two groups, group A and group B. One rat from each group was put into a special designed apparatus. The apparatus, the Rechtschaffen deprivation apparatus, [1] consisted of two plastic cages, placed side by side. The experimental design was such that the rat in one cage was not able to sleep, whereas rat in the other was able to sleep. The study included four phases with an initial seven days of adaptation, followed by 24-hour period of normal sleep (Group ND rats) or sleep deprivation (Group DN rats). Then it was followed by a five day resting period that permitted normal sleep, and a crossover of 24-hour periods during which Group DN rats were permitted normal sleep and Group ND rats were sleep deprived. Body weight and pain threshold (tail flick latency; TFL) were measured on the morning before and after each 24-hour period. Data from both groups were compared and analyzed to see if the sleep deprivation effects are significant.
Results: Following 24 hours of sleep deprivation, body weight decreased by 5 ± 2% and the changes were not significantly different between groups. After 24 hours of sleep deprivation, there were significant increases from baseline in TFL by 35±2% in group ND rats and 31±2% in group DN rats (Table 1). Body weight and TFL returned to original values in all rats after adequate sleep.
Discussion: Our results show that sleep deprivation augments TFL in rats.

Reference: Rechtschaffen A, Gilliland MA, Bergmann BM, Winter JB: Physiological correlates of prolonged sleep deprivation in rats. Science 1983; 221:182-4.

Table 1. Changes in tail flick latency before and after sleep deprivation.

Group	Tail Flick Latency (sec)		
	before sleep deprivation	after sleep deprivation	after adequate sleep
ND	3.4 ± 0.3	4.5 ± 0.6*	Not measured
DN	3.4 ± 0.4	4.4 ± 0.5*	3.3 ± 0.3**

Values represents mean ± standard deviation
* Differs from values before sleep deprivation; $p<0.01$, Student's t-test.
** Differs from values after sleep deprivation; $p<0.01$, Student's t-test.

S-222.

INTERACTION BETWEEN SEROTONIN AND GLUTAMATE RECEPTOR ANTAGONISTS IN SPINALLY MEDIATED ANALGESIA IN RATS

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Background: Glutamate receptor antagonists have great roles in analgesic mechanisms in the spinal cord. Serotonin is an important neurotransmitter in pain mechanism. However the analgesic effect of extrinsically administered serotonin is still controversial. The present study was performed to clarify the analgesic effects of serotonin and its interaction with glutamate receptor antagonists in the rat spinal cord.
Methods: Sprague-Dawley rats with lumbar intrathecal catheters were tested for their thermal tail withdrawal response using the tail flick test and for their paw flinches by formalin injection after intrathecal administration of AP-5 (N-methyl-D-aspartate (NMDA) receptor antagonist), YM 872 (α-amino-3-hydroxy-5-methylisoxazole-4-propionic acid (AMPA) receptor antagonist) or serotonin. The 50% effective doses (ED50) of each agent were calculated. The effects of the combination were tested by an isobolographic analysis using 1/2, 1/4, 1/8, and 1/16 ED50 values of each agent. Eight rats were used in each dose group. Behavioral side effects were also investigated.
Results: The ED50 values of AP-5 and serotonin decreased from 5.5 and 34.4 μg to 0.59 and 3.7 μg and those of YM 872 and serotonin decreased from 1.0 and 34.4 μg to 0.17 and 6.0 μg, respectively by combination in the tail flick test. In the formalin test, ED50 values of AP-5 and serotonin decreased from 7.6 and 12.6 μg to 0.15 and 0.14 μg and those of YM 872 and serotonin decreased from 0.24 and 12.6 g to 0.0004 and 0.0024 μg in the phase 1, and ED50 values of AP-5 and serotonin decreased from 1.4 and 1.25 μg to 0.25 and 0.24 μg and those of YM 872 and serotonin decreased from 0.21 and 1.25 μg to 0.02 and 0.12 μg in the phase 2, respectively. Motor disturbances observed with each agent were not seen in both combinations.
Discussion: Serotonin was analgesic when intrathecally administered. The analgesic effects of intrathecal serotonin and AP-5 or YM 872 were synergistic on thermal and inflammatory induced pain. Therefore, serotonin receptor might have some functional relation with NMDA and AMPA receptors in pain transmission in the spinal cord.

S-223.

SPINAL CORD MORPHOLOGY AFTER REPEATED INTRATHECAL ADMINISTRATION OF PRESERVATIVE-FREE S(+)-KETAMINE IN THE RABBIT

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Introduction: Questions have been raised about the potential neurotoxicity of the neuraxial use of ketamine although ketamine and its active enantiomer S(+)-ketamine have been used intrathecally and epidurally (caudally) for the management of perioperative pain and in a variety of chronic pain syndromes. Thus, studies on neurotoxicity are required before this technique can be recommended or discouraged for clinical practice. The aim of this randomized double-blind study was to assess the neurologic and toxicologic effects on the spinal cord from repeated daily intrathecal administration of commercially available, preservative-free S(+)-ketamine.
Methods: The study protocol was approved by the Animal Research Committee. Eighteen animals were randomly assigned into two groups consisting of six rabbits in the control group, and twelve rabbits in the S(+)-ketamine group. Under general anesthesia, a laminectomy was performed at L5-L6 and a subarachnoid catheter was inserted 3 cm into the intrathecal space. The control group received 0.5 ml 0,9% saline solution, and the S(+)-ketamine group received preservative free 0,5% S(+) ketamine 0.5 ml, equivalent to 0.8 mg/kg once a day for 7 consecutive days. Neurologic evaluation (Tarlov: 0 = paraplegia with no lower-extremity function; 1 = poor lower-extremity function, weak anti-gravity movement only; 2 = some lower-extremity function with good anti-gravity movement but inability to draw legs under body and/ or hop; 3 = ability to draw legs under body and hop but not normally; 4 = normal motor function) was performed 7 days following start of treatment. After 8 days, the animals were sacrificed and the spinal cord was removed and immersed in formalin 10%. Subsequently, histopathologic examination was performed by a neuropathologist blinded to the drug used. Wilcoxon‘s signed-ranks test and chi square test were used for statistical analysis of the Tarlov score within each group and between the two groups, respectively. Significance was set at a value of $P < 0,05$.
Results: One animal in the control group was sacrificed during procedure because of intraoperative systemic complications. The other rabbits (n=17) showed no signs of motor dysfunction after the catheter insertion following recovery from anesthesia. Eight animals from the S(+)-ketamine treated group showed severe histological abnormalities including central chromatolysis, nerve cell shrinkage, neuronophagia, microglial upregulation, and gliosis. The Tarlov score was significantly decreased in the S(+)-ketamine group at study closure. The incidence of paraplegia and paraparesis (Tarlov score = 0-1) was 0% in the control group versus 17% in the S(+)-ketamine treated group
Discussion: Clinical experience following neuraxial administration of S(+)-ketamine has been documented without reference to local central nervous system toxicity following this approach. In view of our results, the neuraxial administration of commercially available preservative free S(+)-ketamine should be avoided in humans.

S-224.

THE EFFECT OF S(-)-NORKETAMINE ON THE DEVELOPMENT OF TOLERANCE TO OPIOIDS IN RATS

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Introduction: Opioids (e.g. morphine) remain the mainstay for the treatment of moderate to severe pain. However, long-term use of opioids is associated with marked side effects and development of tolerance to analgesia. One approach to this limitation has been combining other agents with opioids in order to enhance their analgesia, reduce side effects and inhibit tolerance. In this regard, use of drugs acting as antagonists on NMDA receptor has been of great interest. The only clinically available NMDA receptor antagonist, ketamine, is limited in use due to its marked psychotomimetic, sedative and motor effects. There is a need for NMDA antagonist(s) with better side effects profile. Our previous findings demonstrated that a metabolite of ketamine, norketamine [in particular the S(-) isomer], exhibited fewer side effects (e.g. locomotor depression, ataxia, stereotyped behavior) than ketamine. Potentiation of morphine analgesia by S(-)-norketamine also was demonstrated. In the present study, the ability of S(-)-norketamine to attenuate the development of tolerance to the analgesic effect of morphine was determined. Locomotor effect was also assessed.
Methods: Male Sprague-Dawley rats were injected twice daily (IP) with morphine (7mg/kg) alone or in combination with S(-)-norketamine (3 mg/kg). This dose of S(-)-norketamine had no analgesic effect in a rodent model of acute pain (tail-flick test). Responses were determined prior to (baseline) and at 30 and 60 min after AM dose using tail-flick test (baseline 2-3 s, cut-off 10 s). Percentage of maximum possible effect (%MPE) was calculated. Tolerance was defined as a response ≤5% MPE. Locomotor activity was recorded prior to and at 60 min after drug administration.
Results: Chronic administration of morphine alone resulted in the developed of tolerance to analgesia by day 10 of treatment (<5%MPE). Conversely, in rats repeatedly dosed with morphine and (S)-norketamine a marked analgesic effect (≈80%MPE) was maintained during 12 days of testing. This indicates that the development of morphine tolerance was inhibited in presence of S(-)-norketamine. This likely may be explained by S(-)-norketamine action on the NMDA receptor. Locomotor activity increased with repeated administration of morphine alone and morphine plus (S)-norketamine. This suggests that the locomotor effect of morphine does not involve an NMDA receptor mechanism.
Discussion: The present study demonstrated that a novel NMDA receptor antagonist, S(-)-norketamine, in a low dose that did not produce analgesia and side effects alone, blocked morphine tolerance development in rats. This suggests that S(-)-norketamine may prevent dose escalation and dose-related increase of side effects commonly associated with long term morphine treatment. Our finding may be of importance for development of an effective NMDA antagonist-opioid agonist combination therapy for chronic pain. Such efforts are currently in progress.

S-225.

EFFECTS OF ESTRADIOL ON FORMALIN-INDUCED NOCICEPTIVE RESPONSES IN RATS

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Introduction: Numerous experimental studies have shown that there are differences between the genders in response to painful stimuli and analgesia. Sex hormones are thought to be one of the main factors that account for the phenomenon. Menstrual cycle related pain syndromes can clearly indicate the close relationship between gonadal hormones and pain. The purpose of the present study was to investigate the effect of estrogen on formalin-induced nociceptive responses in rats by comparing the nociceptive response of female rats with different estrogen levels.
Methods: Thirty-two 8-week-old female rats were divided into four groups. Group 1: sham operation (n=8). Group 2: Ovariectomized (n=8). Group 3: Ovariectomized + E_2 50μg /qod. (n=8). Group 4: Ovariectomized + E_2 100μg/qod. (n=8). Formalin tests were performed six weeks later when the plasma estradiol concentration reached balance.
Results: The formalin test period included three phases: phase I (1-10min), interphase (11-20min), and phase II (21-60min). The mean behavioral score was calculated for each phase (0_painlessness, 4_severe pain). The nociceptive scores were comparable among the groups throughout the formalin test period (see Table 1). In this study, we did not find any effect of estradiol on nociceptive responses in the formalin test.

Group(n=8)	Phase I	Interphase	Phase II
Sham	1.53±0.15	1.40±0.24	2.00±0.21
OVX	1.50±0.14	1.33±0.31	1.94±0.27
OVX+E_2(L)	1.39±0.29	1.51±0.38	2.05±0.09
OVX+E_2(H)	1.54±0.21	1.26±0.61	1.88±0.27

Table 1.Rating comparison of different phases among the groups. There was no significant difference among the four groups on each phase. OVX, ovariectomized; OVX+E2(L), ovariectomized + E2 50μg /qod; OVX+E2(H), ovariectomized + E2 100μg/qod.
Discussion: The comparison between normal females and OVX females with different dosage E_2 supplements showed estradiol does not have significant effect on acute pain in the tested range. Separate estrogen influence did not lead to any significant difference in pain perception.
References: [1]Clin J Pain. 2003 May-Jun; 19(3):175-86. [2]Clin J Pain. 2003 May-Jun; 19(3):168-74. [3]Pain 81 (1999) 225-235. [4]Brain Res. 2002 Dec 20; 958(1):139-45. [5]Pain 4 (1977) 161-174. [6]Neuroreport Vol. 14 No.12 26 August 2003.1627-1631

S-226.

ANALGESIC EFFECT OF PROPOFOL ON INCISIONAL PAIN IN RATS

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Introduction: The use of propofol as an IV sedative for monitored anesthesia care is widespread. There is somewhat conflicting literature on the effect of propofol on pain perception: Propofol in subhypnotic doses has no analgesic effect on painful electrical and heat stimulation, but has a hyperalgesic effect on mechanical pressure pain(1); while some found that propofol can increase the pain threshold and reduce the amplitude of the evoked potential to acute laser induced pain(2). This placebol-controlled study was performed to determine whether propofol have analgesic effect on incisional pain.
Methods: Postoperative model of nociception was established in male SD rats weighing 200-250g. Of 84 rats randomly assigned to 7 group, group S is sham operation group; group O was operated without any drug; control group (group I) received 10% intralipid 1ml/kg; preload group P1 received propofol 5ml/kg; preload group P2 received propofol 10ml/kg; post-injected group P3 received propofol 5ml/kg; post-injected group P4 received received propofol 10ml/kg. All drugs were administered intravenously 5 min before or after operation. The analgesic effects of systemic propofol were demonstrated by measurement of propofol were demonstrated by measurement of a cumulative pain score (CPS) based on the weight bearing behavior of the rats.
Results: 1. The cumulative weight-bearing scores greatly increased after operation. The CPS of group O is higher than group S ($P<0.01$). 2. No significant differences in the CPS were noted between group O and group I ($P>0.05$). However, the CPS for 4 propofol groups differs siginificantly from the control (intralipid) group ($P<0.01$). 3. Both preload and post-injected propofol siginificantly suppressed the increassed CPS evoked by pain stimulation, the greater analgesic effect of propofol at higher doses suggesting a dose-dependent manner ($P<0.05$). The CPS of preload and post-injected propofol were higher in the 5ml/kg group compared with 10ml/kg group. ($P<0.05$). 4. Compared with post-injected propofol group, the analgesic effect of preload propofol demonstrated greater ($P<0.01$).
Discussion: The results of this study suggest that propofol could serve as a valuable adjunct for acute postoperative pain management. Systemic propofol induces analgesic effect on acute incisional pain in a dose-dependent manner, and can be used not only for prevention but also for treatment of pain. Preload propofol can be accompanied by the pre-emptive analgesic effect. The effect of propofol given before was better than that given after pain stimulation.
Reference:
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S-227.

EFFECT OF THORACIC MUSCLE SURGERY ON SPINAL INTERLEUKIN-6 CONCENTRATION IN THE RAT

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Introduction: Interleukin-6 (IL-6) is an inflammatory cytokine that is upregulated in the spinal cord in animal models of neuropathic pain and spinal cord injury. Following L5 spinal nerve transsection in the rat, there is a 3-fold increase in spinal IL-6 concentration at 3 days post-injury (Neuroscience 2001;103:529). In the rat sciatic nerve chronic constriction model, there is no increase in dorsal horn IL-6 at 1 day post-surgery but IL-6 levels increase progressively from days 3-14 (J Neurosci 2004;24:8595). Following thoracic spinal cord compression injury in the rat, there is a 1.48-fold increase in thoracic spinal IL-6 at 4 hours post-injury (J Neurosurg Anesthesiol 2005;17:82). The objective of this study is to determine if thoracic spinal cord IL-6 concentration increases following thoracic muscle surgery.
Methods: Following IACUC approval, 12 male Sprague-Dawley rats (350 g) had an injection catheter implanted in the thoracic CSF space under isoflurane. After a 7 day recovery period, animals were anesthetized with intrathecal 0.75% hyperbaric bupivacaine at 5 μL/min In 6 animals, a skin incision was made over the left lateral thoracic region, and both superficial and deep muscles were incised by creating 3 cm long lateral cuts over the 3rd, 5th, and 7th ribs. The intercostal muscles were spared. The muscle wounds were closed with silk sutures and the skin incision closed with nylon sutures. An additional group of 6 animals (sham) only had a skin incision performed under spinal anesthesia. The duration of surgery was 15 min. At 3 h from the start of surgery, the animals were briefly anesthetized with isoflurane, decapitated, and the spinal cord rapidly ejected. A 10 cm length of spinal cord (T1-T3) was dissected on ice and rapidly frozen. Samples were homogenized and the supernatant used to measure IL-6 concentration by ELISA. IL-6 levels in the 2 groups of animals were compared by t test.
Results: At 3 h after surgery spinal IL-6 concentration was 6.06 ± 0.60 pg/ml in animals with thoracic muscle surgery compared to 4.36 ± 0.35 pg/ml in sham operated rats ($p<0.05$).
Discussion: Following thoracic muscle surgery there is a modest (1.39-fold) increase in thoracic spinal IL-6 concentration. Although this change is comparable to the increase seen after thoracic cord injury, it is small compared to increases in lumbar spinal IL-6 that develop in neuropathic pain models. Using this model of thoracic surgical intervention, IL-6 does not appear to be an important early mediator of the central nervous system cytokine response to moderate surgical trauma.

Pain - Clinical

S-228.

PERIOPERATIVE ADMINISTRATION OF PREGABALIN, CELECOXIB, AND THEIR COMBINATION FOLLOWING SPINAL FUSION SURGERY

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INTRODUCTION
A multimodal analgesic approach is currently recommended for the management of acute pain (1). Recent evidence suggests that alpha-2-delta subunit calcium channel ligands (gabapentin and pregabalin), may provide effective post-surgical analgesia (2). Further, these drugs can interact synergistically with NSAIDs to produce antihyperalgesia (3). The combination of gabapentin and rofecoxib, a COX-2 NSAID, was shown to be superior to either single agent for postoperative pain (4). Celecoxib (5) and gabapentin (6) have demonstrated analgesic efficacy following spinal fusion surgery. Although structurally similar to gabapentin, pregabalin has demonstrated greater analgesic efficacy in rodent models of neuropathic pain (7), and exhibits linear pharmacokinetics across its therapeutic dose range with low inter-subject variability. (8). The goal of this study was to assess the combination of celecoxib and pregabalin for pain following spinal fusion surgery.
METHODS
Thirty two patients undergoing elective spinal fusion surgery were prospectively, randomized to receive either placebo (n=7), celecoxib 400 mg (n=8), pregabalin 150 mg (n=8), or a combination of celecoxib 400 mg and pregabalin 150 mg (n=9) by mouth 1 hour before induction of anesthesia. Patients underwent general anesthesia and received fentanyl 5 mcg/kg. Postoperatively, patients received PCA morphine. Twelve hours after initial study drug administration, patients were administered either placebo, celecoxib 200 mg, pregabalin 150 mg, or a combination of celecoxib 200 mg and pregabalin 150 mg by mouth. Morphine use and pain and sedation scores were recorded every 4 hours for the first 24 hours postoperatively.
RESULTS
There were no differences in demographic or surgical variables or sedation scores among the four groups. 24 h cumulative morphine use (mg) was significantly lower in the pregabalin/celecoxib group (41 ± 6) compared to the placebo (125 ± 6) ($P<0.001$), celecoxib (77 ± 8) ($P<0.01$), or pregabalin (72 ± 5) ($P<0.01$) groups. There was no difference in morphine use between the celecoxib and pregabalin groups. Morphine use was significantly ($P<0.05$) lower at each 4 h postoperative interval for group celecoxib/pregabalin compared to the other 3 groups.
DISCUSSION
The combination of pregabalin and celecoxib significantly reduces pain and opioid use than either analgesic alone following spinal fusion surgery.
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S-229.

KETAMINE AS AN ADJUNCT FOR POST-OPERATIVE PAIN AFTER SPINAL FUSIONS

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Introduction: Acute pain management is difficult after spinal fusions in patients with preoperative narcotic dependency. Ketamine, an NMDA antagonist, at subanesthetic doses has been shown to be efficacious in the treatment of chronic pain. This study was designed to assess the use of Ketamine as an adjunct to acute pain management after spinal fusions.
Methods: With IRB approval 16 narcotic dependent patients scheduled for elective posterior spinal fusion were randomly assigned to receive postoperative ketamine (K) or control (C). All patients received a general nitrous-narcotic-propofol anesthetic. K-patients received a 0.2mg/kg i.v. bolus and then an infusion of 2 mcg/kg/min for 26±8 hours after surgery. All patients received PCA hydromorphone, 0.5mg/cc. Patients were assessed postoperatively for pain using a numerical rating scale (NRS) and for hydromorphone usage. Statistics, unpaired T-test; $p<0.05$.
Results: 15 patients completed the study protocol. Patients had similar demographics and operative times (Table). K-patients required less PCA hydropmorphone and had lower NRS scores. Six patients had a NRS score of ≥ 9 in the PACU; four in the C-group, and 3 of these converted to the K-group in order to achieve adequate pain control.
Conclusions: Preliminary findings suggest that the addition of subanesthetic doses of ketamine to the postoperative pain regimen for narcotic dependent patients after spinal fusions reduces narcotic requirements and improves pain control.

	K	C
Age (y)	54±13	47±12
ASA II/III	8/1	5/1
Surgery Duration (h)	4.9±1.0	4.7±1.4
PCA volume 24h (ml)	30±26	63±27, p=0.03
VAS POD-1	3.6	5.3
VAS≥9 DOS (n)	2	4

S-230.

EFFECTS OF REPETITIVE TRANSCRANIAL MAGNETIC STIMULATION ON POSTOPERATIVE PAIN: A PRELIMINARY STUDY

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Introduction: There is emerging evidence that repetitive Transcranial Magnetic Stimulation (rTMS) can alleviate the experience of acute and chronic pain. The majority of TMS-pain studies to date have investigated the effects of rTMS applied over motor cortex with promising results[1]. However, there is some evidence that motor cortex stimulation works by impacting the affective dimension of pain[2], and it's possible that rTMS may be optimized for pain if it's used to stimulate the left prefrontal cortex (a potentially more efficient way to reach limbic structures). One very recent study has found significant anti-nociceptive effects of prefrontal rTMS[3]. Previous studies have focused on neuropathic pain, this pilot study is the first ever examination of the effects of left prefrontal rTMS on postoperative pain.
Methods: We applied either real (n=7) or sham (n=4) rTMS treatments to the left prefrontal cortex of gastric bypass patients while they were recovering in the post anesthesia care unit. The treatments were set at 100% of resting motor threshold, 10 Hz, 10 second stimulus train, 20 seconds interstimulus interval for 20 minutes; a total of 4000 pulses. We recorded pain scores (VAS) and morphine usage with a PCA pump for the first 24 hours postop.
Results: This preliminary study shows a trend towards reduced narcotic usage and improved VAS scores in the first 24 hours following gastric bypass surgery.
Discussion: The data suggests that there's a trend toward improvement in postoperative pain outcomes following a single post-operative session of left prefrontal rTMS. The exact mechanism by which rTMS achieves its effects are unknown. More controlled systematic research in a larger cohort is needed to help determine the reliability of the effects of prefrontal rTMS on postoperative pain.
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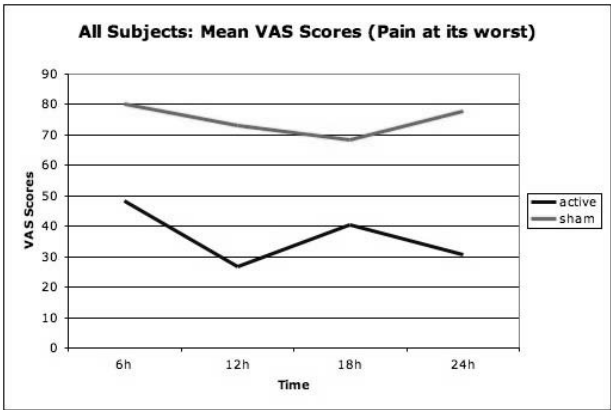

S-231.

ACUTE PAIN SERVICE IMPROVES PAIN CONTROL AND PATIENT SATISFACTION.

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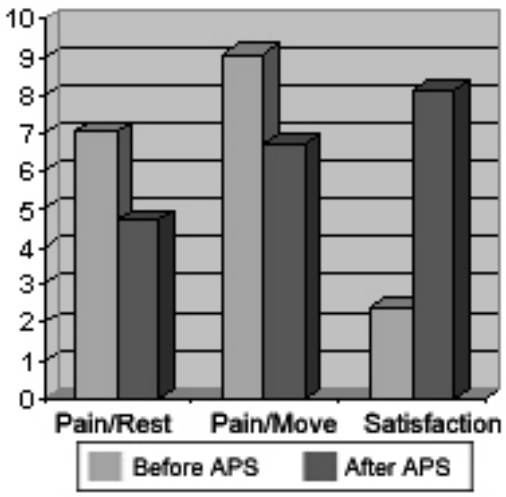
Introduction: In recent years organized acute pain services (APS) have been introduced in major hospitals across the United States. It has been suggested that APS decreases postoperative pain and improves patient's satisfaction (1). In this retrospective analysis of prospectively surveyed patients we evaluated the perceived benefits of APS.
Method: Postoperative patients were surveyed prior to establishing the APS (n=52) and two years later after establishing the APS (n=52). The survey asked patients to rate their pain intensity at rest and with movement on a numerical scale of 0-10, with 0 being no pain and 10 being the worst possible pain. It also asked the patients to rate their overall satisfaction of pain management on a 0-10 scale, with 0 being completely dissatisfied and 10 being completely satisfied.
Results: The results showed that the pain intensity scores were significantly reduced after the establishment of APS from mean values of 7 to 4 at rest, and from 9 to 7 with movement (figure). Patient satisfaction improved from mean values of 2 to 8 (figure).
Discussion: We conclude that the introduction of APS is beneficial for postoperative pain control and for patient satisfaction. Such surveys allow us to objectively evaluate not only the benefits of APS but also areas for further improvement. We noted that the pain intensity scores on movement were not optimal which led to reorganization and further improvement.
Reference: [1] Anesthesiology Clinics of North America 2005;23:203-210.



S-232.

EFFECT OF INTRAVENOUS PARACETAMOL ON POSTOPERATIVE PAIN AFTER TONSILLECTOMY

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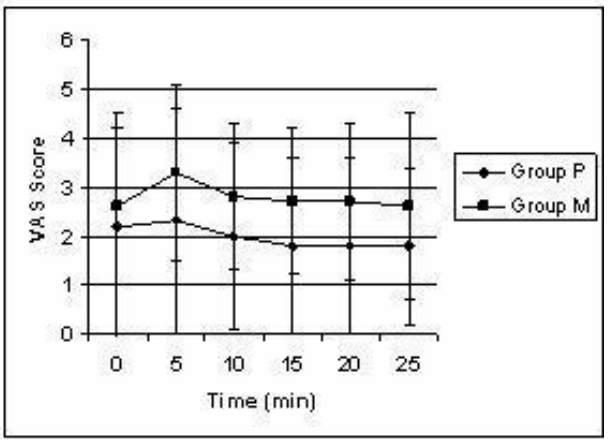
Introduction: Post-tonsillectomy pain is typically treated with opioids or non-steroidal anti-inflammatory drugs (NSAIDs), however, opioids carry the risk of respiratory depression and sedation and NSAIDs are not desirable in children. In contrast, intravenous paracetamol is a non-opioid analgesic that is devoid of sedative and respiratory depression properties and lacks the untoward effects of NSAIDs. This study compared the analgesic efficacy of intravenous paracetamol with that of intramuscular meperidine in children undergoing tonsillectomy.
Methods: Thirty American Society of Anesthesiologists' class I-II patients, aged 5-15 yrs, scheduled for tonsillectomy were enrolled in this double-blind trial. All patients received midazolam 0.5 mg/kg PO 30 min before surgery and fentanyl 1 g/kg IV on induction of anesthesia. Patients were randomized to receive either paracetamol 15 mg/kg IV (group P) or meperidine 1 mg/kg IM (group M) on induction of anesthesia. Sevoflurane was used for induction and maintenance of anesthesia, and no other analgesics were administered throughout the case. Postoperatively, visual analogue scale (VAS) score was determined every 5 min until discharge from recovery room together with requirements for postoperative analgesia. Postoperative pain was treated with morphine 0.05 mg/kg IV every 10 min prn. Repeated measures analysis of variance was used to analyze VAS data, and Chi square statistic was used to compare the number of patients who received postoperative analgesia in both groups. Data are presented as mean ± SD and statistical significance was defined as $p < 0.05$.
Results: VAS scores over time were consistently lower among group P patients compared with those in group M (Figure), however, this did not achieve statistical significance ($p = 0.2$). In contrast, 3 patients in group P required postoperative morphine compared to none in group M ($p = 0.2$). No major adverse effects were observed in the study.
Discussion: Intravenous paracetamol provided effective postoperative analgesia in children undergoing tonsillectomy. There was a trend toward lower VAS scores among patients who received intravenous paracetamol compared to those who received intramuscular meperidine, however, with the current number of patients enrolled the sample size was insufficient to demonstrate statistical significance. It is possible that postoperative morphine administration had contributed to the lower VAS scores in group P, but this remains to be determined as more patients are being recruited in this study.



S-233.

MULTIMODAL ANALGESIC REGIMEN IN PATIENTS UNDERGOING TOTAL ABDOMINAL HYSTERECTOMY: AN OPTIMAL INTRATHECAL MORPHINE DOSE INVESTIGATION STUDY

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INTRODUCTION. Intrathecal morphine administered at a dose of 0.3mg combined with NSAIDs create an adequate pain control without additive systemic opioids during first postoperative day. Unfortunately, high incidence of pruritus affects patients' satisfaction. Using intravenous PCA morphine we compared the pain control effectiveness, the side effects distribution and patients' satisfaction scores in two intrathecal morphine dose regimen groups - 0.3mg and 0.2mg.
METHODS. 60 non-obese ASA I and II patients undergoing total abdominal hysterectomy were enrolled in this study. Antiemetic prophylaxis with dexamethasone, 8mg and ondansetron, 4mg was performed. Patients were operated under spinal anesthesia with bupivacaine, 20mg, and midazolam, 2.5-5mg intravenously. First group (n = 30) received 0.3mg morphine sulfate intrathecally, second group (n = 30) - 0.2mg. Intravenous PCA morphine was used 24hr postoperatively with 2mg boluses regimen, without background infusion. NSAIDs (diclofenac, 75mg i/m) were administered twice per day for three days. Pain severity (VAS, endpoints 0-10), postoperative nausea and vomiting (PONV, 3-rating scale), pruritus (3-rating scale), sedation, respiratory depression, patients' satisfaction scores (VAS, endpoints 0-10) were evaluated 2, 4, 6, 9, 12, 18 and 24 hr postoperatively. PCA morphine consumption was registered at 6, 12 and 24 hr. Peristaltic waves resume was registered. Data was analyzed using Student's test and are reported as mean ± SD.
RESULTS. Postoperative pain (VAS > 3) was registered in 0% cases in I group vs 23.3% in II group. 9 patients (30%) needed additional systemic morphine via PCA with highest infused dose 6mg in I group vs 25 patients (83.3%), highest morphine dose - 18mg. Other results are presented in the table.

Groups	IV PCA morphine consumption at 24hr, mg	Resume of peristaltic waves, hr	PONV %	Sedation %	Pruritus %	Patients' satisfaction (VAS≥8),%
I group -0.3mg ITM	1 ± 1.7	20.9 ± 2.4	36.7	63.3	76.7*	80
II group - 0.2mg ITM	9.5 ± 9.2*	21.9 ± 1.4	20	50	20	73.3

* - p value < 0.001
DISCUSSION. This study revealed that ITM at a dose of 0.2mg doesn't cover morphine requirements during first postoperative day. Though lower dose of ITM (0.2mg) causes less side effects - pruritus incidence differs significantly ($p<0.001$), patients' satisfaction scores are higher in I group. We assume that 10mg morphine administered subcutaneously near the end of operation can cover additional opioid needs with less side effects and without intravenous PCA when a 0.2mg dose of ITM is used. This hypothesis should be investigated in further studies.

S-234.

PREOPERATIVE ADMINISTRATION OF INTRAVENOUS FLURBIPROFEN AXETIL REDUCES POSTOPERATIVE PAIN IN SPINAL FUSION SURGERY

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Introduction; Postoperative analgesia after spinal fusion surgery is usually controlled by systemic opioids and/or non-steroidal anti-inflammatory drugs (NSAIDs) because of no indication of epidural analgesia. Although NSAIDs show opioid-sparing effect [1], it is controversial whether NSAIDs have the preemptive analgesic effect [2]. Flurbiprofen axetil (FA) is an injectable cyclooxygenase (COX) inhibitor, and it was reported that preoperative administration of FA reduced postoperative pain [3]. This study was designed to evaluate postoperative analgesia and opioid-sparing effect of preoperative administration of intravenous FA in patients undergoing spinal fusion surgery under general anesthesia.
Methods; Thirty six patients were randomly allocated into one of three groups. They received preoperative FA, 1mg/kg (group A), postoperative FA, 1mg/kg (group B), or placebo (group C). All groups received intravenous morphine via patient-controlled analgesia devices for postoperative analgesia. The pain score was evaluated by a visual analogue scale (VAS) at 0 (T_0), 1 (T_1), 2 (T_2), 6 (T_3), 12 (T_4) and 24 (T_5) hrs after surgery and morphine requirement was measured at T_0 to T_3 and T_3 to T_5.
Results; VAS in group A was significantly lower than that in group B at T_0 and T_1, and that in group C throughout the time course after surgery. Postoperative morphine consumption in group A was significantly lower than those in group B and C at T_0 to T_3.
Discussion; The result show that preoperative administration of intravenous FA provides an immediate postoperative analgesia and an opioid-sparing effect in early postoperative period in patients undergoing spinal fusion surgery under general anesthesia. The pre-administration of FA would reduce or delay the development of peripheral inflammation resulting from the inhibition of prostaglandin production during spinal surgery. An immediate postoperative analgesia might be due to inhibiting the peripheral sensitisation.
Referrences; 1. Anesth Analg 91; 1221-1225: 2000 2. Anesth Analg 100; 757-773: 2005 3. Can J Anesth 48; 234-237: 2001

S-235.

COMPARISON OF INTERPLEURAL MORPHINE AND BUPIVACAINE FOR POSTTHORACOTOMY PAIN MANAGEMENT

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Introduction: The treatment of pain in the postoperative period after thoracotomy is of great importance. Pain has a restrictive effect on chest wall movement which may cause ineffective cough, accumulation of airways secretions, and atelectasis. Pain may be further exacerbated by the presence of chest tubes. The interpleural injection of local anesthetics, and opioids can produce effective analgesia after thoracotomy by unilateral multiple intercostal nerves block. Bupivacaine has been studied most extensively than opioids in various concentrations and volumes either by intermittent bolus or by continuous infusion (1, 2). This prospective, randomized, double blinded clinical trial was designed to compare the efficacy of interpleural (ip) morphine sulfate to ip bupivacaine hydrochloride in the management of pain after thoracotomy.
Methods: 25 men and 11 women with a mean age of 41 years (range, 17 to 74 years) undergoing elective posterolateral thoracotomy were randomly divided preoperatively into two study groups. At the end of surgery, in 18 patients (ipm group) 0.2 mg/kg morphine sulfate in 40 ml saline was injected via an interpleural catheter. 18 patients (ips group) received 30 ml of 0.25% bupivacaine hydrochloride with epinephrine in 10 ml of saline interpleurally. Then every 4 hours, the patients were given trial solutions for the first 24 postoperative hours. They also received supplementary doses of intravenous morphine upon request. The patients were asked to evaluate separately the pain severity of their incision and chest tubes sites, at rest and when coughing just before each ip injection and 30 min afterwards by using a visual analog scale (VAS; 0-10). The first postoperative pain assessment was performed in the recovery room, 30 min after the first ip injection. Supplemental analgesic consumption, degree of sedation, and other side effects were recorded during 24 hours. Data collection was begun after the first ip injection.
Results: Both interpleural morphine and bupivacaine significantly reduced mean pain scores 30 minutes after ip administration. Even though, VAS pain scores decreased significantly in ipb group, pain relief was not sufficient.(VAS>3). Pain scores were significantly lower in the ipm group than ipb group at most times after thoracotomy. Supplementary morphine requirements were significantly less in ipm group. No significant side effects were detected in both groups.
Discussion: After thoracotomy, interpleural morphine gives better pain control than ip bupivacaine and provides effective and satisfactory analgesia. Interpleural analgesia with bupivacaine is insufficient for pain relief.
References: 1) Ann Thorac Surg 1992; 53: 449-54. 2) Anesth Analg 2000; 91: 44-50.

S-236.

EPIDURAL BLOOD PATCH THERAPY FOR CHRONIC WHIPLASH ASSOCIATED DISORDER

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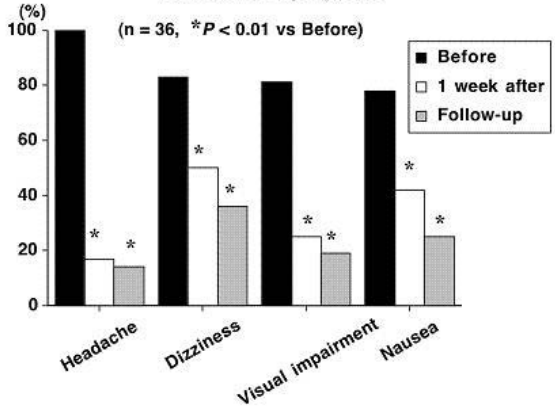
<Introduction> Patients with whiplash associated disorder (WAD) are classified according to the Quebec criteria and these criteria indicate the chart of treatment (1). However, the etiology of WAD is not clarified and symptoms are often unresponsive to conventional treatments. Although there is no objective neurological deficit, most chronic WAD patients complain of neurological symptoms such as headache, dizziness and nausea. On the other hand, patients with cerebrospinal fluid (CSF) leak have similar complaints. Recently, it was reported that radioisotope (RI) cisternography is useful in diagnosis of intracranial hypotension (CFS leak)(2). We investigated that how chronic WAD is related to CSF leak by RI cisternography and if epidural blood patch is effective for chronic WAD.
<Methods> Subjects were 66 chronic WAD patients without fracture and dislocation, and they had symptoms for more than 3 months. All patients underwent RI cisternography to check CSF leak. Backgrounds, symptoms and the results of RI cisternography were recorded and analyzed. In case of patients with CSF leak, epidural blood patch (EBP) was performed on patients request after conventional therapy. The efficacy of EBP was assessed by changes in symptoms (with or without headache, dizziness, visual impairment, and nausea) before, 1 week after, and 6 month after the EBP. Statistical analysis was performed by chi-square test and statistical significance was considered when $P < 0.05$.
<Results> Of all patients, 37 patients (56%) showed abnormal RI cisternography findings and 36 patients with CFA leak received EBP. Most of the CSF leaks were observed in lumbar region. Mean duration of symptoms was 33.3 months. Before the EBP, headache, dizziness, visual impairment, and nausea were reported by 100%, 83%, 81%, and 78% of the patients with CSF leak, respectively. One week after the EBP, these symptoms were decreased significantly ($P < 0.01$) and these effects still continued in 6-month follow-up ($P < 0.01$)(Fig. 1).

Fig.1 Changes in percentage of patients with each symptom



<Discussion> Trivial trauma can lead to CSF leak. In some cases of chronic WAD patients with obstinate symptoms, CSF leak should be included in one of etiologies. Epidural blood patch can be the effective therapy for chronic WAD.
<References> (1) J Neurosurg 101: 421-6, 2004. (2) Spine 20: 1S-73S, 1995.

S-237.

WITHDRAWN

S-238.

A CASE SERIES OF SUPERIOR HYPOGASTRIC BLOCKADE FOR TREATMENT OF REFRACTORY INTERSTITIAL CYSTITIS

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Introduction: Interstitial cystitis (IC) is an increasingly common, incurable form of chronic pelvic pain which can be severely debilitating. Current therapy is inadequate with only two treatments approved by the Food and Drug Administration (oral pentosan and bladder installation of dimethyl sulfoxide (DMSO)). Many cases are refractory to these and a wide variety of other treatments (1). The superior hypogastric plexus (SHP) block and neurolysis has been described as a potential therapy for IC (2), but this therapy has not been systematically studied and recommendations for its use are rarely found in the literature. To our knowledge this is the first reported retrospective review of the use of SHP block used specifically to treat IC.
Methods: All cases of refractory IC treated with SHP block over a one year period at the University of Colorado Pain Medicine Clinic were evaluated retrospectively for technique, efficacy and complications.
Results: Four patients were treated during the review period. All were women who were refractory to first-line treatments of IC. Each received at least one SHP block. A total of 8 blocks were performed all using the fluoroscopic-guided, lateral technique as described by Raj et al.(2) with bilateral injection of local anesthetic and in some cases steroid solution. Three out of 4 patients, in 6 out of 8 blocks, reported significant relief of symptoms for a period of 3 to 9 weeks. One complication was reported: a patient reported motor impairment to a lower extremity which resolved completely within approximately 12 hours.
Discussion: Visceral pain from the urinary bladder is relayed to the central nervous system via sympathetic afferents which pass through the SHP before synapsing with the T11-L2 nerve roots (2), (3). SHP blockade is the only treatment for IC aimed at directly interrupting the sympathetic pathway of pain transmission (4). Our review showed significant benefit from this therapy with pain relief lasting several weeks to months. Weaknesses of this review include its retrospective approach, the small number of patients, the lack of objective measurement criteria by which to judge treatment success, the lack of blinding, and the lack of a control arm. Notwithstanding these shortcomings, the positive response to SHP block demonstrated through this review suggests that further systematic evaluation of this treatment approach to IC is warranted.
References:
(1) J Urol 173: 1186-1191, 2005.
(2) Radiographic Imaging for Regional Anesthesia and Pain Management. Raj, et al., 2003.
(3) Neural Blockade in Clinical Anesthesia and Management of Pain, 3rd Edition. Cousins, et al., 1998.
(4) Campbell's Urology, 8th Edition, 2002.

S-239.

MONO DELTA 9-TETRAHYDROCANNABINOL-BASED THERAPY IN PATIENTS WITH FIBROMYLAGIA SYNDROME - A CLINICAL TRIAL

AUTHORS: **M. T. Schley**, A. Leger-Goerke, R. Rukwied, U. Friess, M. Schmelz, C. Konrad;
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INTRODUCTION. Fibromyalgia syndrome (FMS) shows evidence of central nervous system hyperexcitability related to central sensitization. Cannabinoid CB1 receptors are present in human neocortex and amygdala and the endogenous cannabinoid system has a central function in extinction of aversive memories. Delta 9-tetrahydrocannabinol (delta 9-THC) was tested fpr pain relief in patients fulfilled the diagnostic ACR criteria for fibromyalgia. **METHODS:** FMS patients started with a drug escalation phase from 2.5 to maximally 30 mg THC by 2.5 mg per week if side effects were well tolerated. Patients entered a baseline period of 2 weeks, followed by 3 months treatment period with a titration protocol allowed them to escalate drug dosage in 2.5 mg increments in 1 week-intervals. 12 FMS patients were classified as responders [VAS decreased >50% of baseline value] or non-responders [VAS decreased <50% of baseline value]. Patients were observed for 4 months using a comprehensive set of outcome measures that included the MPI, PSQI, SF-36, SF-12, CES-D, PDI and FIQ. Endpoint of the study was 4 months after beginning therapy period. **RESULTS:** 31 patients who met the American College of Rheumatology criteria for fibromyalgia, 17 FMS patients chose to participate in the study. The dropout rate in the baseline phase was 17.7% (n=3) and in titration period 15.4% (n=2); 64.7% (n=12) completed the study. The results of the MPQ, PDI, and SF-12 remained unchanged in responder and non-responder group. After 21 days 5 of 14 patients (36%, 95% confidence interval = 30.1-45.8%) were responders and 9 patients (64%, % confidence interval = 55.5-74.2%) were non-responders. In responder group, the best dosage delta 9-THC was reached after 35 days with dosages between 10 - 15mg per day. **CONCLUSION:** This trial had demonstrate a clinical benefit of a mono delta 9-tetrahydrocannabinol-based therapy in patients with refractory fibromylagia syndrome. Data suggest that a FMS patient subpopulation particularly profit from the delta 9-THC therapy and refer to the existence of a clinical endocannabinoid deficiency syndrome.
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Sorensen et al: Hyperexcitability in fibromyalgia. J Rheumatol 25(1), pp. 152-155, 1998
Arendt-Nielsen et al: Central sensitization in fibromyalgia and other musculoskeletal disorders. Curr Pain Headache Rep 7(5), pp. 355-61, 2003
Marsicano et al: The endogenous cannabinoid system controls extinction of aversive memories. Nature Aug 1;418(6897):530-534, 2002

S-240.

INTRATHECAL ANALGESIA VIA IMPLANTED PUMP IS EFFECTIVE IN THE TREATMENT OF REFRACTORY CANCER PAIN

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Introduction:
Various guidelines provide useful algorithms and recommendations for cancer pain refractory to medical management. (1-4) Neuraxial analgesia is one of the choices available and has been gaining popularity. (5) Past studies have shown the benefits of neuroaxial analgesia in lower pain scores, decreased medicine need and improved quality of life. (6,7) We report here the results of a much larger scale and longer follow-up study of neuraxial analgesia in a major cancer hospital pain clinic over a 5-year period.
Methods:
This study is a retrospective chart review of all cancer pain clinic patients at the University of Texas M.D. Anderson Cancer Center having neuraxial analgesia treatment between October 2000 and April 2005. After IRB approval of the protocol, charts for all patients who recently underwent epidural or intrathecal opioid infusion were reviewed. Data of pain scores (0-10), total oral morphine equivalent dosage, opioid side effects of drowsiness and mental cloudiness scores (0-10) at the base (prior to neuraxial analgesia) 3 months, 6 months, and 18 months were collected.
Results:
160 patients received neuraxial analgesia over the 5-year period. Out of the 160 patients; 138 patients survived at least 3 months since the placement of epidural or intrathecal infusion device. The survival number dropped dramatically to 19, 9, and 4 at 6 months, 12 months, and 18 months respectively. The data from a 3-month follow-up revealed improved pain control. The numerical pain scores decreased significantly from 7.09 +/- 1.84 to 3.73 +/- 2.37. Oral opioid intake also decreased significantly from 577.13 mg/day oral morphine equivalents to 206.56 mg/day. The drowsiness and mental clouding scores (0-10) also improved significantly from 5.39+/- 3.09 to 2.98 +/- 2.74 and 4.56 +/- 3.22 to 2.49 +/- 2.65, respectively. The pain scores, total opioid usage and opioid related side effects recorded at 6 months, 12 months, and 18 months all showed similar statistically significant improvement as of a 3-month follow-up but the patient numbers are too small (19, 9 and 4) to present.
Discussion:
1. Neuraxial analgesia is an effective treatment for cancer pain patients who failed medical management.
2. Of the 5% of cancer patients who may have pain refractory to medical management, (5) only approximately 2% (160/8000) in our clinic received neuraxial analgesia. Our approach may be too conservative.
3. The benefits of neuraxial analgesia are persistent from the initiation to those few long-term survivors. Most of our patients were deceased between 3 and 6 months.
References:
1. Anesth Analg 1988;67: 1159-61.
2. J Pain Symptom Manage 1993;8:335-9.
3. AHCPR Publication, Clinical Practice Guideline.1994;94: 0592.
4. Oncology (Hunting) 2000; 14:135-50.
5. Pain 2001;93:247-57.
6. JClin Oncol 2002;20:4040-9.
7. Pain Medicine 2004;5:239-47.

S-241.

METHADONE SURVEY: VARIATIONS IN METHADONE PRESCRIBING PRACTICES AMONG PAIN PHYSICIANS

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Introduction: The synthetic opioid methadone is a promising analgesia for the management of chronic neuropathic pain.[1] Methadone therapy is increasing as its advantages are being realized over other opioids.[2] Methadone's lack of known active metabolites, high bioavailability, low cost, and its additional receptor activity as an antagonist of N-methyl-D-aspartate receptors make it an attractive analgesic.[3] We surveyed 550 pain physicians to determine their use of methadone.
Methods: The study was approved by Institutional Review Board. A list of 550 pain physicians which included practitioners in private practice, university setting, and community hospital were obtained and surveys were sent via mail. Out of 550 surveys sent, 124 surveys were received with replies.
Results: Of the124 physicians, 111 use methadone in their pain practice. Of the13 physicians who do not use methadone, the main reason for not using the drug for 5 physicians was because of the social stigma, 2 because of minimal experience with the drug, 2 because the drug was not effective, 1 because of lack of knowledge, and 1 because of potential side effects. Of 111 physicians who use methadone, 100 used it for neuropathic pain, 101 for somatic pain, 80 for visceral pain, 78 for cancer pain, and 34 for sickle cell pain. Of 111 physicians who use methadone, 65 physicians stated <20% of their patients were on methadone for pain, 34 stated 20%-40%, 7 stated 40%-60%, 2 stated 60%-80%, 1 stated 80%-100%, and 2 no response. Of 111 who use methadone, 21 stated that methadone was their primary opioid of choice, 88 stated that it was not, and 2 no response. The typical methadone dosing regimen varied widely: 63 typically prescribed on TID schedule, 34 on BID schedule, 28 on QID schedule, and 8 on QD schedule. 30 clinicians gave multiple dosing schedules as typical. There were also differences in the starting regimen. Of 111 physicians who use methadone, 86 start methadone at low dose and titrate up for analgesia while minimizing side effects. 14 clinicians load methadone and titrate down to minimize side effects while maintaining analgesia.
Discussion: The majority of survey responders (90%) did use methadone in their pain practice, but on a very limited basis as 59% state that <20% of their patients are on methadone. TID dosing schedule was the most typical regimen (57%) and 77% prefer to titrate up on the dosage. It seems interesting that not more clinicians use methadone as a primary analgesic. One reason for this is due to social stigma of its use in treatment of heroine addicts and a lack of widely recognized treatment algorithms or guidelines to assist clinicians with opioid conversions and maintenance.
References: [1]Palliative Medicine 2003;7:576-587, [2]Clinical Journal of Pain 2005;21:364-369, [3]Pain Medicine 2002;3:339-348.

S-242.

LOW DOSE BUPRENORPHINE ENHANCE THE SPASTIC PARAPARESI INDUCED BY INTRATHECAL MORPHINE AFTER NONINJURIOUS INTERVAL OF SPINAL ISCHEMIA IN RATS

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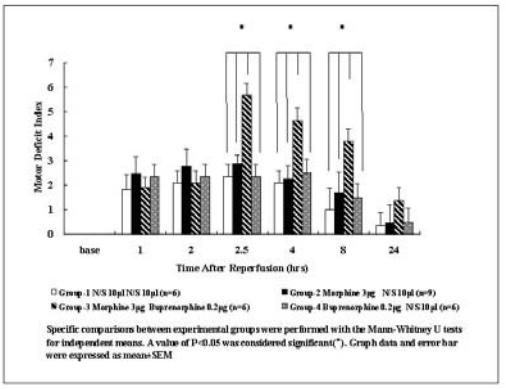
Introduction: We have recently reported that intrathecal (IT) injection of morphine (Mor) after non-injurious interval of spinal ischemia induced transient spastic paraparesis in rats(1). This effect was reversed by subsequent IT naloxone administration, suggesting that spinal opioid receptor play an active role in the spinal functional dysinhibition initiated by transient spinal ischemia. It was reported that Bup play some role in the analgesic actions of mu-opioid agonists in the spinal cord same as morphine(2). (3)However,we reported IT buprenorphine (Bup) 4micg did not induce spastic paraparesis after non-injurious interval of spinal ischemia (4). Therefore, we hypothesized that low dose IT Bup and Mor has interactive effect for the spastic paraparesis. The aim of this study was to characterize the interaction between low dose IT Bup and Mor after non-injurious interval of spinal ischemia in rats.
Methods: In using rats implanted with IT catheter, the placement and subsequent inflation of a 2F Fogarty catheter in descending thoracic aorta induced 6 min of ischemia under halothane anesthesia. After ischemia rats were randomly divided into four groups and received intrathecal injections at 30min and 2hrs after reperfusion as follows: Group-1 saline 10micl and saline 10micl, Group-2 Mor 3micg and saline 10micl., Group-3 Mor 3micg and Bup 0.2micg, Group-4 Bup 0.2micg and saline 10micl. After injections rats were allowed to recover, and the motor function was periodically assesed using motor deficit index (MDI: 6=complete paraplegia, 0=complete normal) for 24hrs.
Results: Neither IT 0.2micg Bup (Group-4) nor IT 3micg Mor (Group-2) could induce any spasticity same as IT saline (Group-1). On the other hand, the combination with IT 0.2micg Bup and 0.3micg Mor progressed a spasticity, resuting in complete paraparesis(Figure).
Conclusion: Our results demonstrated that low dose IT Bup enhance the spastic paraparesis induced by morphine after non-injurious interval of spinal ischemia in the rat. We suggest that the small dose morphine can induce spastic paraparesis in combined with buprenorphine
References: (1) Anesthesiology. 87(3A): A647, 1997. (2) Life Sci. 56(15):285, 1995. (3) (4) Anesthesiology. A839,1999.



S-243.

THE EFFECTS OF PAIN STIMULATION ON BISPECTRAL INDEX (BIS), HEART RATE AND BLOOD PRESSURE AT DIFFERENT MAC-VALUES OF SEVOFLURANE

AUTHORS: **M. Sandin**, S. Thorn, K. Axelsson, M. Wattwil;
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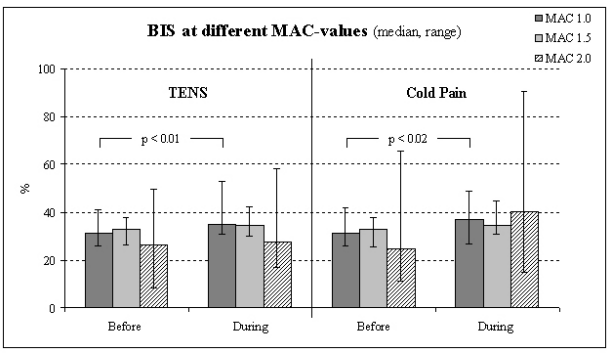
INTRODUCTION: The effects of pain stimulation on bispectral index (BIS), heart rate (HR) and blood pressure (BP) were studied in volunteers at 1.0, 1.5 and 2.0 MAC of sevoflurane.
METHODS: In ten healthy volunteers (6 men, 4 women, age 20-26 y) anesthesia was induced and maintained with sevoflurane. No other drugs were given. The volunteers were spontaneously breathing via a laryngeal mask but ventilation was supported if necessary to keep end-tidal CO_2 between 5.0 and 6.0%. Pain stimulation with transcutaneous electrical nerve stimulation (TENS) (5s, 60 mA, 50 Hz, 0.25 ms square-wave electrical impulse) and cold pain (CP) (one hand in ice cold water for 30 sec) were administrated after 15 min of stable anesthesia at 1.0, 1.5 and 2.0 MAC of sevoflurane. Stimulation started with TENS followed 10 min later with CP. BIS was recorded continuously. HR and BP were recorded every minute during 5 min before and during 5 min after the pain stimulation.
RESULTS: Systolic blood pressure (SBP) and HR increased significantly ($p < 0.01$) during pain stimulation at 1.0 MAC of sevoflurane. There was a significant increase of BIS during pain stimulation at 1.0 MAC but no changes at 1.5 MAC (fig.). BIS did not exceed 53 in any volunteer at 1.0 and 1.5 MAC. A powerful variation of BIS was seen at 2.0 MAC with periods of burst suppression (BS) in all volunteers and periods of high BIS-values despite clinical signs of deep anesthesia. This occurred both before and during pain stimulation. One volunteer (# 8) had a short episode of convulsions at 2.0 MAC and therefore 2.0 MAC of sevoflurane was not administrated to the last two volunteers.
DISCUSSION: A significant increase of BIS, HR and SBP was seen during pain stimulation at 1.0 MAC of sevoflurane. A paradoxical increase of BIS and periods of BS were seen at 2.0 MAC of sevoflurane. This may be due to an epileptogenic activity of sevoflurane and one volunteer even developed a short episode of convulsions during 2.0 MAC.



Pediatric Anesthesia

S-244.

LASER-ASSISTED PENETRATION OF TOPICAL ANESTHESIA IN CHILDREN: A PRELIMINARY REPORT

AUTHORS: I. T. Cohen, **D. Berkowitz**;
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Introduction: The pain associated with needles is one of the most unpleasant experiences of childhood. Unfortunately, topical anesthetics cannot penetrate the waxy water-resistant stratum corneum layer. A new low-power laser system can remove a small area of the stratum corneum and allow rapid penetration of local anesthetics. (1) Because children respond and perceive pain differently than adults, the usefulness and application of this new device needs to be studied in the pediatric population.
Methods: After IRB approval and parental consent 29 children, 3 to 17 years old who required phlebotomy were enrolled in this randomized, double blinded clinical trial. All subjects had the laser device pressed against their skin, lidocaine cream 4% applied, and, after five minutes, underwent phlebotomy. For patients randomized to the control group, the laser was not engaged. Using age appropriate pain assessment scales, the children were asked to report on the intensity of the pain they experienced with the laser and with phlebotomy. Patient satisfaction was obtained by survey. Statistics: Sample size was determined using a 2-tailed Student t-test at an alpha of 0.05 to achieve statistical power of 90% to detect a 4-point difference in the pain scores. Student t-test and Fisher's Exact test were used to compare data, parameteric and non-parametric, respectively.
Result: See Table

Subject Demographics and Evaluation of Pain

	n	Age (years) Mean ± SD	M:F	Pain > 6 with Laser	Pain > 6 with Phlebotomy	Less Pain Compared to Previous Times
Laser - Assisted	15	10.1 ± 4.5	6:9	0	0	3/10
Control	14	10.3 ± 3.8	7:7	1	4	9/12
p values		NS	NS	NS	0.04	0.01

Discussion: In this preliminary study, laser-assisted penetration of local anesthesia in children undergoing phlebotomy was effective and well accepted.
References: 1. Arch Dermatol. 2003;139: 1288-1290.

S-245.

DORMANT BODY ACTIVE BRAIN: PROPOFOL FOR INFANTS UNDERGOING FMRI STUDIES IN 3T MAGNET

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Introduction:
The goal of selecting an anesthetic agent for functional magnetic resonance imaging (fMRI) in children is two-fold; ensuring immobility and causing the least effects on cerebral metabolism specifically changes in cerebral blood flow and tissue oxygen extraction. The reason is that fMRI uses blood-oxygen-level-dependent (BOLD) signals to study brain function (1). Propofol is commonly used in children for routine clinical MRI scans but in adults it has been associated with impairment of central processing of auditory information during fMRI(2,3). We report the successful use of propofol in children undergoing fMRI studies in a 3T magnet.
Methods:
Anesthesia was requested for three infants scheduled for fMRI studies in the 3T magnet. The mean age and weight were 9.6 ± 1.1 months and 7.3 ± 1.5 kg, respectively. Anesthesia was induced with sevoflurane outside the magnet room. After placing an IV, a bolus of propofol was administered in order to transport from the induction room to the 3T MRI suite. Once in the magnet room, additional doses of propofol were given as the MRI-compatible monitor was placed and oxygen was administered via nasal canula. The infusion pump was placed outside the magnet room and an infusion of propofol was started at 200 µg/kg/min. In one patient, an LMA was inserted since an additional spine MRI scan was scheduled and the patient needed to be placed in the prone position.
Results:
The mean bolus and infusion doses of propofol required to complete the scan were 5 ± 1 mg/kg and 182 ± 28 µg/kg/min, respectively. All three children were successfully scanned though intermittent boluses were required at times during the scan due to movement. The mean time of scan duration was 116 ± 25 minutes. None of patients had any respiratory complications and the quality of the fMRI studies was acceptable.
Discussion:
General anesthesia is often requested for fMRI when sedatives fail due to the inability of infants to remain immobile. In our patients, propofol provided the necessary immobility for completion of the scan and did not negatively impact the acquisition of the images. The proper selection of agent is crucial since sedatives such as pentobarbital and chloral hydrate demonstrate brain activation using visual and auditory stimuli (4). Although propofol provided the necessary environment for fMRI studies for infants in a 3T magnet further studies are needed to understand the effects of different anesthetic agents on cortical activity.
References:1. Anesthesiology 2005;103:11-19 2.Anesthesiology 2004;100:617-25 3. Acta Anaesthesiol Scand 2005;49:784-91 4. Radiology 2001;221:56-63

S-246.

COMPARISON OF THE EFFECT ON DISPERSION OF REPOLARIZATION OF AGE-ADJUSTED MAC VALUES OF SEVOFLURANE IN CHILDREN

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Introduction: QT interval prolongation is associated with torsades des pointes (TdP), but is a poor predictor of drug torsadogenicity. Susceptibility to TdP arises from increased transmural dispersion of repolarisation (TDR) across the myocardial wall, rather than QT interval prolongation per se [1]. TDR can be measured on the ECG as the interval between the peak and end of the T wave (Tp-e) [2]. Thus Tp-e is an easily measured assay of drug torsadogenicity. Any overt or covert predisposition to TdP may be unmasked by perioperative stress. Anaesthetic agents that do not increase TDR would therefore be useful in minimising any increased perioperative risk of TdP. An earlier study demonstrated no effect of 3% sevoflurane on TDR [3]. We have investigated the effect of three age-adjusted MAC concentrations of sevoflurane on QT and Tp-e intervals in children.
Methods: 54 ASA I-II children, aged 3-10 years, were randomized to receive sevoflurane 1, 1.25 or 1.5 MAC, age-adjusted [4], for 15 minutes prior to elective surgery. All groups breathed 40% oxygen in air via face mask or laryngeal mask. Twelve-lead ECGs were recorded on each patient pre-induction and 15 minutes post-induction. RR, QT and Tp-e intervals were measured in leads II and V5 by an investigator blinded to group allocation and to pre-induction/post-induction status of the recordings. Corrected QT interval (QTc) was calculated as $QT/\sqrt{RR}$. Paired t-tests were used to compare QTc and Tp-e before and after anaesthesia in each group; one-way ANOVA was used for between-group comparisons of QTc and Tp-e.
Results: ECG data was not available for one child in group 1.25 MAC. QTc was significantly prolonged in all 3 groups; Tp-e was not (see table). There were no post-induction differences in QTc or Tp-e between the groups.

	Pre	Post	p value
1 MAC (n = 18)			
QTc lead II	421 (17)	455 (19)	0.0001
QTc lead V5	416 (16)	456 (19)	<0.0001
Tp-e lead II	76.8 (12.1)	71.3 (15.7)	0.30
Tp-e lead V5	77.1 (13.2)	73.6 (17.3)	0.36
1.25 MAC (n = 17)			
QTc lead II	405 (16)	460 (18)	<0.0001
QTc lead V5	414 (17)	453 (15)	<0.0001
Tp-e lead II	73.4 (9.4)	71.5 (18.1)	0.70
Tp-e lead V5	79.9 (10.6)	78.7 (20.7)	0.86
1.5 MAC (n = 18)			
QTc lead II	424 (15)	452 (27)	0.0007
QTc lead V5	429 (22)	460 (27)	0.0019
Tp-e lead II	76.9 (10.2)	68.3 (9.4)	0.0036
Tp-e lead V5	78.0 (10.1)	72.3 (11.0)	0.12

QTc = corrected QT interval (msec).
Tp-e = Tpeak-end interval (msec).
Pre = pre-induction ECG. Values are mean (SD)
Post = post-induction ECG. Values are mean (SD)
p = p value for paired t test

Discussion:
Sevoflurane prolongs the QTc in healthy children, but does not increase dispersion of repolarization, indicating low or no torsadogenicity, and making it unlikely to increase predisposition to TdP.

References:
[1] J. Cardiovasc. Electrophysiol 1999; 10; 154-64
[2] Circulation 1998; 98:1928-36
[3] Anesth. Analg. 2005; 100: 71-7
[4] Br. J. Anaesth 2003; 91: 170-4

S-247.

MEMORY OF EMERGENCE AND RECOVERY IN SCHOOL AGE CHILDREN

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Introduction: The return of higher cognitive functions, such as awareness, orientation, and memory formation(1,2), during recovery from anesthesia is difficult to assess in pediatric patients. This investigation examined school age children recovering from general anesthesia for adenotonsillectomy.
Methods: After IRB approval and parental consent, 60 ASA I - II, non-premedication, non-delayed, 5 to 11-year-old patients, scheduled for adenotonsillectomy, were studied. Using induction rooms, general anesthesia was induced with sevoflurane. Maintenance of anesthesia was achieved with desflurane 3-5%, fentanyl 2.5 mcg/kg IV, and dexamethasone 0.5 mg/kg IV. When observed to have regular respiration and purposeful movement or grimacing, patients were extubated. A researcher observed for emergence agitation, pain, and recovery times. Before patient discharge, a structured interview regarding emergence and recovery was conducted. The study data were summarized by univariate summary statistics, such as means, standard deviations, and percentages.
Results: Reported as averages: age was 7.1 (±1.6) years, weight was 31.3 (± 10.5) kilograms, duration of anesthesia was 39 (±11.9) minutes, time to Steward score of 6 was 26.5 (±14.1) minutes, and time to orientation x 3 was 32 (±16.7) minutes. Male to female ratio was 27:33. Emergence agitation > 3 occurred in 8 patients and pain > 6 in 22. In addition, 15 patients received fentanyl when self-reported pain was > 6. A total of 45 patients (75%) received fentanyl in the PACU.
Postoperative interview findings are summarized in Table 1. Three patients had no memory of the immediate postoperative period. Patients who recalled awakening in the operating room were able to describe the overhead surgical lights, suctioning, and being moved to a stretcher. Post hoc analysis found no relationship between early memory and patient age, agitation, pain, fear, or speed of recovery.
Discussion: Explicit memory appears to be present in children soon after emergence from general anesthesia, even though the ability to follow commands or respond to questioning was not apparent. (3) Approximately half the children reported fear and confusion and about a third described experiencing nausea or dizziness. These finding suggest greater efforts may be needed to address postanesthesia experiences in this patient population.
References: 1. J Clin Monit; 11:35-40,1995. 2. Anesth Analg; 90:168-74, 2000. 3. J Clin Exp Neuropsychol; 24:713-9, 2002.

Memory of Recovery in School Age Children						
	Recall OR	Pain > 6	Nausea	Dizzy	Scared	Confused
n	20	39	19	22	30	29
%	33.9%	66.1%	32.2%	37.3%	50.8%	49.2%

S-248.

A PILOT STUDY: VIDEOPHONES IN A PEDIATRIC DAYCARE SETTING

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INTRODUCTION: Information and communication technology (ICT) will play an inevitable role in health care delivery of the future[i]. We hypothesized that communication between staff and parents by means of a videophone in the postoperative day care setting would be received favorably.
METHODS: After ethics committee approval two Tandberg 1000© videophones, one placed in our recovery room and the other placed in a private parent waiting room, were used to communicate postoperatively between attending staff (surgeon and/or recovery room nurse) and parents. Twenty-five children undergoing short duration minor day care surgery were randomly enrolled. After surgery the attending staff involved with the patient's care spoke with the parents over the videophone. Those involved were asked to anonymously respond after the encounter to a seven-item questionnaire evaluating the technical aspects of the equipment, surroundings, confidentiality and overall satisfaction. Responses were rated from 1 (agree strongly) to 5 (disagree strongly). Written comments were allowed. All data are described as proportions or medians (range). Groups were compared with Mann-Whitney U test.
RESULTS: A 98% response rate was achieved. Other than audio clarity, the public had a more favorable impression of the technology compared to staff (Table 1). This reached statistical significance in the areas of facility comfort, confidentiality and satisfaction. Concerns about the impersonal nature of the technology were raised by both groups but to a greater extent with staff. Eighty-seven percent of parents and 83% of staff were neutral to strongly in favor of promoting this technology.

Table 1

Question	Parent* N= 25	Staff* (N=30)	P value
Audio clarity	2 (1-5)	2 (1-5)	0.104
Video clarity	1 (1-4)	2 (1-3)	0.081
Facility comfort	1 (1-5)	3 (1-5)	0.000
Confidentiality	1 (1-4)	2 (1-5)	0.007
Ease of use	1 (1-4)	2 (1-5)	0.395
Recommend use	1 (1-5)	2 (1-5)	0.100
Satisfaction	1 (1-5)	2 (1-5)	0.026

* Median (range)

DISCUSSION: Our pilot study conveys an acceptance of videophone technology in the hospital setting by staff and more so by parents. In hospital communication between physicians and patients using this type of technology has been found to be acceptable in the adult literature [ii]. There are concerns about the impersonal aspect of it and audiovisual quality. Advantages may include improved confidentiality and efficient allocation of health care staff. Further evaluation is required in the pediatric perioperative care setting.
REFERENCE:
[i] Social Science & Medicine 52:1889-1901
[ii] J Am Coll Surg 2004; 199: 523-530.

S-249.

ANTERIOR AND POSTERIOR CEREBRAL BLOOD FLOW VELOCITY AND AUTOREGULATION IN PRE-PUBERTAL BOYS AND GIRLS

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Objective: To describe differences between anterior and posterior cerebral blood flow velocity and autoregulation in young healthy boys and girls.
Design: Prospective observational cohort study
Setting: Harborview Medical Center.
Study participants: Healthy children who were 4-8 years old and had no history of seizure, syncope, dysautonomia, and or neurological/ cardiac disorder.
Materials and Methods: After IRB approval, consent and assent, study participants underwent measurement of middle cerebral and basilar artery flow velocities (Vmca and Vbas) and static cerebral autoregulation testing of the middle cerebral artery (MCA) and basilar artery (BAS) using the tilt test methodology. Cerebral autoregulation was quantified using the autoregulatory index (ARI) for the MCA (ARImca) and BAS (ARIbas). An ARI < 0.4 indicates impaired cerebral autoregulation. All data are presented as mean $\pm$ SD. Significance was set at $p < 0.05$.
Results: 34 children (16 M: 18 F) 4-8 years (6 $\pm$ 2) were enrolled. There was no difference in baseline mean arterial pressure (MAPe) or drop in MAPe during autoregulation testing between boys and girls. Vmca was greater than Vbas in boys (Vmca 93 $\pm$ 13 vs. Vbas 60 $\pm$7; p = 0.001) and girls (Vmca 96 $\pm$13 vs. Vbas 70 $\pm$10; p = < 0.001). Girls had higher Vmca (96 $\pm$ 13 vs. 93 $\pm$ 12: p = 0.001) and Vbas (70 $\pm$10 vs. 60 $\pm$7; p = 0.02) than boys. ARImca and ARIbas were $\geq$ 0.4 in all children. Overall, there was no difference between ARImca and ARIbas (0.95 $\pm$ 0.18 vs. 0.95 $\pm$ 0.23; p = 0.9). There was no difference in ARImca (0.97 $\pm$ 0.07 vs. 0.94 $\pm$ 0.11; p= 0.39) nor in ARIbas (boys 0.97 $\pm$ 0.09 vs. girls 0.94 $\pm$ 0.25; p = 0.63) between boys and girls.
Discussion: Our preliminary findings indicate that similar to older children (1) and adults (2), pre-pubertal girls between 4-8 years have higher Vmca and Vbas than boys. This difference may reflect inherent genetic differences in cerebral blood flow velocity between the sexes. On the other hand, the lack of gender differences in ARI of the anterior or posterior circulations during early childhood in the presence of such differences in pubertal children (1) suggests a hormonal role in the control of cerebral autoregulation.
References: Vavilala MS, Kincaid MS, Muangman SL, Suz P, Rozet I, Lam AM. Gender differences in Cerebral Blood Flow Velocity and Autoregulation Between the Anterior and Posterior Circulations in Healthy Children. Pediatr Res 2005;58(3):1-6.

S-250.

USE OF HIGH-FREQUENCY JET VENTILATION IN THE MANAGEMENT OF CONGENITAL TRACHEAL STENOSIS

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Introduction: Airway management during surgical procedures on the trachea is a challenge to anesthesiologists since it is difficult to maintain adequate gas exchange with an open trachea and provide good operative conditions. We report our experience, in which high-frequency jet ventilation (HFJV) was used through two catheters to maintain adequate gas exchange during tracheoplasty in a patient with tracheal stenosis.
Case pesentation: A 2-year-old boy (81.7cm/11.1Kg) suffering from congenital tracheal stenosis presented for tracheoplasty. Preoperative CT scan revealed the tracheal stenosis from just below the larynx to 1 cm above the carina. Anesthesia was administered with propofol and fentanyl. After posterolateral thoracotomy, the trachea was incised just above the carina. First, through this incision, each main bronchus was cannulated with an 8-Fr insufflation catheter for HFJV and ventilation was switched from conventional mechanical ventilation (CMV) to HFJV. Next, the trachea was longitudinally incised and an endotracheal tube (ET) was replaced by a larger-sized ET as a stent. Then, two other 8-Fr catheters were passed through the ET and inserted into both main bronchi and the catheters previously positioned through the tracheal incision were removed. A good surgical field was obtained since HFJV was administered with the catheters through the ET during the tracheoplasty. Airway pressure monitored by an electric pressure transducer did not rise above 20 hPa. At the end of the tracheoplasty, the catheters were pulled out of the ET and CMV was re-established. Surgery was completed without any complications such as subcutaneous emphysema or pneumomediastinium.
Discussion: Our experience suggests that tracheoplasty just above the carina can be carried out safely under HFJV with two thin catheters inserted into each bronchus. HFJV during anesthesia for tracheal surgery has several advantages over cardiopulmonary bypass (CPB). Use of HFJV provides adequate ventilation and oxygenation with unobstructed vision and full access to the trachea, since the surgical field is free of catheters. Adequacy of gas exchange was confirmed by the combination of pulse oximetry, inspection to ensure suitable lung inflation, and frequent arterial blood gas analysis. As mentioned above, our method of HFJV during tracheoplasty provides adequate gas exchange without complications and without hindering surgeons' sight. On the other hand, CPB, which requires anticoagulation, carries the risk of serious perioperative hemorrhage. In addition, CPB requires aoritc and vena caval cannulas which often hinder surgeons' sight, especially in infants, in whom the surgical field is very narrow.
Conclusion: HFJV through two thin catheters positioned in each bronchus proviede effective respiratory support during surgical repair of tracheal stenosis just above the carina. We believe that our method yields adequate gas exchange and a good surgical field.

S-251.

ARE OPIOIDS INDICATED IN PEDIATRIC STRABISMUS SURGERY?

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AFFILIATION: [1]Children's Hospital of Eastern Ontario, Ottawa, ON, Canada, [2]The Ottawa Hospital, Ottawa, ON, Canada, [3]Chalmer's Research Group, CHEO Research Institute, Ottawa, ON, Canada.

INTRODUCTION: The use of intraoperative opioids during strabismus surgery has been associated with increased morbidity. We hypothesized that the administration of opioids during strabismus surgery would produce a smoother postoperative recovery with minimal side effects.
METHODS: With ethics committee approval, 259 consecutive patient's charts were reviewed who underwent elective strabismus surgery under general anesthesia during a 12-month period starting April 2002. The data recorded included patient demographics, method of anesthesia, use of intraoperative opioids, perioperative complications, need for postoperative rescue analgesia and antiemetics and time of discharge. All data are described as proportions or mean +/- SD. Chi-square and unpaired student t-tests were applied where appropriate.
RESULTS: All 259 children were assessed. The groups had similar demographic data. Forty-eight children received fentanyl, 24 received morphine and one received remifentanil intraoperatively. The proportion of patients requiring at least one postoperative intervention (e.g. administer medications or manage laryngospasm) was somewhat less in those receiving intraoperative narcotics (71%) than those without (82%) although this trend did not reach statistical significance (P=0.063). There was no difference in the incidence of complications or duration of postoperative stay (see Table1).

Table 1

Characteristic	Intraoperative Narcotic	No Intraoperative Narcotic	P value
N (%)	73 (28)	186(72)	
Intra/postoperative Complications	7 (2.8)	16 (6.3)	0.826
Postoperative intervention	52 (71)	152 (82)	0.063
Duration of Postoperative Stay (min)	132 ± 31	129 ± 75	0.755

DISCUSSION: The administration of intraoperative opioids for children undergoing strabismus surgery did not negatively impact on their in-hospital stay. The routine administration of potent antiemetic combinations such as ondansetron plus decadron in our institution are likely responsible for limiting opioid induced nausea and vomiting. The addition of opioids in this population may aid in the differentiation between postoperative pain versus emergence agitation. A prospective randomized controlled double-blind trial is required to accurately document reduced rescue analgesia/ antiemetic requirements and emergence agitation in the 24 hours following surgery before considering the widespread use of opioids in this population.

S-252.

COMPARATIVE EFFICACY OF CAUDAL KETAMINE WITH OR WITHOUT BUPIVACAINE IN PEDIATRIC SUB-UMBILICAL SURGERY

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INTRODUCTION: Caudal bupivacaine provides effective analgesia for inguinal and penoscrotal surgery.[1] Previous work shows that caudal administration of ketamine in children significantly prolongs the duration of post -operative analgesia.[2] Although caudal analgesia is widely used in developed countries, it is still under -utilized in developing countries. This study compares the analgesic efficacy and side effect profile of caudal ketamine with or without bupivacaine at the Korle Bu Teaching Hospital, Accra, Ghana.
METHODS: Following ethics committee approval and parental/ guardian informed consent, 62 unpremedicated ASA I-II, children aged 2-8 years undergoing elective urologic or lower abdominal surgery were randomized into three groups. After induction of general anesthesia, patients received caudal block under aseptic condition using a 23G hypodermic needle. Group I (n=20) received a caudal injection of plain 0.125% bupivacaine 1mlkg^{-1}. Group II (n=22) received caudal ketamine 0.5mgkg^{-1}, diluted with Normal saline using the same weight -related volumes. Group III (n=20) patients received a similar dose of local anesthetic mixed with ketamine 0.5mgkg^{-1}. All patients were monitored for SpO2, HR, and BP. The duration of surgery, need for supplemental per-operative opiates, haemodynamic and respiratory parameters were noted. Postoperatively, a blinded post anesthesia care unit (PACU) nurse assessed the quality of analgesia using a modified pain score. Degree of sedation, side effects such as nausea and vomiting, muscle weakness, urinary retention and shivering were also noted. Intravenous morphine was prescribed for all the patients and the decision to administer this was left to the nurses. Patients were given supplementary analgesia if their observational pain score was greater than 4 (OPS 0-10). Parametric data were analyzed using Student's t test. P≤0.05 was considered significant.
RESULTS: No additional analgesic was required in any of the study groups intraoperatively. There was no significant difference in the objective pain score while the patients were in the PACU. The number of patients requiring no supplemental analgesia as time elapsed is shown in Fig. 1.The median time to first analgesia was significantly longer in group III (median 15.5h) than in group I (median 8.5h) ($p < 0.05$). There was no significant difference in the time to first analgesia between patients in group II and the other two groups.
CONCLUSION: The addition of 0.5mgkg-1 of ketamine to caudal 0.125% plain bupivacaine significantly decreased the need for rescue analgesics in the first 24hr post operative period in pediatric patients undergoing elective inguinal and lower abdominal operations. Caudal administration of ketamine alone provided analgesia of similar quality and slightly longer duration than 0.125% bupivacaine but this was not statistically significant. The frequency of complications was not significantly different in the three groups.
Reference: Marhofer P et al : S(+) -ketamine for caudal blocks in pediatric hernia repair: Br J Anaes, 1999;82:153

S-253.

NEUROCOGNITIVE FUNCTION IS NOT IMPAIRED IN ADULT MICE EXPOSED TO NEONATAL ANESTHESIA

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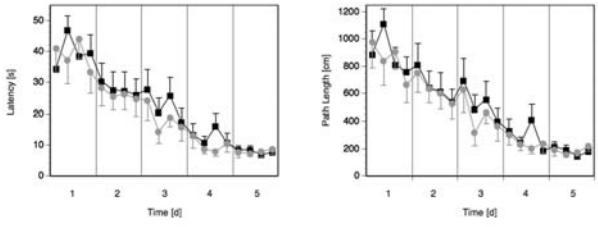
Introduction: In rats, a six-hour isoflurane anesthetic on postnatal day (P) 7 has recently been implicated in causing widespread neuronal cell death in neonates as well as learning deficits in adult animals. (1) Based on this data the authors hypothesized that anesthetics pose a significant risk of damaging the developing human brain. (2) However, these data have yet to be confirmed in other neonatal mammalian species. Accordingly, the present study examined the effects of a six-hour exposure to isoflurane in neonatal mice on their spatial learning and memory function in adulthood.
Methods: The offspring of CD1 (male)/ C57BL6 (female)-breeding pairs was anesthetized on P7 and raised by the dam until adulthood for neurofunctional testing. P7 neonatal mice were randomly assigned to receive anesthesia (isoflurane 1.5% in 30% oxygen) or room air for 6 hours with spontaneous ventilation in warmed incubators and then returned to their dam. On P28 they were separated from the dam and raised until the week of P70, when they were tested in a Morris water maze by an observer unaware of group assignment. Mice were introduced into the tank at four different, predetermined locations and time until animals reached the submerged 10 cm-diameter platform (escape latency) and path length, both measures of neurocognitive and spatial memory function, were automatically recorded (Polytrack) during 4 daily trials for 5 days.
Results: Twenty-four animals have undergone water maze testing thus far. The figure demonstrates escape latency on the left and path length on the right (mean±SEM) for animals exposed to room air (black boxes, n=13) or to isoflurane (grey circles, n=11) as neonates. There were no significant differences in performance between the two groups at any time point (ANOVA, $P > 0.3$).
Discussion: The developing mammalian brain is considered to be exquisitely sensitive to pharmacologic interference during the brain growth spurt phase. However, contrary to previous results in a neonatal rat model, a six-hour isoflurane anesthetic in neonatal mice failed to impair neurocognitive and spatial memory function as measured by Morris water maze performance in the same animals in adulthood. These preliminary results suggest that neurologic dysfunction in adulthood after neonatal anesthesia may not be a universal phenomenon for all mammalian species.
References: 1. J Neurosc 2003;23:876, 2. Trends Pharmacol Sci 2004;25:135



S-254.

IN-VITRO POTASSIUM RELEASE ON EXPOSURE TO SUCCINYLCHOLINE IN CEREBRAL PALSY

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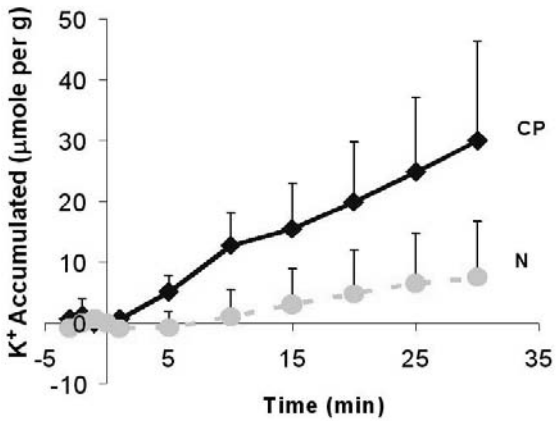
AFFILIATION: [1]A.I. duPont Hospital for Children, Wilmington, DE, [2]Nemours Biomedical Research, Wilmington, DE, [3]Thomas Jefferson University, Philadelphia, PA.

Introduction: Neurological and neuromuscular diseases can lead to abnormalities in the conformation and function of neuromuscular junctions (NMJs), especially in expression of acetylcholine receptors (AChRs). A previous study in children with cerebral palsy (CP) suggests abnormal spread of AChRs in CP[1]. Due to their action at NMJs, neuromuscular blocking agents (NMBAs) have altered potency and the ability to cause significant adverse reactions in patients with CP[2, 3]. Little is known about appropriate NMBA use or adverse events that might occur due to abnormal NMJ conformation in children with CP. Here we present one aspect of our ongoing studies examining NMJs in children with CP.
Methods: Seventeen children with spastic CP and 12 neurologically normal children were enrolled in the study after IRB approval and parental consent. Paraspinal muscles underwent biopsy (from motor innervations) during scheduled spinal fusion surgery. Biopsies were placed into Hanks Balanced Salt Solution. Measurements were made using ion-specific potassium electrodes (Orion) with a double junction reference electrode (Orion) and an Accumet model 50 ISE meter (Fisher). Potassium readings were taken to verify a stable baseline, and then succinylcholine was added (10 µg/gm of the muscle in medium). Changes in K^+ concentration were recorded over time. Results were analyzed using repeated measures analysis of variance.
Results: Children with CP tended to release more potassium than did those with idiopathic scoliosis. The results were not statistically significant ($p = 0.078$) due to the lack of power from the small sample size, but the findings suggest an increased sensitivity to succinylcholine in children with CP.



Discussion: Neurological diseases, such as stroke or Parkinson's, are known to cause up-regulation of AChRs. Such up-regulation, if profound, can cause hyperkalemia when exposed to succinylcholine. This in-vitro study is indicative of the possibility of hyperkalemia occurring in CP when exposed to succinylcholine. As some of these patients with CP are also subject to immobility, it is possible that the relative immobility in CP could contribute to the abnormalities seen at the neuromuscular junction.
References: 1) Anesthesiology 2002; 96: 330-5. 2) Anesthesiology 1972; 37: 332-7. 3) Anesthesiology 2001; 94: 523-9.

S-255.

POLYCYTHEMIA AFFECTS THE SUCCESS OF PERCUTANEOUS PERIPHERAL ARTERIAL CANNULATION IN INFANTS AND CHILDREN UNDERGOING CARDIOVASCULAR SURGERY

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Introduction: Arterial cannulation in children can be accomplished by percutaneous palpation of the pulse (PC), by using audio Doppler (AD) or surgical cut-down (CD) techniques. We correlated the ease (number of attempts, cannulation site change and time) and cannulation success with patient's age, weight, hematocrit and saturation and previous cut-down scar presence in children undergoing cardiovascular surgery.
Methods: We prospectively studied 81 children less than 10 years of age, ASA PS 2-4 who required peripheral arterial cannulation before undergoing cardiovascular surgery under general anesthesia. PC was performed by anesthesia fellows under the supervision of the attending cardiac anesthesiologist. The artery was punctured with a 24 or 22-G catheter followed by introduction of a guidewire over which a 2.5-G Cook catheter was inserted and sutured. Data collected included the age, weight, hematocrit, oxygen saturation, number of attempts to achieve cannulation success by different methods and incidence of site change.
Results: There were 41 infants and 40 children (mean age 5.2±3.6; 42.6±25.4 mo.; and mean weight 5.4±1.9; 14.8± 5.8 kg). PC was successful in 60 of the 81 patients (74.1%). Of the 21 patients with failed PC, 7 had successful cannulation by Doppler method and the remaining 14 children had surgical cut-down (66.7%). The incidences of previous cut-own in the successful and failed group were 11.7% and 33. 3% (* P<0.0001). The ulnar artery was cannulated successfully in 8 children by palpation and by using a Doppler in 4 patients. The success rate by PC in children less than 10-kg (n=49) compared to those weighing more than 10-kg (n=32) was 73.47% and 93.33% respectively (*P<0.038). Among cyanotic children (hematocrit >40 and saturation <95%) more infants (16/28) required more than 5 attempts to achieve successful cannulation compared to non-cyanotic children 57.14% vs 33.96% (*P< 0.059). The number of children achieving successful cannulation in less than 5 minutes was significantly higher in non-cyanotic children (hematocrit <40 and saturation >95%) compared to their cyanotic counterparts 56.6% vs 25.00%(*P< 0.021). The actual time in cyanotic patients for successful cannulation was 17.46±12.23; compared to 11.41±12.10 in the non-cyanotic patients (Kruskal-Wallis test P< 0.0006). The number of times the original site for arterial cannulation had to be changed in cyanotic patients to another site was also more than in non-cyanotic patients (67.86% vs 35.85% *P< 0.009).
Discussion: Percutaneous arterial cannulation (PC) in infants and smaller children is technically more difficult than in older children especially after previous cut-downs. Hyperviscosity of blood in polycythemic cyanotic patients results in sluggish flow and delayed flash back even when the catheter is intraluminal. This may explain the higher rate of failure in these patients. (*Fisher's Exact test)

S-256.

THE USE OF MR-COMPATIBLE INFUSION PUMPS ALLOWS BETTER PROPOFOL TITRATION, FASTER RECOVERY AND DISCHARGE TIMES IN PEDIATRIC MRI SEDATION

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Introduction: Sedation is usually required for pediatric Magnetic Resonance Imaging (MRI) in children to reduce motion artifacts. Propofol administered for MRI sedation has been delivered in our institution using two infusion techniques: a metered burette system where propofol is diluted in Lactated Ringer using the rule of six (1) or an infusion pump: Medrad Continuum MR-compatible Infusion System (Medrad Inc. Indianola, PA). Although the use of the rule of six has been discouraged for vasoactive drugs, propofol has a wider margin of safety and is frequently used this way in the MRI suite in the absence of MR-compatible pumps. However, the dose may not be completely accurate. This study aimed to review the use of these two methods of propofol infusion and to determine the difference, if any, between the total amount of drug delivered, and the impact on hemodynamics, sedation status and discharge time of the patients.
Methods: With IRB approval, the charts of 140 children aged 0 to 18 years, American Society of Anesthesiologists Physical Status I or II requiring sedation for elective outpatient MRI exam were reviewed. Continuous data were analyzed by the two-sample t test and /or Kruskal-Wallis test. Discrete data, such as nominal and/or ordinal data were analyzed by the Chi-square test and/or Fisher's exact test for contingency tables. The overall two infusion delivery methods comparisons were analyzed using proportions of complications by the Chi-square test and/or Fisher's exact test. For all tests of significance, an alpha=0.05 has been used as a significance level (2).
Results: A total of 70 patients in each group were studied. The (mean ±sd) total amount of propofol infused corrected to the time of infusion was significantly less in the infusion pump group (0.265±0.163 mg/kg/min) than the metered burette system (0.330±0.336 mg/kg/min, p=0.003). There were also significant mean differences in awakening times (0.566±0.348 vs. 0.772±0.437 min, p=0.006), fluid intake (0.774±0.405 vs. 1.028±0.511 ml, p=0.01), discharge times (1.136±0.449 vs. 1.414±0.559 min, p=0.008) and temperature changes (-0.015±0.015 vs. -0.022±0.019 ºC, p=0.037) in the infusion pump group versus the buretrol infusion group. Values are expressed as unit per minute of propofol infusion time.
Discussion: This study demonstrates that when similar NPO guidelines are applied, both infusion techniques preserve hemodynamic stability and are associated with minimal complications. The use of an infusion pump minimizes the amount of propofol judged adequate by the anesthesiologist to achieve sedation in MRI and lead more consistently to a faster emergence and early discharge after sedation in children undergoing MRI studies.
References:
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S-257.

ANESTHETIC MANAGEMENT OF CHILDREN AND ADOLESCENTS WITH VON HIPPEL-LINDAL DISEASE AND PHEOCHROMOCYTOMA

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Introduction: Von Hippel-Lindau (VHL) disease is a heritable multisystem cancer syndrome that results form a mutation in the VHL gene. Pheochromocytomas are catecholamine secreting tumors, usually arising from the chromaffin tissue of the adrenal medulla. Pheochromocytomas can occur sporadically or in association with VHL syndrome, multiple endocrine neoplasia type 2 (MEN2), the pheochromocytoma-paraganglioma syndrome, and neurofibromatosis type 1. In patients with pheochromocytoma, acute and chronic elevation of catecholamines levels can lead to uncontrolled hypertension, acute and chronic cardiomyopathies and renal dysfunction. However, little has been reported on the anesthetic management of children and adolescents with VHL and pheochromocytoma.
Methods: Records of patients treated for VHL and pheochromocytoma from 1991 to 2004 were retrospectively reviewed. Patients younger than18 years of age were identified. We reviewed all preoperative medication, anesthetic technique, intraoperative monitoring, and postoperative analgesia.
Results: We identified 10 patients who received 14 anesthetics for excision of pheochromocytoma excision during the 14-year study period. The median age was 13 and it ranged from 6 to 18 years. All patients were enrolled in studies of the natural history of VHL syndrome and the diagnosis of pheochromocytoma was made in screening laboratory and imaging studies. In preparation for surgery all patients were treated with phenoxybenzamine at a daily dose between 0.18-1.95 mg/kg/day. In 10 of the 14 surgeries, patients were also given metyrosine at a daily dose of 12-24 mg/kg/day preoperatively. Only one patient received a beta-blocker for heart rate control preoperatively. The criteria indicative of adequate α-blockade and readiness for surgery included presence of orthostatic hypotension, tiredness, nasal congestion, control of hypertension. Anesthesia was induced with intravenous agents in all but one patient. All patients had general anesthesia with isoflurane as the volatile anesthetic and 5 patients had placement of epidural catheters for both intra and postoperative use. Eight of the 13 pheochromocytomas surgeries were performed laparoscopically. During 5 of the anesthetics vasoactive agent(s) were administered intraoperatively to treat labile blood pressure. There were no intraoperative surgical or anesthetic complications, and no patient required blood transfusion. During the immediate postoperative period, pain was controlled via epidural analgesia in 5 patients, and intravenous in 8, intramuscular opioids in one patient.
Discussion: We describe a unique pediatric patient population with VHL in which the diagnosis of pheochromocytoma is made very early in the history of the disease. For the most part, the perioperative course of resection of pheochromocytomas in this patient population was very stable. The adequacy of preoperative volume expansion and blood pressure control with alpha-blockers is an essential component of safe anesthesia during the surgical excision. In addition, it is conceivable that in children, early diagnosis of the disease and aggressive preoperative α- and β- blockade contribute to a stable intraoperative course.

S-258.

MEASURING THE DISTANCE FROM THE SKIN TO THE EPIDURAL SPACE BY COMPUTED TOMOGRAPHY IS BENEFICIAL TO PREDICT THE EPIDURAL DEPTH IN CHILDREN

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Introduction: We investigated whether computed tomography (CT) was useful to predict the depth of the epidural space in children. Method: 20 surgical patients aged 2 to 13 who had preoperative CT examination and whose parents agreed to receive epidural anesthesia (EA) were studied. EA was performed at the interspace between the T8-L2 using midline approach. Actual distance from the skin to epidural space (AD) was measured by marking on the Tuohy needle. Distance from the skin to the epidural space in the midline (MD) and the distance from the skin to the supraspinous ligament in the midline (DSSL) were measured from CT. MD and DSSL and also height and weight and body mass index (BMI) were compared with AD. Result: There were significant correlation between AD with MD (r^2 = 0.782, p = 0.019), BW (r^2 = 0.858, p = 0.01) and BMI (r^2 = 0.554, p = 0.034). The relationship between AD and MD was described by the regression equation: AD = 1.008 x MD.
Discussion: We reported that CT is beneficial to predict the epidural depth in adults. There are several studies using the CT to predict the depth of epidural space [1] in adult patients. But we can't find those studies for children. There are several studies using ultrasound for prediction of epidural space in children[2]. In this study measuring the distance from the skin to the epidural space using CT is the good predictor of the epidural depth in the midline approach of thoracic and lumber EA in children.
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S-259.

ACTIVATION OF LONG INTERSPERSED NUCLEAR ELEMENTS (LINE) IN THE NEONATAL RAT FOLLOWING CHRONIC IN UTERO COCAINE EXPOSURE

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Introduction: Mammalian transposable elements consist of DNA transposons and retrotransposons. The long interspersed nucleotide element L1 or LINE elements are the most abundant retrotransposons in the human genome, and are responsible for genomic expansion, and have also been associated with diseases by altering gene expression (1). An L1 element consists of a 5 prime untranslated region (UTR), two open reading frames (ORF) that encode proteins, a 3 prime UTR, a poly A signal (AATAAA) and a poly A tail. Within the second ORF, there are the reverse transcriptase (RT) and endonuclease (EN) domains. Cocaine and other drugs of abuse have been shown to modify gene expressions and induce the expression of novel genes following chronic exposure. Whether mobile genetic elements contribute to these observed changes in gene expression has not been specifically investigated. The goal of our study is to examine the effect of chronic gestational cocaine treatment on the activation of long interspersed element (L1Rn) in the rat pups.
Methods: The study was approved by IACUC of Columbia University. Timed-pregnant (gestational day 0-1) female Sprague-Dawley rats were given saline (Control) or cocaine at 60 mg/kg (Cocaine) in equal volume daily by intragastric administration from gestational day 2 until postpartum day 14. Total RNA was isolated from hearts, whole brains, spinal cord, liver, spleen and kidneys in neonatal rats on postnatal days 1, 7 and 14 and used in experiments. We performed RT-PCR to quantitate PCR products that corresponded to partially (JG1) and entirely within ORF1 (JG2) and two other regions within ORF2 (JG3 and JG4), using beta-actin for normalization. Primer sets are as follows:

JG1: CTCCAGCATCATGATCAAT (S),
AACAAGACTACATGGCACCA (AS)
JG2: ATGGAAATAGAAGCAATCAA (S),
CTATGGTTTTGTTGAAGATATT (AS)
JG3: ATACAAGGGCACCTACATACG (S),
GACCAGGTTATCATTGAGTAGAG (AS)
JG4: TAGACCGCAGGAAACAAATAA (S),
CGGCAATGAACATAGTGGAGC (AS)

Results: JG 2 was significantly increased in cocaine-exposed neonatal rats in all organs examined at day1 and day 7, but not at day 14. JG1, JG3 and JG 4 were only examined in hearts and there were no significant differences between CTL and Cocaine at any age.
Conclusion: Our results indicate that in utero cocaine exposure significantly upregulated a segment of ORF1 in the neonatal rat in all organs examined. ORF1 encoded proteins are thought to perform nucleic acid chaperone activity and they have been identified in germ cells and vascular endothelial cells (2). Future studies will focus on the relationship between the observed effect of in utero cocaine exposure on JG2 and cocaine-induced changes in gene expression in the neonatal rat (3)
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S-260.

REEXAMINATION OF MECHANISTIC INTERACTION OF LOCAL ANESTHETICS WITH MEMBRANE LIPID BILAYERS

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Introduction: While the blockade of Na^+ channels is the mode of action of local anesthetics, there is a long-standing controversy on whether their primary acting sites are membrane proteins or lipids. Unlike the former, the latter has two major problems: whether the physicochemical property of membranes is changed by obligatorily charged drugs and whether such changes are differentiated between stereoisomeric drugs [1]. We reexamined the mechanistic interaction of local anesthetics with membrane lipid bilayers by determining the membrane effects of quaternary lidocaine derivative (QX-314) and anesthetic optical isomers.
Methods: Membrane fluidity changes were assessed by measuring the fluorescence polarization of DPH-labeled liposomal membranes with the lipid bilayer structure [2]. Membrane lipids consisted of different phospholipids and cholesterol with the appropriate compositional ratio. Liposomes suspended in 1-70 mM phosphate buffer (pH 7.4, containing 0-100 mM NaCl) were treated with lidocaine, QX-314, bupivacaine and ropivacaine (0.75-3 mM) for 10 min, followed by polarization measurement.
Results: Lidocaine (3 mM) fluidized DPPC membranes to decrease DPH polarization, but not QX-314 (3 mM). Not only lidocaine but also QX-314 induced the fluidization of POPC, POPS, POPA, POPG and cardiolipin membranes in increasing order of intensity. QX-314 was effective on nerve cell model membranes prepared with cholesterol, POPC, POPS, POPE and sphingomyelin (polarization decrease: 6.0 ± 0.5%) as well as lidocaine (7.6 ± 0.3%). Their effects were increased by lowering phosphate and NaCl concentrations in reaction media. The nerve cell model membranes were differentially fluidized by stereoisomeric bupivacaine (0.75 mM) with relative potency of 1.00 ± 0.13 for S-(-)-enantiomer, 1.30 ± 0.03 for racemate and 1.50 ± 0.06 for R-(+)-enantiomer ($P < 0.01$, vs. antipode and racemate) and by stereoisomeric ropivacaine (1 mM), 1.00 ± 0.07 for S-(-)-enantiomer and 1.37 ± 0.03 for R-(+)-enantiomer ($P < 0.01$, vs. antipode). The membranes without cholesterol showed no difference between these stereoisomers.
Discussion: Positively charged QX-314 fluidized more acidic phospholipid membranes under less salt conditions. The ionic interaction is responsible for its effects as in membrane-active cationic drugs [3]. Bupivacaine and ropivacaine optical isomers induced differential fluidization in membranes with cholesterol, but not without. Such enantioselectivity is considered to be produced by several chiral carbons in cholesterol molecule that increase the chirality of membranes [4]. Charged and stereoisomeric local anesthetics interact with membrane lipid bilayers almost comparably to lidocaine and structure-specifically in a lipid composition-dependent manner, influencing the function of receptors and channels by disturbing their surrounding lipids.
References:
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S-261.

EFFECTS OF INTRAVENOUS ANESTHETICS ON ENDOTOXIN-INDUCED INFLAMMATION IN RATS AND MINIATURE PIGS

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Introduction: Intravenous anesthetics such as propofol, ketamine, and midazolam are widely used for sedation during sepsis. Several studies suggest that anesthetics have protective roles against endotoxemia. [1-3]. However, there are few reports on the effects of intravenous anesthetics in septic pig model. The aim of this study was to investigate whether intravenous anesthetics could attenuate endotoxin-induced organ injury in rats and miniature pigs.
Methods: Twelve two anesthetized male Wistar rats were randomly assigned to four groups: a) endotoxemic group (n = 7): receiving lipopolysaccharide (LPS) (15 mg/kg); b) pretreatment with propofol group (n = 5): treated identically to the endotoxemic group with additional infusion of propofol (20 mg/kg/hr) 15 minutes before LPS; c) pretreatment with ketamine group (n = 5): treated identically to the endotoxemic group with additional infusion of ketamine (20 mg/kg/hr) 15 minutes before LPS; d) pretreatment with midazolam group (n = 5): treated identically to the endotoxemic group with additional infusion of midazolam (0.15 mg/kg/hr) 15 minutes before LPS. 2 h after LPS injection, peripheral blood was sampled to measure aspartate aminotransferase (AST), alanine aminotransferase (ALT), lactic dehydrogenase (LDH). Liver tissue, and lung tissue were sampled to measure wet to dry weight ratio (W/D) and myeloperoxidase (MPO) assay. Next, anesthetized six miniature pigs were randomly assigned to two groups: A) pretreatment with propofol group (n = 3); B) pretreatment with ketamine group (n = 3). For 5 h, electrocardiogram, direct arterial pressure and central venous pressure were monitored. During experiment, blood samples were taken for blood gas analysis, AST, ALT, LDH, cytokine activity, and chemiluminescence assay at various time: before LPS injection and at 30, 60, 120, 180, 240, and 300 minutes after LPS injection.
Results: In rat model, no significant differences were noted in AST, ALT and LDH. Compared with the endotoxemic group, pretreatment with ketamine group showed significantly decreased W/D in lung tissue ($p = 0.03833$). In pig model, no major differences were observed in hemodynamic parameters, blood gas analysis, and biochemical parameters.
Discussion: Ketamine administration inhibited lung edema in rats injected with endotoxin. Although further studies are needed to define the mechanism of the inhibitory effects, this finding suggests that appropriate use of ketamine as an anesthetic may provide protective effects against endotoxin-induced acute lung injury.
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S-262.

RESOLUTION OF INFLAMMATORY RESPONSES BY SERINE/THREONINE KINASE PKR

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INTRODUCTION
Development of respiratory complications post-operatively causes significant morbidity and prolonged hospitalization. The mechanisms by which post-operative pneumonia takes place have been extensively studied to date. However, once these inflammatory responses are triggered, the responses must be terminated by some as yet unknown mechanisms. We identified serine/threonine kinase PKR (the double stranded RNA -activated protein kinase) as an immuno-modulatory molecule which may contribute to the termination of the inflammatory responses.
METHODS
RAW264.7 cells were transiently transfected with catalytically inactive dominant-negative PKR expression plasmid together with NF-kappaB reporter plasmid. Relative luciferase activities were analyzed when the cell line was stimulated with bacterial products and cytokines.
RESULTS
When the cell line was stimulated with bacterial products such as LPS (lipopolysaccharide), the phosphorylation of NF-kappaB has been detected. Stimulation with inflammatory cytokines such as TNF-alfa (tumor necrosis factor alfa) also catalyzed NF-kappaB. Co-expression of dominant-negative PKR expression plasmid suppressed NF-kappaB activation when the cells were stimulated with the cytokines. On the contrary, co-expression of dominant-negative PKR expression plasmid did not suppress NF-kappaB activation triggered by the stimulation with bacterial products.
DISCUSSION
PKR, a ubiquitously expressed serine/threonine protein kinase that is induced by interferon (IFN), activated by dsRNA, cytokine, growth factor, and stress signals, is an essential signal transducer (or modifier) for cells to respond adequately to different stresses such as factor deprivation, products of inflammatory stimuli, and infection with microbial organisms. Initially, PKR was described as a translational inhibitor in an IFN-induced antiviral pathway, leading the infected-cells to commit suicide known as apoptosis. More recently, PKR has been shown to regulate several signaling pathways such as those activating IRF-1, p53, p38, and NF-κB. We present here that PKR is involved in signal transduction pathways mediated by inflammatory cytokines, but not by bacterial products. Given that bacterial products are the first for cells to encounter when infection takes place, apoptosis must be avoided. On the contrary, given that inflammatory cytokines are the secondary products derived from the cells that have been already stimulated with the primary infectious stimuli, there must be some negative feedback system that terminates the infectious state. It would be reasonable to assume that PKR plays an essential role in this process by leading the cells that have been stimulated with inflammatory cytokines to undergo apoptosis.

S-263.

FENTANYL ATTENUATES THE ANTIGEN-INDUCED AIRWAY CONSTRICTION OF THE SENSITIZED RAT

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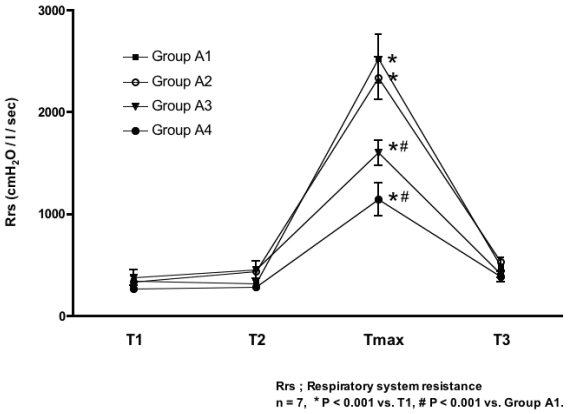
Introduction: The antigen-induced contractile response is an essential mechanism of the attack of bronchial asthma. Although fentanyl attenuates the contractile response of sensitized rat trachea by the inhibition of cholinergic nerves in the smooth muscle in vitro (1), it is not clear whether fentanyl affects this contractile response in vivo. We investigated the effects of fentanyl on the antigen-induced contractile response of the sensitized rat trachea in vivo.
Methods: Studies were conducted under guidelines approved by our Animal Care Committee. Thirty-five male Wistar rats weighing 250-300 g were used, and were divided into two groups. Group A was sensitized with intraperitoneal ovalbumin (OA), 10 μg, mixed with $Al(OH)_3$, 10 mg, as adjuvant. Group B received the same volume of normal saline. Fourteen days later, the rats were anesthetized with intraperitoneal pentobarbital. The trachea was cannulated and prepared for recording the airway resistance. The rats were paralyzed with continuous infusion of vecuronium, and the lungs were ventilated at a rate of 40 / min with a tidal volume of 10 ml/kg. Group A was divided into four subgroups. Group A1 received normal saline and OA (1 mg/kg), Group A2 received fentanyl, 3 μg/kg, and OA, Group A3 received fentanyl, 10 μg/kg, and OA, and Group A4 received atropine, 0.01 mg/kg, and OA. Group B received normal saline and OA. Respiratory system resistance (Rrs) was calculated 1 minute before drug administration (T1), 1 minute before OA administration (T2), at the time of maximal airway pressure obtained after OA administration (Tmax) and 10 minutes after Tmax (T3). Data were expressed as mean ± SE. Statistical significance was determined using ANOVA.
Results: OA did not change Rrs in Group B, but significantly increased Rrs in Group A at Tmax. This Rrs increase was attenuated in Group A3 and Group A4 (Figure).



Rrs ; Respiratory system resistance
n = 7, * P < 0.001 vs. T1, # P < 0.001 vs. Group A1.

Discussion: The present study shows that both atropine and fentanyl attenuated the OA-induced airway constriction of the sensitized rat. This observation suggests that the antigen-induced airway constriction in vivo would be mediated by acetylcholine, and that the antigen-induced airway constriction would be reduced by fentanyl in vivo. Fentanyl seems to be suitable for anesthetic management of asthmatic patients.
Conclusion: Antigen-induced airway constriction of sensitized rat is attenuated by fentanyl in vivo.
References: 1) IARS 79th Congress S370, 2005.

S-264.

THE COMBINED EFFECT OF CORTICOSTERONE AND PROPOFOL ON THE LONG TERM POTENTIATION IN THE RAT HIPPOCAMPUS IN VITRO

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Introduction: Stress and anesthetics are factors resulted in lesion of learning and memory during perioperative period. LTP was considered as the possible molecular mechanism of learning and memory currently. Many researchers reported that high concentration corticosterone blocked long-term potentiation (LTP). Propofol is widely used intravenous general anesthetics in clinical anesthesia, which could inhibit LTP in high concentration. According to previous report, propofol in low concentration (3μM) has no effect on LTP. The physiological corticosterone concentration in rodents is 0.1-1μM and corticosterone in high concentration (10μM) inhibits LTP. The goal of the present study is to investigate combined effect of corticosterone in high concentration (10μM) and propofol in low concentration (3μM) on LTP of hippocampal slices in vitro.
Methods: Synaptic responses were measured using electrophysiological recording from rat hippocampal brain slices. Bipolar nichrome stimulating electrodes were placed on Schaffer collateral fibers and a glass microelectrode was located in the area of CA1 cell bodies for recording the popular spikes (PS). Propofol (3μM) and corticosterone (10μM) were applied in the perfusate after being bubbled with the carrier gas (95%O_2 and 5%CO_2) into the artificial cerebrospinal fluid. In addition, Propofol (3μM), corticosterone (10μM) and intralipid were applied respectively. Nothing was applied as control. Baseline of PS was recoding for 20min and LTP was induced using high frequency stimulation (HFS, a 1 s train of 400 stimuli). Amplitude of PS was normalized as a percent of baseline and data are expressed as mean ± SD. Unpaired t-test and analysis of variance (ANVOA) followed by Student-Newman-Keuls test were used. A $P<0.05$ was accepted as evidence of significant difference.
Results: In control slices, HFS induced LTP (normalized PS 40min after HFS: 1.501±0.124, $P<0.01$). This degree of LTP was not altered by intralipid (1.436±0.160, $P<0.01$). Continuous administration of 3μM propofol did not block LTP (1.332±0.077, $P<0.05$). In the presence of 10μM corticosterone administration continuously, HFS did not induce LTP (1.180±0.089, $P>0.05$). In slices incubated by 3μM propofol combined with 10μM corticosterone, LTP also was blocked (1.079±0.063, $P>0.05$). The amplitude of PS incubated by 3μM propofol combined with 10μM corticosterone 40min after HFS was lower than that of incubated by 3μM propofol or 10μM corticosterone ($P<0.05$).
Discussion: According to our report, 10μM corticosterone inhibited LTP and 3μM propofol did not inhibit LTP. When both were applied, the inhibitory effect of 10μM corticosterone on LTP was facilitated by 3μM propofol compared with 10μM corticosterone applied singly.
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S-265.

KETAMINE AND THIOPENTAL SODIUM: INDIVIDUAL AND COMBINED NEUROPROTECTIVE EFFECTS ON RAT CORTICAL CULTURES EXPOSED TO NMDA OR NITRIC OXIDE

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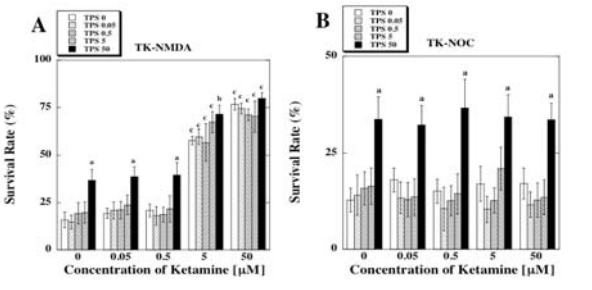
Background: An NMDA blocker, ketamine demonstrated neuroprotective effects in several in vivo and in vitro studies. However, ketamine is not recommended to use in patients of cerebral ischemia for its adverse neurological effects. We anticipated that a combined administration of ketamine and thiopental sodium (TPS) would be highly effectively in protecting cerebral cortical neurons from ischemia even in reduced dose combinations.
Methods: We examined the degree of neuroprotection at various concentrations (0-50 μM) of ketamine and TPS, alone and in combination in cortical cultures 24 hr exposed to NMDA or NOC. The survival rate of E16 Wistar rat cortical neurons was evaluated on photomicrographs before and after experiments.
Results: Higher doses (5 and 50μM) of ketamine showed improved survival rates (57.9±2.2%, 76.7±3.0%, respectively) against NMDA but not NOC. Enhanced survival rate was seen with combined administration of 5μM ketamine and 50μM TPS (survival rate; 71.3±4.8%. $P<0.05$ ketamine alone, $P<0.01$ TPS alone; 36.7±5.9%), against NMDA-induced neurotoxicity in vitro. Only the highest dose of TPS showed enhanced survival rates against NOC. This neuroprotection was not influenced by ketamine.
Conclusions: These data indicate that a clinical dose of ketamine offers significant neuroprotection during prolonged exposure to NMDA but not NOC. Meanwhile, combinations of clinical doses of ketamine and TPS could provide better neuroprotection against NMDA-induced neurotoxicity. Hence, these two intravenous anesthetics would be one of the best combination for clinical application.

Fig. 1



S-266.

MOLECULAR MECHANISMS OF PRESSURE REVERSAL OF ANESTHESIA - COMPUTATIONAL SEARCH OF XENON BINDING SITE OF MYOGLOBIN UNDER 1000 BAR

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Introduction: Pressure reversal of anesthesia is phenomenon that pressure application to anesthetized living system cause emergence from anesthesia. According to framework of thermodynamics the system volume is necessary to be increased by anesthesia, however anesthetic binding site which cause volume increase has not yet clarified. Many recent studies reveal that anesthetic interact with ligand-gated ion channels, such as GABAa receptor, neuronal acetylcholine receptor and etc [1]. Pressure reversal hypothesis "Anesthetic binds to site, and squeezed out due to pressure" has been proposed [2]. Xenon binding of substrate biding site of lysozyme under 2k bar was reported to be unstabilzed comparing normal pressure using docking simulation, while at internal site of lysozyme, xenon binding was stabilized by 2k pressure [3]. Pressure dependence of the binding, stabilized or not, was dependent on its site character. Are these pressure dependence of xenon binding common to protein? How the mechanisms of pressure reversal of xenon binding were consisted of? The aim of this study is to find xenon binding site of myoglobin under 1k bar, and to refer to its stabilities under high pressure.
Methods: Myoblobin structures of at 1k bar and normal pressure, 1JP8 and 1JP6 (protein data base), were from Protein Data Bank [4]. Hydrogen atoms were added to their defects and energy optimization of hydrogen-heavy atom bonding (distance and angle) to find complete structure including hydrogen was done. MOE 2004.3 (Chemical Computing Group, Canada) was used for docking between xenon and myoglobin. Fixing structure of 1JP8, energy minimum position of xenon was searched to find xenon-myoglobin complex structure. Xenon binding energy of the complex was calculated using MMFF94x force field and partial charge. Van der Waals energy was calculated for interaction energy.
Results & Discussion: Xenon did not bind to 1k bar myoblobin structure 1JP8, while it bound to normal pressure structure 1JP6. This supported the hypothesis "Anesthetic binds to site, and squeezed out due to pressure". It was reported that at xenon binding site of lysozyme, which showed pressure reversal, the binding was increased partial molar volume. Major contribution to this volume increase due to xenon binding was turned out to be from solvent exclusion volume rather than electrostrictive water release [5]. Thus, this study result of binding stability decrease under high pressure implied that xenon binding to myoglobin also increase volume.
References: [1] Br J Anaeth. 89: 17-31(2002). [2] Biophys. J. 60: 1309-1314(1991). [3] Int. Cong. Ser. 1283: in press. (2005). [4] Structure. 10: 51-60 (2002). [5] Imai T, in preparing.

S-267.

OREXIN DECREASED KETAMINE ANESTHESIA TIME IN RAT-RELEVANCE TO BRAIN NORADRENERGIC NEURONAL ACTIVITY

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Introduction
Orexin A and B (OXA/B) are endogenous neuropeptides, identified in the rat hypothalamus, and play an important role in feeding and arousal regulation. Previously we reported that OX selectively evoked norepinephrine (NE) release from rat cerebrocortical slices, also reported that OX significantly decreased pentobarbital, thiopental and phenobarbital anesthesia times in rats, and they inhibited OX-evoked NE release in rat cerebrocortical slices (1). As ketamine markedly increased NE release in the medial prefrontal cortex during anesthesia, therefore we hypothesize that ketamine anesthesia may result from of an interaction with central orexinergic systems.
Methods
With the approval of the institutional committee on animal research of the University of Hirosaki School of Medicine, total 57 male SD rats weighing 340-400 g were used. We performed two experiments, (a) anesthesia time study and (b) microdialysis study. (a) A stainless cannula was implanted into the lateral cerebroventricle. On a separate control day, the rats received 4µl pyrogen free saline intracerebroventriculaly, and the rats received ketamine intraperitoneally. Four dose of the ketamine were used: 50 mg/kg (n= 7), 100 mg/kg (n= 9), 125 mg/kg (n= 8) and 150 mg/kg (n= 9). Five days later, the same rats received 1 nmol OXA (4µl) intracerebroventriculaly, and the rats received ketamine intraperitoneally as control day. In addition, the effect of 10 nmol SB-334867-A, an orexin receptor antagonist, with 1 nmol OXA on ketamine anesthesia (100 mg/kg) was studied (n= 9). The anesthesia time was defined as duration of loss of righting reflex. (b) Rats were allocated randomly to one of three groups: group OX (n= 5), group K (n= 5) and group OX-K (n= 5). A stainless cannula was implanted into the lateral cerebroventricle and dialysis probe into the prefrontal cortex. After obtaining five consecutive stable samples of norepinephrine; group OX received OXA 1 nmol icv, group K received ketamine 100 mg/kg ip, group OX-K received OXA 1 nmol icv and ketamine 100 mg/kg ip. Dialysates were obtained every 10 min for 180 min, and NE concentration in the dialysates was measured with HPLC.
Results
(a) The OXA decreased anesthesia time in lower 3 doses of ketamine. Maximum effect was observed at ketamine 100 mg/kg (75.3 +/- 4.7%, $p< 0.01$). SB-334867-A reversed the effect of OXA. (b) In all groups, the NE concentrations were increased significantly compared with baseline after administration of each agent. The AUC of Group OX-K of the NE concentration time course from 0 to 180 min was significantly smaller than that of Group K ($p< 0.05$)
Discussion
Our results indicated that orexinergic neuron may be involved in process of ketamine anesthesia with interaction with noradrenergic neuron.
Reference 1. Neuroscience 121: 855-863, 2003

S-268.

EFFECTS OF RHO-ASSOCIATED PROTEIN KINASE (ROCK) INHIBITORS ON THE FORCE PRODUCED BY MUSCARINIC RECEPTOR STIMULATION IN RAT BRONCHIAL SMOOTH MUSCLE

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Introduction
Smooth muscle contraction in response to physiologic agonists is associated with an increase in the cytosolic Ca^{2+} concentration ($[Ca^{2+}]i$). However, contractile force is not determined by $[Ca^{2+}]i$ alone because membrane receptor stimulation with various receptor agonists increases the force at a constant $[Ca^{2+}]i$ (=increased Ca^{2+} sensitivity). This increase in Ca^{2+} sensitivity is reportedly mediated by G-proteins, particularly small G-protein Rho, in different smooth muscles, including airway. We have previously showed that selective Rho-associated protein kinase (ROCK) inhibitors, Y-27632 and fasudil, decrease the force produced by muscarinic receptor stimulation with acetylcholine (ACh) in rabbit tracheal smooth muscle, suggesting that these ROCK inhibitors may act as bronchodilator. A new ROCK inhibitor H-1152 is reportedly more potent and selective than Y-27632 and fasudil. We examined these ROCK inhibitors to determine whether they also exert inhibitory effects on the force by muscarinic receptor stimulation in rat airway smooth muscle.
Methods
Two ring strips (width 200μm, diameter 500μm), cut from the intrapulmonary bronchus of male Wister rat, were placed in 400μl organ baths containing Krebs-Henseleit solution (bubbled with 95% O_2-5% CO_2 gas mixture at 25°C) at a resting tension of 50mg. After equilibration period, isometric force was measured. After obtaining a stable contraction with 30μM (produces nearly half the maximal contraction by 1mM in preliminary study) ACh, H-1152 (0.01-100μM),fasudil (0.01-100μM) and Y-27632 (0.01-300μM) were cumulatively applied.
Results
All ROCK inhibitors produced a concentration-dependent relaxation of rat bronchial smooth muscle stimulated with 30μM ACh. The 50% effective concentrations (EC_{50}) were approximately 1.26μM (H-1152), 7.08μM (fasudil), and 22.4μM (Y-27632).
Discussion
H-1152 produced a dose-dependent relaxation of rat airway smooth muscle stimulated with ACh. The inhibitory effects of fasudil and Y-27632, shown in our previous report using rabbit tracheal muscle, were reconfirmed in rat bronchial smooth muscle. EC_{50} value of H-1152 for relaxation was much lower than those of other ROCK inhibitors. These results suggest that ROCK inhibitors generally decrease the force by muscarinic receptor stimulation in rat airway smooth muscle by inhibiting G-protein-associated increase in Ca^{2+} sensitivity, and H-1152 is more potent and selective than conventional ROCK inhibitors. Volatile anesthetics are considered essential for anesthetic management of asthmatic patients due to their strong bronchodilatory effect. These agents reportedly decrease Ca^{2+} sensitivity by affecting smooth muscle protein phosphatase activities; this is not seen with intravenous anesthetics. However, results of the present study suggest that in the near future, with the direct inhibitory effect of ROCK inhibitors on Ca^{2+} sensitivity, intravenous anesthetics also may be used safely for asthmatic patients.
Conclusion
ROCK inhibitors generally decrease the force by muscarinic receptor stimulation in rat airway smooth muscle. ROCK inhibitors, particularly H-1152, may act as a potent bronchodilator.
References
1) Anesthesiology 2004 suppl; A1518
2) J Neurochem 2002; 9-16

S-269.

CHARACTERIZATION OF THE FUNCTIONAL CHANGES IN MUSCLE DURING EXPERIMENTAL AUTOIMMUNE MYASTHENIA GRAVIS (EAMG) IN THE RAT

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Introduction: This study characterizes the functional changes in the muscle of rats, induced to have myasthenia gravis. Force and fatigability were evaluated and correlated to the clinical score of muscle weakness, acetylcholine receptor (AChR) number in muscle, and rat AChR antibody (R-AChR-Ab).
Methods: After institutional approval, male Lewis rats (n=26) were immunized to induce EAMG by injection of Torpedo AChR (T-AChR),[1] emulsified with complete Freunds adjuvant (CFA) and phosphate buffered saline/bovine serum albumin (PBS/BSA) 0.01%. All animals received booster immunizations at 4 and 8 weeks after initial injection of T-AChR. Another 13 animals were sham-immunized (controls) with CFA and PBS/BSA, and no T-AChR. Muscle weakness was scored clinically on a 0-3 scale, 0 being normal, and 3 severe muscle weakness.
Anti-rat-AChR (R-AChR) Ab was measured by radioimmunoassay using 125I-a-bungarotoxin (BuTX).[2] Under anesthesia, neuromuscular functions were assessed by mechanomyograph using single twitch, train-of-four (TOF), and 50 Hz tetanus. AChR in muscle was quantitated using 125I-a-BuTX.[3]
Results: Overall weight gain and final body mass were reduced at 8 weeks in animals with score 3 compared to controls (72 ± 2 vs. 264± 6g, and 197 ± 3 vs. 383 ± 8g for a score 3 vs. controls, respectively, $p < 0.0001$). Single twitch (67 ± 3 vs. 324 ± 8g), peak tetanic tension (123 ± 2 vs. 503 ± 4g), specific force (twitch/muscle weight, 225 ± 12 vs. 524 ± 9g/g) and TOF fade ratio (0.75 ± 0.007 vs. 0.99 ± 0.001) and AChR number (8 ± 0.3 vs. 29 ± 0.7 fmol/mg protein) were reduced ($p <0.001$) in animals with score 3 compared to controls. There was a negative correlation between anti R-AChR Ab and AChR number ($r= 0.97$, $p <0.0001$).
Discussion: Neuromuscular function of EAMG rats had the following characteristics: 1)depressed single twitch; 2)depressed tetanic tension at 50Hz; and 3)fade of TOF and 50 Hz tetanus. EAMG in the rat could provide a useful model to study efficacy of drugs and other forms of therapy in the treatment of myasthenia gravis.
References: 1) Neurology 1976; 26:1054; 2) J Neurol Neurosurg Psychiatry 1985; 48:1246; 3) Muscle Nerve 1993; 16:348.

S-270.

SUGAMMADEX (ORG 25969) CAN PREVENT NEOMYCIN-INDUCED RE-OCCURRENCE OF NEUROMUSCULAR BLOCK IN GUINEA PIGS

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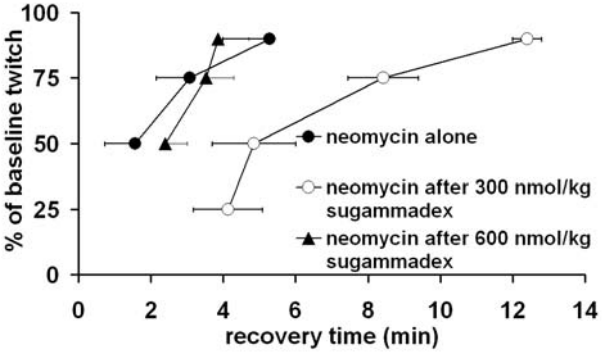
Introduction: Sugammadex (Org 25969) is the first example of a new class of reversal agents: the Selective Relaxant Binding Agents. In both animal and clinical studies, sugammadex administration causes fast, effective and complete reversal of rocuronium-induced neuromuscular block [1]. This compound forms tight complexes with steroidal neuromuscular blocking agents, especially rocuronium. As a result, rocuronium is no longer able to act on nicotinic receptors. After spontaneous recovery from neuromuscular block, however, the occupation of the nicotinic receptors is still very high. Under these circumstances, administration of drugs, which reduce acetylcholine release, can cause re-occurrence of block. Aminoglycosides, which reduce acetylcholine release by a blocking effect on P/Q-type calcium channels, are such an example. Sugammadex can cause complete reversal by capturing only a fraction of the rocuronium molecules. However, higher doses of sugammadex can capture almost all rocuronium molecules, thereby eliminating the risk of re-occurrence of block. Aim of this study was to determine whether a high dose of sugammadex can prevent neomycin-induced re-occurrence of block.
Methods: Guinea pigs were deeply anaesthetised and artificially ventilated. Single twitch M. gastrocnemius contractions were recorded. Neuromuscular block was induced with rocuronium (430 nmol/kg; $3xED_{90}$), followed by complete reversal with either 300 nmol/kg or 600 nmol/kg sugammadex. This was followed by a 5 min infusion of neomycin (40 µmol/kg in total) to cause re-occurrence of block. One group of animals only received neomycin (n = 4 animals in each treatment group).
Results: The recovery from neomycin-induced re-occurrence of block is shown in Figure 1. After the lower dose of sugammadex, neomycin caused a marked prolongation of neuromuscular block. However, a higher dose of sugammadex prevented this completely. Isothermal microcalorimetry has shown that neomycin does not form complexes with sugammadex.



Discussion: After complete reversal of rocuronium-induced neuromuscular block with a normal dose of sugammadex, the effect of neomycin on twitch height was markedly prolonged. However, the high dose of sugammadex completely prevented this phenomenon. These results can be explained by the fact that the high dose of sugammadex is able to reduce the occupation of nicotinic receptors by rocuronium to such extent, that no potentiation of the effect of neomycin can occur.
References: [1] Epemolu O, Anesthesiology, 99(3), 632, 2003.

S-271.

RECOMBINANT HUMAN NMDA RECEPTOR SIGNALING IS INHIBITED BY STRUCTURALLY DIFFERENT LOCAL ANESTHETICS

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Intravenous local anesthetics have been shown to reduce hyperalgesic pain states in human and animal experimental pain models. N-methyl-D-aspartate (NMDA) receptor activation contributes to hyperalgesia. We and others have shown that local anesthetics (LA) inhibit NMDA receptor signaling. The mechanism of action seems to be indirectly mediated via inhibition of proteinkinase C. However, LA are structurally different and their common action on sodium channels does not necessarily imply an additional common alternative effect on NMDA receptors. Structural features required for local anesthetic activity are well known, but there is no such knowledge for the alternative effects of LA. In this study the possible distinction between LA concerning differences in structure of compounds (stereoselectivity, amide-LA vs. ester-LA vs. carbamate-LA were tested.
Methods: According to the protocol of the local animal and use committee, human NR1A/2A NMDA receptors were expressed recombinantly in Xenopus laevis oocytes. In NMDA receptor expressing oocytes inward currents induced by glutamate/glycine were measured by 2-electrode voltage clamp, and are reported as µA (mean±SEM). Oocytes were incubated in lidocaine, procaine or an experimental carbamate LA (figure 1) for 10 min. For stereoselectivity experiments cells were incubated in S-(-) ropivacaine and R-(+) ropivacaine for 10 min.
Results: Whereas glutamate/glycine (10/10 µM) was without effect on uninjected oocytes, it induced consistent inward currents in oocytes expressing NMDA receptors (data not shown. LA with amide (lidocaine 10^{-4} M, inhibited to 45%), ester (procaine 10^{-4}M, inhibited to 60%) or carbamate (inhibited to 37%) type of linkage between aromatic ring and amine nitrogen inhibited NMDA receptor signaling. Whereas reponses to agonistst were inhibited to 62% after S-(-) ropivacaine incubation, the stereoisomer R-(+) ropivacaine was without effect.
Discussion: Sodium channel blocking potency of LA depend upon substitutions in the aromatic ring, the alkyl groups attached to the amine nitrogen, and on the type of linkage in the intermediate chain. Our data show that inhibition of NMDA receptor function does not depend on the type of linkage in the intermediate chain of the LA but is stereoselective for ropivacaine.

S-272.

EFFECT OF PROPOFOL ON GLUTAMATE AND γ-AMINOBUTYRIC ACID RELEASE FROM RAT HIPPOCAMPAL SYNAPTOSOMES

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Introduction: To observe the effect of propofol on the release of glutamate and γ-aminobutyric acid (GABA) from rat hippocampal synatosomes.
Methods: Adult male SD rats (180-250g) were decapitated. Hippocampus was rapidly removed and rinsed in ice-cold 0.32M sucrose solution. Then the homogenate was centrifuged at 1,000g for 5min. The supernatant fraction was collected and centrifuged at 12,000g for 20min. The pellet (crude synaptosome) was stored on ice for up to 2h until use. All steps were carried out at 0-4°C. Protein concentrations were determined by the method of Bradford using bovine serum albumin as a standard. When Ca^{2+}-dependent release of glutamate and GABA were observed, dihydrokainic acid (DHK) and nipectic acid were added into artifical cerebrospinal fluid (aCSF). When Ca^{2+}-independent release of glutamate and GABA were observed, DHK, nipectic acid and Ca^{2+} were omitted from aCSF. Synaptosome were incubated at 37°C for 15-20min. 20μM veratridine or 30 mM KCl was added into aCSF to evoke release of glutamate and GABA. In order to maintain isoosmolarity, Na^+ concentration in aCSF was reduced when 30mM KCl was used. After 5min incubation, release was terminated at 0°C as EGTA (final concentration was 10mM) was added into mixture. The mixture in tube was centrifuged at 12,000g for 20min and supernatant fraction was stored at -70°C. The concentration of glutamate and GABA released from synaptosome were determined by reversed-phase high-performance liquid chromatography (RP-HPLC). For the evoked release of glutamate and GABA, six synaptosomes were included with each concentration of propofol, and the synaptosomes in each group were from different rats hippocampus. To investigate the influence of bicuculline on the effect of propofol, synaptosomes were incubated with 100μM bicuculline before addition of propofol. In addition, intralipid was added as solvent control. Data was expressed as mean±SD and analyzed with student's t test, a P value <0.05 was accepted as evidence of significant difference.
Results: 30, 100 and 300μM propofol significantly inhibited veratridine-evoked Ca^{2+}-dependent release of glutamate and GABA ($P<0.01$, $P<0.01$, $P<0.01$). However, propofol has no effect on elevated KCl-evoked Ca^{2+}-dependent release of glutamate and GABA. Veratridine or elevated KCl evoked Ca^{2+}-independent release of glutamate and GABA was not affected significantly by propofol. Bicuculline did not significantly affect inhibition by propofol of glutamate and GABA release evoked by veratridine or elevated KCl.
Discussion: This study suggested that propofol could inhibit Ca^{2+}-dependent release of glutamate and GABA in a concentration-dependent manner. In addition, this inhibitory effect was not mediated by $GABA_A$ receptor. However, propofol had no effect on the Ca^{2+}-independent release of glutamate and GABA.
References:
1. Anesthesiology; 2002, 97: 1500-1506.
2. Anesthesiology; 2000, 93: 1329-1335.

S-273.

PROPOFOL AND ETOMIDATE DO NOT AFFECT NOREPINEPHRINE RELEASE FROM RAT CARDIAC SYMPATHETIC NERVE ENDINGS

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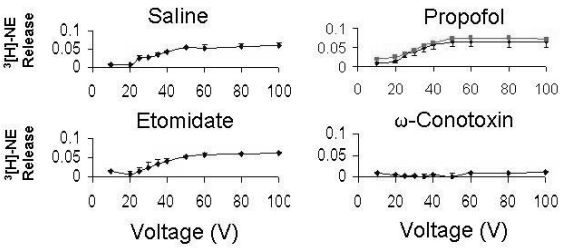
Introduction: The hypotensive effect of propofol (P) but not etomidate (ET) was attributed to a direct relaxing action of P on vasculature and to decreased sympathetic activity (1,2). It is controversial whether P affects baroreceptor sensitivity (2,3). P produces negative inotropy in the heart (4). Our aim was to determine whether P or ET affect evoked norepinephrine (NE) release from cardiac sympathetic nerve endings.
Methods: We measured twitch contractile force and ^{3}[H]-NE release in rat atria that were labeled with NE[7-^{3}H(N)]. To determine stimulation-evoked release of ^{3}[H]-NE, atria were bathed in Krebs containing desipramine, metanephrine, and U-0521. This portion of the experiment was divided into eleven 10-min periods (S0-S10). During S0 no stimulation was applied. For S1-S10, atria received, during the first 5 min only, a pulse train (3 Hz) to evoke NE release. The stimulus intensity was 10 V in the first period and was increased in the subsequent stimulation periods to a maximum of 100 V. At the end of each period, a sample was taken to measure tritium, and the bath liquid was replaced. The effects of P (2 μg/ml, n=4 or 50 μg/ml, n=1), ET (2 μg/ml, n=3), ϖ-conotoxin (100 nM, n=3) or saline (100 μl, n=3) were studied in S1-S10. From samples S1-S10, stimulated ^{3}[H]-NE release (overflow) was expressed as a fraction of tissue radioactivity with correction for background (unstimulated) release of tritium. The latter was obtained as the ^{3}[H]-NE release during S0. Data are given as mean ± SD. Statistical significance was determined by ANOVA at a p value less than 0.05.
Results: Progressive increase in stimulation intensity generated a voltage dependent rise in ^{3}H-NE release following a sigmoidal curve (See Fig). P and ET did not affect ^{3}[H]-NE release. However, ϖ-conotoxin GVIA nearly abolished the release. P and ET had no significant effect on the stimulating voltage giving half-maximal release of NE ($V_{½}$) or on the maximal evoked release of tritium (E_{max}).



Conclusions: P and ET do not interfere with evoked release of NE from cardiac sympathetic nerve endings. Thus, the negative inotropic effect of P is due to its action elsewhere than at the presynaptic nerve terminals.
References: 1) Br J Anaesth 1983;55:105-11. 2) Anesthesiology 1992;76:725-33. 3) Anesth Analg 1987;66:1115-20. 4) Br J Pharmacol 2001;132:742-8.

S-274.

HAPTIC JENGA AND NANOJACKS: CREATING NOVEL LOCAL ANESTHETICS FROM THE BUILDING BLOCKS OF LIFE

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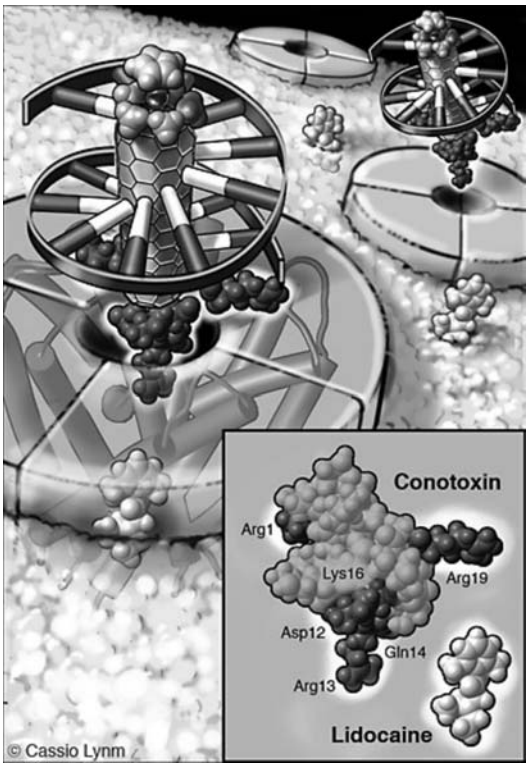
Introduction: Tetrodotoxin and mu-conotoxin block sodium channels in peripheral neurons and skeletal muscle but not in the myocardial conducting system, while Jingzhaotoxin is cardiotoxic. These proteins bind to specific amino acids in the outer vestibule of the sodium pore. In contrast, lidocaine and bupivacaine, diffuse through most neural membranes binding to the cytoplasmic side of the inner activation gate.
Methods: To create nonlethal local anesthetics, the 3-D structures of mu-conotoxin (1TCG) and sodium channel (1BL8) were downloaded from the Protein Data Bank, to serve as a basis for a drug /receptor interface, a pharmacophore. Model drugs are assembled, using off-the-shelf nanofabricating techniques to synthesize: (1) amino acid covered fullerenes or (2) peptide capped, carbon nanotubes, rendered water soluble by a coat of DNA.
Results: Samples closely resemble the naturally occurring 22 amino acid snail toxin (fig1 insert). Manipulation of prototypes is by a miniature, computer- linked robotic arm that creates a resisting force vector based on known electrostatic potentials. The limitation of loading the local anesthetic into a specific channel is simulated with a given set of steric conditions. Ease of placement and tightness of fit translate into a score for block onset and duration of action. A game of ionic Jai Alai is played where the goal is to stop sodium conductance by plugging as many channels as possible before the antisense DNA unravels from the nanojack ending production of pore proteins.
Discussion: Other nanocarbon structures are available in this drug modeling toolkit to generate novel sodium channel blockers so residents can try their skills at playing the sorcerer's apprentice without releasing a deluge of real neurotoxins from basement laboratories.



S-275.

MOLECULAR CONFORMATION FOR MUSCARINIC ACTION

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Recent studies on the mechanism of action of neuromuscular relaxants have focused on how their molecular shape determines their action[1,2]. So far, similar computer-based conformation-action relationship (CAR) of the cholinergic compounds has limited to their nicotinic action. As exemplified by the bronchoconstriction of rapacuronium, however, the CAR of the muscarinic action appears important. Of the cholinergic compounds, the textbook, Anesthesia, has stated in each edition that the distance from the center of the quaternary N to the van der Waals (vdw) extension of a hydrogen bond acceptor determines whether a compound is nicotinic or muscarinic[3]. If this distance (N-Ovdw distance) is 5.9 Angstrom (A), the compound will be nicotinic; if 4.4 A, muscarinic. These rules were derived by Beers & Reich, in late 1960s, based on compounds then available[4]. Recently, the rule of 5.9 A has been verified with computer precision, and validated in epibatidine and vecuronium. The rule of 4.4 A has remained unchallenged.
Methods: The compounds included in the original publication of Beers & Reich were analyzed by computer, using a molecular modeling package (Sybyl, v.7.0, Tripos, St. Louis). Tertiary N atoms were modeled as protonated. Extensive searches were performed using the random search protocol. Conformers of high energy are pharmacologically irrelevant, and were discarded. The lowest energy conformer of each compound was harvested, along with other low energy conformers. The vdw extensions of their O atoms were computed, as were the N-Ovdw distances. Specifically, the N-Ovdw used by Beers & Reich to derive the rule of 4.4 A was examined.
Results: The subject N-Ovdw distances of the lowest energy conformers were: acetylcholine, 3.63; atropine, 3.91; F2581, 3.82; 5-methylfurmethide, 3.30; pilocarpine, 2.95; meprochol, 3.04; muscarine, 2.98; F2268, 3.38; muscarone, 2.97; TFTM, 2.96; arecoline, 4.99; and methylcrotonic betaine, 5.89 Angstroms. Except for the last two compounds, which are weak muscarinic agents, the N-Ovdw distances converged around 3.0-3.8 A. With a small-moderate energy penalty (0.1-5.0 kcal/mol), an N-Ovdw of 4.4 A could be assumed by all compounds.
Discussion: The rule of 4.4 A for muscarinic action proved imprecise. It should be revised to 3.0-3.8 A. Nevertheless, the present study qualitatively validated that a preferred N-Ovdw distance for muscarinic action exists, and that the distance is distinctly shorter than the corresponding distance for nicotinic action. Modern research has revealed numerous subtypes of muscarinic receptors, as well as new ligands for various subtypes. Elucidation of the receptive site topology, and the corresponding molecular shape of the subtype-selective ligands, may facilitate development of improved muscarinic agents, such as M2- versus M3-specific compounds.
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Pharmacology - Clinical

S-276.

ONDANSETRON FOR THE TREATMENT OF POSTOPERATIVE NAUSEA AND VOMITING (PONV) IN PACU: EFFICACY FOLLOWING PRIOR PONV PROPHYLAXIS WITH ONDANSETRON, DEXAMETHASONE, OR NO PRIOR PONV PROPHYLAXIS

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Introduction:
There is a paucity of data on the treatment of established postoperative nausea and vomiting (PONV) in patients who have received a prophylactic antiemetic. Expert opinion suggests that an antiemetic acting on a different receptor system would constitute a better treatment option in patients who experience PONV despite receiving a prophylactic antiemetic. We tested the hypothesis that ondansetron would be less efficacious for the treatment of established PONV in patients who received prior prophylaxis with ondansetron compared with patients who did not receive PONV prophylaxis and patients who received PONV prophylaxis with dexamethasone.
Methods:
The perioperative database was prospectively designed to collect PONV outcome variables. We searched the perioperative database (starting April 2001 till June 2005) for patients aged > 18 years who received general anesthesia for a variety of surgical procedures. We searched for patients who received inhaled agents (isoflurane or sevoflurane with or without nitrous oxide) for maintenance of anesthesia and received PONV prophylaxis with ondansetron, dexamethasone, or did not receive PONV prophylaxis. We included patients who developed PONV in PACU, and received ondansetron as the first agent for the treatment of PONV. Success of the rescue agent (complete response) was defined as no further nausea, vomiting, or need for additional antiemetics in PACU. Fisher's exact test was used for categorical data and t-test was used for continuous data. $P<0.05$ was accepted as statistically significant.
Results:
Ondansetron 4 mg was used as the first line agent for the rescue treatment of PONV in 3470 patients who received prophylaxis with ondansetron (ondansetron group), 211 patients who received prophylaxis with dexamethasone (dexamethasone group), and 2877 patients who received no PONV prophylaxis (no prophylaxis group). There was no difference in patients' demographics between the groups except for significantly less females in the no prophylaxis group (table). Complete response to rescue with ondansetron occurred in 1745 patients (50%) in the ondansetron group, 125 patients (59%) in the dexamethasone group ($p=0.01$ vs. ondansetron group), and 1747 patients (61%) in the no prophylaxis group ($p=0.0001$ vs. ondansetron group).

Patients"demographics, numbers are mean±SD or number (%). *$p<0.05$

	Ondansetron Group	Dexamethasone Group	No Prophylaxis Group
Number	3470	211	2877
Age, years	49±17	49±15	51±18
Weight, kg	81±22	83±23	82±24
Height, cm	168±12	169±10	170±12
Females	2223(64%)	131(64%)	1474(51%)*

Conclusion:
Rescue treatment for established PONV with ondansetron is significantly more effective in patients who received prior PONV prophylaxis with dexamethasone or did not receive PONV prophylaxis, compared to patients who received prior PONV prophylaxis with ondansetron.

S-277.

ONDANSETRON ORALLY DISINTEGRATING TABLET VERSUS PLACEBO FOR THE PREVENTION OF POSTOPERATIVE NAUSEA AND VOMITING

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Ondansetron orally disintegrating tablet (ODT) is a new freeze-dried oral formulation of ondansetron. The hypothesis of this study was that the administration of ondansetron ODT would result in a decreased incidence of postoperative nausea and vomiting (PONV).
Forty patients received either placebo (Group I, n = 20); or 8 mg ondansetron ODT (Group II, n = 20) prior to induction of general anesthesia. PONV was evaluated at regular intervals. The results were analysed using Chi-square and Kruskal- Wallace tests.
Both groups were well matched for demographic characteristics. The incidence of nausea and emesis was significantly lower in Group II (17.5%, $p<0.02$ and 10%, $p< 0.01$, respectively). Resque anti-emetic requirements were higher in Group I ($p<0.05$).
We concluded that ondansetron ODT significantly reduces the incidence of PONV.
Reference: Gan TJ et al. Anesth Analg 2002, 94: 1199-1200.

S-278.

DOES COMBINATION ANTIEMETIC PROPHYLAXIS PREVENT EARLY AND LATE POSTOPERATIVE NAUSEA AND VOMITING (PONV) IN HIGH-RISK PATIENTS UNDERGOING LAPAROSCOPIC AND PLASTIC SURGERY?

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Introduction: Recent clinical trials have demonstrated that prophylactic antiemetic regimens with different mechanisms of action can reduce incidence of emetic symptoms in high-risk surgical populations.[1,2] We are conducting an ongoing prospective, observational multicenter study to determine the incidence of early and late (postdischarge) nausea and vomiting in patients at high risk for PONV to evaluate practice patterns of antiemetic use and determine the population-based effectiveness of commercially available antiemetics.
Methods: To date, 101 adults scheduled for elective laparoscopic or plastic surgery were screened for risk factors associated with PONV. Points were assigned for female gender, nonsmoking status, history of PONV and/or motion sickness. Patients with 2 or more points were consented to participate in this 72-hour study, which evaluated the occurrence of nausea, vomiting, and need for rescue antiemetic therapy at 0-6, 6-24, 24-48 and 48-72h intervals. These symptoms and associated interference with functioning were collected from the patient using an interactive voice response system. Interference with functioning was measured using a Likert scale including 5 items (appetite, sleep, physical activities, social life, enjoyment of life) that asked how much PONV interfered (1 = not at all, 4 = very much). Functional interference was defined as an average score of 2 or higher across all 5 items.
Results: At least 1 prophylactic antiemetic was administered in 79% of patients, and 2 or more in 60% of patients at time of skin closure. Yet prior to discharge from the PACU, 45% of all patients experienced nausea, and 18% vomited. Similar rates for nausea and vomiting (44% and 23%, respectively) were seen after discharge from the PACU. Rescue medication was taken by 60% of patients. A total of 40% reported functional interference at some point by PONV, with the highest levels of interference related to loss of appetite and enjoyment of life.

Demographics			
Mean age, y (range)	41 (19-69)		
Female, %	88		
No smoking history, %	69		
No alcohol consumption, %	30		
History of PONV, %	65		
History of motion sickness, %	80		
Prophylaxis Treatment, %			
No antiemetic	12		
1 antiemetic	19		
2 antiemetics	29		
3 or more antiemetics	31		
Unknown	9		
Surgery, %			
Laparoscopy	62		
Plastic surgery	20		
		Hours after awakening	
		Early (0-6h)	Overall (0-72h)
Vomiting, %		18	29
Nausea, %		45	59
Use of Rescue Medication, %*		44	60
Functional Interference, %		24	40

*Of these patients, 91% took prescription rescue medication.
Discussion: Despite widespread use of multimodal antiemetic prophylaxis (including short-acting 5-HT_3 receptor antagonists) in patients at risk for developing emetic symptoms, a high incidence of PONV symptoms still occurred in the early postoperative period and can persist up to 72 hours after surgery. In high-risk surgical patients, improved prophylactic antiemetic regimens are clearly needed.
References
1. N Engl J Med. 2004;350:2441-2451.
2. N Engl J Med. 2004;350:2511-2512.

S-279.

ASSOCIATION OF SINGLE NUCLEOTIDE POLYMORPHISM EXPRESSION WITH POSTOPERATIVE NAUSEA AND VOMITING AND RESPONSE TO ONDANSETRON TREATMENT

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Introduction: Postoperative nausea and vomiting (PONV) is a common cause of anesthetic morbidity. We sought to determine if gene single nucleotide polymorphism expression was associated with PONV and the response to Ondansetron.
Methods: Following IRB approval and informed consent, 200 patients aged 18 to 80, ASA I-II, requiring general anesthesia for superficial cutaneous procedures were to be enrolled. A blood sample was obtained from each patient for genetic analysis. A standard anesthetic protocol was used. No prophylactic antiemetics were administered. The presence of PONV was evaluated in the recovery area and Ondansetron 4 mg IV repeated once, was administered to treat nausea or vomiting. Patients not responding to 2 doses of Ondansetron were rescued with other antiemetics.
Results: A total of 161 patients have completed the study to date. Sixty-three patients (39%) experienced postoperative nausea or vomiting and required treatment with Ondansetron. Twenty-eight patients (44%) were unresponsive and required rescue medications. The response rate to Ondansetron treatment was 68% for patients with nausea, but only 39% for patients with vomiting. DNA was extracted from whole blood and analyzed with Jurilab DrugMEt microarray test and assays of over 20 CYP polymorphisms. While there were few patients in the extreme groups UM (Ultra rapid metabolizers - three functional copies of the gene) and PM (Poor Metabolizers - no functional copies of the gene), the UM patients experienced PONV and did not respond to Ondansetron treatment. The PM patients responded to Ondansetron. No significant difference in response between extensive metabolizers (two functional genes) and intermediate metabolizers (one functional gene) was identified.
Discussion: Our results are in agreement with the reported literature for PONV and CYP2D6 expression and Ondansetron treatment failures. Clearly, genes other than CYP2D6 and/or other nongenetic factors explain most variation. Further analysis including Mu, NMDA, Serotonin 5-HT3 and GABA receptor gene polymorphisms is underway. This data will be correlated to the clinical findings to determine what genes may be predictive of PONV and better target treatment modalities.
References:
1, Anesthesiology, V 102, p 543, 2005
2. J Clin Oncol., V 20, p 2805, 2002
3. J Clin Oncol., V 21, p 2147, 2003

S-280.

TITRATION OF FENTANYL BASED ON RESPIRATORY RATES AT EMERGENCE FROM GENERAL ANESTHESIA

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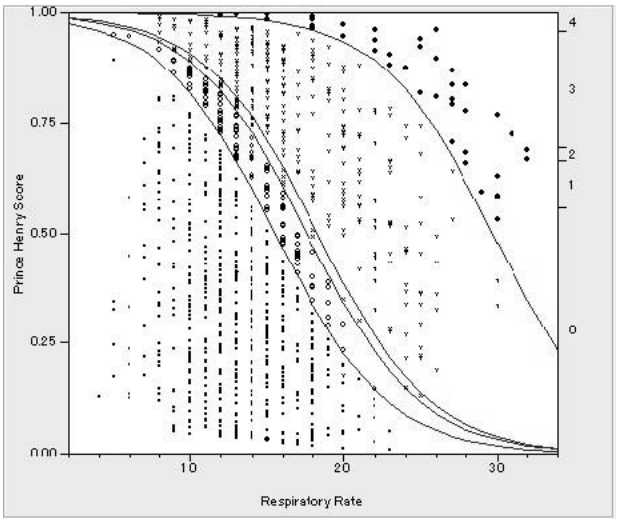
Introduction The effect site concentration(Ce) of fentanyl is not a good index to titrate fentanyl for pain control at emergence from general anesthesia. In this study, we assessed the hypothesis that respiratory rate would be a good index to titrate fentanyl for pain control at emergence from general anesthesia. Furthermore, we assessed whether multimodal approach affected our hypothesis.
Method With IRB-approval, 1,762 patients classified as ASA physical status I-III, with a mean age of 48±18 years, who underwent surgeries under general anesthesia between November 2003 and August 2005 were randomized to one of the two groups. In Group 1(n=1,027), patients were not given nonsteroidal anti-inflammatory drugs (flurbiprofen axetil,FA) during surgery. In Group 2(n=735), patients were given FA by thirty minutes before the end of surgery. Anesthesia was induced with propofol and maintained with sevoflurane. Fentanyl was administered using off-line pharmacokinetic simulation model. Spontaneous respiratory rates and Prince Henry Score (PHS 0: no pain, 1: pain on cough, 2: pain on deep breathing, 3: moderate resting pain at rest, 4: severe resting pain at rest) were recorded at five minutes after they extubated a tracheal tube. The data were analysed by the statistical software (JMP IN5.1.2J, SAS institute Inc.). Ordinal logistic fits of Prince Henry Sore by respiratory rates in both groups were done.
Result there were no statistical differences between the two groups in sex, age, height, weight, %VC, FEV1.0%, anesthetic time, operating time, total dose of fentanyl. Logistic fit of PHS by respiratory rates without FA was in the figure 1 (PHS 0: black dot, 1: white circle, 2: cross, 3: Y, 4: black circle). Respiratory rates in Group 1 were significantly correlated with PHS. Respiratory rates in Group 2 were not significantly correlated with PHS.
Discussion These findings indicate that respiratory rate without NSAIDs is a good index to adjust fentanyl Ce for good pain control. The reason why respiratory rates with NSAIDs were not correlated with PHS was not clear. Although Multimodal approach is better for acute pain control, fentanyl is unable to be titrated based on respiratory rates at emergency from general anesthesia.
Reference none



S-281.

METHYLNALTREXONE IN POST-OPERATIVE BOWEL DYSFUNCTION: RESULTS OF A DOUBLE-BLIND, RANDOMIZED, PLACEBO-CONTROLLED TRIAL IN SEGMENTAL COLECTOMY PATIENTS

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Background: Post-operative bowel dysfunction (POBD) occurs in virtually all patients who undergo bowel resection and the delayed return of function is the most common cause of prolonged hospitalization. Endogenous opioids have been implicated in POBD, which may be exacerbated by opioid pain medications. Methylnaltrexone (MNTX), a quaternary derivative of naltrexone, is a peripheral opioid antagonist that can block peripheral effects of opioids while sparing central analgesic effects. In this double-blind, placebo controlled study, we tested hypothesis that MNTX would shorten the duration of POBD.
Methodology: Following IRB approval and informed patient consent, 65 patients undergoing segmental colectomies were randomized to receive MNTX, 0.3 mg/kg, every 6 hours by IV infusion, or placebo, for a maximum of seven days or up to 24 hours after GI recovery defined as time to tolerance of solid food and first bowel movement. Treatment began within 90 minutes following surgery.

Results: There was no difference in demographics. The time to various recovery milestones are shown in the table below.

Time To (mean ± S.E.)	MNTX (hrs) n=33	Placebo (hrs) n=32	P value (log-rank *)
Toleration of Full Liquids	68 ± 9	97 ± 19	.06
Toleration of Solid Food	97 ± 12	124 ± 17	.13
First Bowel Movement	98 ± 6	118 ± 10	.02
GI Recovery (Composite)	115 ± 9	137 ± 16	.13
Discharge Eligibility	116 ± 7	149 ± 17	.03
Actual Discharge	138 ± 7	165 ± 16	.08

*1-sided
MNTX was well tolerated in this study. The most common adverse events reported were fever and nausea, which occurred at similar rates in both groups. No serious adverse events related to study drug occurred. Withdrawal from the study for any reason was 4 patients on MNTX and 9 patients on placebo. There were no differences in pain scores between the two groups.
Conclusion: MNTX administered post-operatively to patients following segmental colectomy may accelerate bowel recovery and hospital discharge. Confirmatory phase 3 studies are warranted.

S-282.

COMPARISON OF EFFICACY OF OXYBUTYNIN AND TOLTERODINE FOR PREVENTION OF CATHETER RELATED BLADDER DISCOMFORT: A PROSPECTIVE, RANDOMIZED, PLACEBO CONTROLLED DOUBLE BLIND STUDY

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Introduction:
Patients awakening from anesthesia who have undergone catheterization of urinary bladder intraoperatively often complain of an urge to void in the postoperative period because of catheter related bladder irritation. Muscarinic receptor antagonists' oxybutynin and tolterodine have been used successfully for the management of overactive bladder (1). The present study was therefore aimed to evaluate the efficacy oxybutynin and tolterodine in attenuating bladder discomfort in patients undergoing intra-operative catheterization.
Methods:
234 consecutive adult patients, ASA physical status I and II, either sex, undergoing urological surgery requiring bladder catheterization were randomized into 3 equal groups of 78 each. Group C (control) received placebo, group O (oxybutynin) received oxybutynin 5mg and Group T (tolterodine) received tolterodine 2 mg. Drugs were administered orally 1 hour prior to surgery. Following induction of anaesthesia patients were catheterised with a 16 Fr Foley catheter and the balloon was inflated with 10mL normal saline. In the post anaesthesia care unit bladder discomfort was assessed on arrival (0), 1, 2 and 6 hours. Severity of bladder discomfort was recorded as mild (reported by the patient only on questioning), moderate (reported by the patient without questioning; not accompanied by any behavioural responses) and severe (reported by the patient himself and accompanied by behavioural responses).Behavioural responses observed were flailing limbs, strong vocal response and attempts to pull out the catheter. Presence or absence of adverse effects such as postoperative nausea vomiting (PONV), facial flushing, dry mouth and blurred vision were noted.
Results:
In the control group bladder discomfort was observed in 45/78 patients. Significant reduction in the incidence of bladder discomfort was observed following oxybutynin (26/78) and tolterodine (24/78) therapy along with reduction in its severity ($P<0.05$).
Significantly more number of patients treated with either oxybutynin or tolterodine had mild discomfort compared to control at 1 and 2 hr in the postoperative period. Moderate and severe discomfort were more in the control group compared with oxybutynin and tolterodine group at 1 and 2 hr in the postoperative period ($P<0.05$). The incidence of dry mouth was significantly higher in the tolterodine and oxybutynin groups compared with control ($P<0.05$). There were no differences in the incidence of other side effects between the groups at any time.
Discussion:
Both oxybutynin and tolterodine administered 1 hr prior to surgery significantly reduced the incidence and severity of urinary catheter related bladder discomfort in the postoperative period and can be safely administered to patients likely to be catheterized intraoperatively for reducing the incidence and severity of catheter induced bladder discomfort.
References:
1. Prospective randomized controlled trial of extended release oxybutynin chloride and tolterodine in the treatment of overactive bladder: results of the object study. Mayo Clin Proc 2001; 76:358-63.

S-283.

DESFLURANE VERSUS SEVOFLURANE FOR LAPAROSCOPIC GASTROPLASTY IN MORBIDLY OBESE PATIENTS: A COMPARISON OF RECOVERY CHARACTERISTICS

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Introduction: Morbid obesity is a risk factor for postoperative respiratory complications. Sevoflurane and desflurane have the lowest blood/gas partition coefficients, allowing for rapid emergence, which may result in decreased postoperative respiratory complications[1]. The purpose of the study is to compare time to emergence from anesthesia and recovery characteristics with desflurane and sevoflurane in morbidly obese patients undergoing laparoscopic gastroplasty. A previous study showed desflurane was associated with faster recovery in patients undergoing laprotomy[2].
Methods: After institutional IRB approval, seventy patients (35 per group) with a body mass index (BMI) of ≥35 undergoing laparoscopic gastroplasty under general anesthesia were enrolled for this randomized, double blind study. Intra-operative observations were; times from turning agent off to eye opening and extubation. Postoperative observations were; oxygen saturation (SpO_2), blood pressure, heart rate, pain and nausea Visual Analogue Scale (VAS) scores, emesis, modified Aldrete score, and Mini Mental Status (MMS) exam score measured on admission to PACU and at 15 minute intervals until discharge. Interval data was analyzed using t-test, ordinal data with the Mann-Whitney rank sum test. $P < 0.05$ is significant.
Results: Demographic data (gender, age, BMI), duration of surgery, times from turning agent off to eye opening and extubation, and average length of stay in PACU were similar in both groups. Recovery characteristics were comparable except that desflurane resulted in; higher heart rate on PACU admission and at 15 minutes, higher nausea VAS at 15 minutes, higher MMS score at 45 minutes, lower SpO2 at 30, 45, and 105 minutes, but corresponding lower oxygen supplementation (L/min) at 30, and 60 minutes.
Discussion: In morbidly obese patients undergoing laparoscopic gastroplasty, sevoflurane and desflurane result in comparable emergence and recovery characteristics except for lower oxygen supplementation, a higher heart rate, and an increased nausea rate with desflurane in the PACU.
References:
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Eds. Clinical Anesthesia 4th ed. Philadelphia, PA. Lippincott, Williams and Wilkins; 2001:377-417.
2. Anesth Analg. 2004 Dec;99(6): 1848-53. Emergence and recovery characteristics of desflurane versus sevoflurane in morbidly obese adult surgical patients: a prospective, randomized study. Strum EM, Szenohradszki J, Kaufman WA, Anthone GJ, Manz IL, Lumb PD.
TABLE

	Sevoflurane	Desflurane	P value
Age (yrs)	41.4 ± 10.0	44.6 ± 9.6	0.19
BMI (kg/m^2)	47.6 ± 6.7	47.3 ± 6.3	0.88
Operative time (mins)	150.9 ± 22.0	151.7 ± 47.7	0.93
Off-Eye Open (mins)	5.6 ± 4.1	4.6 ± 3.6	0.27
Off-Ext Time (mins)	9.4 ± 5.9	7.8 ± 5.1	0.23
PACU stay (mins)	144.3 ± 24.7	160.2 ± 41.4	0.08
PACU 15 min HR (bpm)	71.3 ± 13.18	79.4 ± 12.10	0.01
PACU 15 min Nausea VAS	21.8 ± 29.95	40.6 ± 37.65	0.03
PACU 30 min SpO2 (%)	99.5 ± 0.73	98.5 ± 2.1	0.01
PACU 30 min O2 (L/min)	9.37 ± 2.0	7.84 ± 2.6	0.01
PACU 45 min SpO2 (%)	99.0 ± 1.93	98.1 ± 1.83	0.02
PACU 45 min MMS	25.41 ± 5.24	27.66 ± 3.12	0.04
PACU 60 O2 (L/min)	6.24 ± 3.10	4.72 ± 2.22	0.02
PACU 105 min SpO2 (%)	98.4 ± 1.85	97.2 ± 1.79	0.01

S-284.

SIMULATION OF THE T_4/T_1-VERSUS-T_1 RELATIONSHIP: THE ROLE OF PHARMACOKINETICS OF THE MUSCLE RELAXANTS

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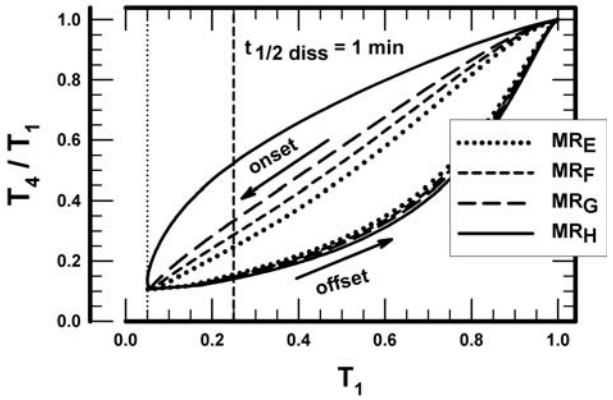
Introduction: Slower interaction of a muscle relaxant (MR) with the presynaptic than the postsynaptic receptors (1) suffices to explain the clinically observed T_4/T_1-versus-T_1 relationship. If the postulate of a slow interaction is accepted, then the time needed to attain peak submaximal neuromuscular block (NMB) by a MR will influence the T_4/T_1 ratio during the onset, but less so during the offset, of NMB. This hypothesis was tested using four hypothetical MRs with varying pharmacokinetics such that MRs produce peak submaximal NMB at varying times.
Methods: We assumed that the amount of acetylcholine (ACh) released by the fourth stimulus is diminished by increasing occupancy of the presynaptic receptors. Dissociation half-life of the MR complex with the presynaptic receptors ($t_{½diss}$) determines how fast the occupancy of the presynaptic receptors develops and wanes. For these simulations, $t_{½diss}$ was set to 1 min. The MRs bind to a single site at the presynaptic ($K_{Dpre} = 10^{-6}$ M), but to two sites at the postsynaptic receptor ($K_{D1}=10^{-7}$ and $K_{D2}=10^{-6}$ M). Twitch strength, be it of T_1 or T_4, was calculated identically from the peak concentrations of the postsynaptic receptors with both binding sites occupied by ACh (2). The four hypothetical muscle relaxants (labeled E to H) were characterized by common V_C and V_{SS} (0.045 and 0.25 $L \cdot kg^{-1}$, respectively), but different systemic clearances (1.5, 5, 10, and 50 $mL \cdot kg^{-1} \cdot min^{-1}$). The transport of the MRs to and from the effect compartment was simulated to occur by diffusion dependent on the concentration gradient and the rate constant $k_{e1}=0.2$ min^{-1}. The ED95 doses ($10^{-7} \cdot mol \cdot kg^{-1}$) and the times (min) of $T_1=0.05$ were: MR_E 0.67 and 7.8, MR_F 0.89 and 5.7, MR_G 1.17 and 4.3, and MR_H 3.09 and 1.8.
Results: T_4/T_1-versus-T_1 plots yielded similar patterns during the offset of NMB for all MRs. However, the MRs with higher clearances and shorter onset times demonstrated less fade during onset than those with slower onset (Figure).



Discussion: Varying fade during onset of NMB by equieffective doses of different MRs can be explained by differences in pharmacokinetic properties of the MRs alone rather than by invoking differences in affinities of the MRs for the presynaptic receptors.
References: (1) Bowman WC: Anesth Analg 59: 935, 1980. (2) Nigrovic V, Amann A: J Pharmacokinet Pharmacodyn 30: 23, 2003.

S-285.

SINGLE DOSE VS CUMULATIVE DOSE - RESPONSE EVALUATION FOR ROCURONIUM - VECURONIUM INTERACTION

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INTRODUCTION: Rocuronium (ROC) - vecuronium (VEC) interaction has been revisited by comparison of their potencies derived from single dose - response (SDR) relationship [(1)]. Cumulative dose - response (CDRR) has been used to study this interaction, but no comparison was made to SDR [(2)]. The aim of the present trial is to compare ROC-VEC interaction assessed by both methods.
MATERIAL & METHODS: During induction with propofol, opioids and nitrous oxide in elective consenting patients, CDRR for ROC and VEC were calculated by administering three small successive doses after a stable previous response. Data for SDR was previously published [(1)] (n= 45). For both methods electromyography was used for monitoring, and ED_{50} obtained by solving Hill equation (γ= 4.75). Using mixtures of fractional ED_{50}, theoretical and experimental potency were calculated, algebraic sum used to identify the type of interaction.
RESULTS: Final doses and blockade during CDRR were: 38 ± 6 and 383 ± 21 $\mu g.Kg^{-1}$, 77 ± 20 and 85 ± 16% for VEC (n= 12) and ROC (n= 11) respectively(mean ± standard deviation). CDRR for the mixture came next, with final doses and blockade of 23 ± 2 and 147 ± 14 $\mu g.Kg^{-1}$ (approximately 1 x ED_{50} [(1)]) and 81 ± 19% (n= 11). By comparison, ED_{50}'s for CDRR were 14 and 38% higher than previously calculated by SDR for VEC and ROC respectively [(1)]. Assuming and additive effect, theoretical and experimental ED_{50}'s from CDRR were 11 to 35% (range) larger than those from SDR for VEC and ROC respectively. Algebraic sum denotes this interaction to be equally additive by either method (Table 1).
DISCUSSION: Both SDR and CDRR methods showed identical final results suggesting that can be used indistinctly for the present purpose. Potency is underestimated during CDRR, as have been described [(3)]. Our results closely resemble that from another study using SDR and log/probit techniques [(4)] (Table 1). In conclusion: CDRR is suitable for identifying ROC-VEC interaction, deserving further trials with other relaxants to take advantage of the small sample size for the construction of the dose-response relationship [(5)].
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Table 1: Results

	ED_{50} $\mu g.Kg^{-1}$ THEORETICAL	EXPERIMEN-TAL	ALGEB SUM
SINGLE DOSE			
ROC (ref. 1)	142 ± 63	105 ± 47	63 ± 14	
VEC	24 ± 8	17 ± 9	11 ± 2	0.907
ROC (ref. 4)	144	72	66	
VEC	23	12	10	0.920
CUMULATIVE			
ROC	232 ± 58	161 ± 37	78 ± 40	
VEC	28 ± 6	19 ± 4	16 ± 4	0.907

S-286.

ATRACURIUM ACCUMULATION-ELIMINATION PROPORTION

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INTRODUCTION: After recovery of a first dose (D1st), cumulative ED_{50} for a second dose (D2nd) of vecuronium or mivacurium resulted twice as potent [(1 - 2)]. No similar studies have been performed on atracurium (ATR) or single dose-response curves used for comparison. These are the aims for the present trail.
MATERIAL & METHODS: In part one: three groups of patients (n= 15 e/a) received 200, 250 or 300 $\mu g.Kg^{-1}$ ATR as a D1st. At 50% spontaneous recovery a D2nd, half sized, was administered. For second dose, the effect was corrected (©D2nd) subtracting the remaining block. Maximal blockade was assessed by electromyography. In both cases, ED_{50} was calculated solving Hill equation.Slope of the curve was obtained from the regression line for log dose-probit effect transformation. In part two: similar groups received 50, 100 or 200 $\mu g.Kg^{-1}$ single doses ATR (SGL). An additional group (n= 11) received cumulative (CMLT) fractional doses of ATR and ED_{50}'s obtained by the same methodology. Analysis of variance, Student-Newman-Keuls, T test and comparison of proportions with $p<0.05$ as significance, were used for statistical comparisons.
RESULTS: In part one: ED_{50}'s D2nd/D1st ratio was 0.32 and for D1st/©D2nd: 0.85: p= 0.0001. In part two: SGL/CMLT ratio was 0.72 not significant different from D1st/©D2nd. During CMLT final dose and block were 250±15 $\mu g.Kg^{-1}$ and 70±10% respectively. Neither cero nor 100% block were noticed (Table 1).
DISCUSSION: As a remaining block is present at the time of D2nd administration, correction should be made in order to obtain real effect [(3)]. Increased potency shown by D2nd can be explained by certain accumulation [(1 - 2)] and decreased potency shown by CMLT is usually related to some elimination during processes [(1)]. Consequently reported SGL/CMLT ratio (ED_{90}: 175/206= 0.84) [(4)] is in the present range. D1st/©D2nd ratio and SGL/CMLT ratio are not significant different, suggesting some correlation should exists between the proportion of accumulation and elimination of ATR. Such findings can't be drawn from previous reports [(1 - 2)] as "complete" clinical recovery from D1st already took place.
REFERENCES: 1) Anaesthesia 1993; 48: 572.- 2) Anaesthesia 1996; 51: 41.- 3) Anesth Analg 2005; 100: S418.- 4) Clin Pharmacol Ther 1988; 44: 56
Table 1.-(♣): (p=<0.05): 1) vs= 2.-3.- 2) vs= 3.- (*): p= 0.0001.- (¶) no statically significant

Part One	(1) D1st	(2) D2nd	(3) ©D2nd	D1st/©D2nd
ED_{50} ($\mu g.Kg^{-1}$)	142±43♣	46±13♣	166±39♣	0.85¶
Part Two	SGL	CMLT		SGL/CMLT
ED_{50} ($\mu g.Kg^{-1}$)	171±81*	235±82*		0.72¶

S-287.

THE RELATIONSHIP BETWEEN DURATION OF SUSTAINED HEAD LIFT AND ACCELEROMYOGRAPHIC TRAIN-OF-FOUR RATIO DURING RECOVERY FROM NEUROMUSCULAR BLOCKADE

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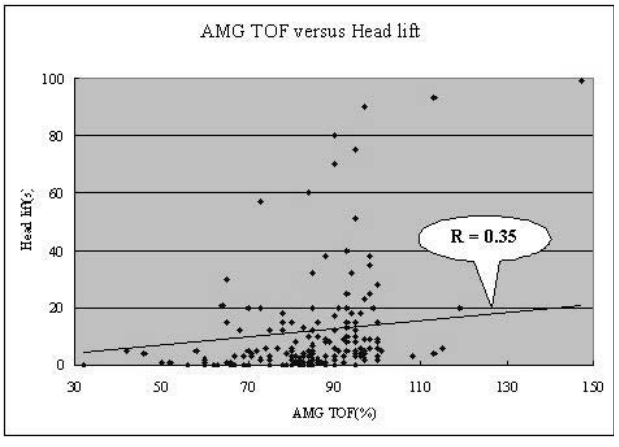
Introduction: Mechanomyography(MMG), electromyography(EMG) and acceleromyographic(AMG) are common objective neuromuscular function monitors. In clinical practice, sustained head lift is often used to assess clinical recovery of neuromuscular blockade. In the past, studies on correlation between sustained head lift and objective neuromuscular function monitoring were often performed with EMG and MMG but not with the more easily available AMG. This study investigates the correlation between AMG TOF (train of four) ratio and duration of sustained head lift on degree of recovery in neuromuscular blockade.
Methods: Thirty-two ASA I or II adult patients scheduled for elective surgery were enrolled and monitored with an AMG monitor (TOF-Watch®). General anesthesia was induced with i.v. fentanyl, lidocaine, propofol and rocuronium. Either endotracheal intubation or laryngeal mask insertion was performed for general anesthesia. Desflurane, O_2 and supplement i.v. fentanyl were used for maintenance. Intermittent rocuronium 4~5mg i.v. bolus was given to sustain a TOF ratio of less than 60%. Lidocaine 2% solution was sprayed onto the cords and the endotracheal tube 5 minutes before emergence. If patients were able to open eyes under command and acknowledge the presence of physician they would be requested to lift their head 5 times with one minute interval in between. Duration of sustained head lift and TOF ratio were simultaneously recorded for each head lifting. Patients were extubated as recovery of TOF ratio reached 95% ~ 100%. The data was analyzed to obtain information on the correlation between AMG TOF ratio and different durations of sustained head lift.
Results: The correlation coefficient (R) between sustained head lift and AMG TOF ratio was 0.35. Average AMG TOF ratio when benchmark was set as sustained head lift duration of ≥ 5 seconds vs ≥ 10 seconds was 88.9% (standard deviation;SD: 13.3%) and 89.3% (SD: 13.6%) respectively.
Discussion: Although sustained head lift is being regarded as the standard test of clinical neuromuscular function[1], we demonstrate that the relationship between sustained head lift and AMG TOF ratio was not linear. Since the average AMG TOF ratio was almost identical for sustained head lift of ≥ 5 seconds and ≥ 10 seconds, we concluded that sustained head lift of ≥ 5 seconds is just as good as ≥ 10 seconds.
References:
1.Miller's Anesthesia 6th ed, vol. 1, p 487, 2004.



S-288.

A RESTRICTIVE METHOD USED FOR THE EVALUATION OF PRIMING VECURONIUM

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INTRODUCTION: Priming technique (PRM) is designed to speed onset time (OT), which is affected by the block achieved and interpatient variability. To minimize these factors a restrictive method (RET) and the speed of action (SA) concept are advised [1 - 3]. The aim of the present trial is to reevaluate PRM principle for vecuronium (VEC) through these proposals.
MATERIAL & METHODS: During induction with intravenous agents and nitrous oxide, consenting patients randomly received VEC, either by bolus (BOL) (n= 38) or PRM (n= 34): 40 or 10 + 30 $\mu g.Kg^{-1}$ respectively, 3 minutes apart. For regular (RGL) method of study, time to 80% block (80%), OT and maximal effect assessed by electromyography. SA was considered as the ratio between OT and fractional blockade (SEC / %) during initial phase (end of drug injection to 80% block), final (between 80% and maximal effect) and global (end of drug injection to maximal blockade). Data for seven patients [1] from each group with final block between 93 and 95% were matched for anthropometric and dosage characteristics and used for the RET study by the same parameters. T test, analysis of variance and Student-Newman-Keuls tests with $p<0.05$ level for significance (SIG), were used for statistical comparisons.
RESULTS: Non-SIG differences among dosage, age, weight and gender distribution, were notice. During RGL, 80%, OT, initial and global SA was SIG shorter after PRM. However, using the RET study non-SIG differences could be achieved (Table 1).
DISCUSSION: During priming with other MRD, fractional onset time and effect have been measured [4 - 5], but insufficient data analysis and full paralyzing doses prevented for further studies. Present results showed that both BOL and PRM have a biphasic onset time [2 - 3]: initial phase being five times faster than final and thus avoiding prolongation for global SA. Wide variability in present and other's time measurement can desfavourably influence statistical assessment. In conclusion: RET technique does not support present or older results showing an accelerated effect due to PRM. Present methodology deserves that previous works should be revisited for valid conclusions.
REFERENCES: 1) Anesth Analg 1993; 77: 574. - 2) Anesth Analg 2005; 100: S424.- 3) Anesth Analg 2005; 100: S422.- 4) Br J Anaesth 1986; 58: 827.- 5) Anesth Analg 1989; 68: 127

Table 1) Results.- (*): seconds. - (**): SEC / %.- (♣): p= 0.0001

	80%*	OT*	INITIAL**	FINAL**	GLOBAL**
REGULAR					
BOLUS	273±68♣	430±97♣	3.41±0,8♣	16±11	4.87±1♣
PRIMING	206±74♣	315±75♣	2,57±0.9♣	17±23	3.61±0.9♣
RESTRICTIVE					
BOLUS	257±85	435±133	3.21±1	15±8	4.74±1.4
PRIMING	185±37	328±55	2.3±0.4	11±2	3.56±0.6

S-289.

SINGLE OR CUMULATIVE DOSE RESPONSE FOR COMPARISON OF ROCURONIUM AND MIVACURIUM

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INTRODUCTION: Cumulative dose-response relationship (CDRR) for mivacurium (MIV) and rocuronium (ROC) are the least studied, only used during modifying conditions or to reveal basic properties[1- 2], but no comparison are made with single-dose technique (SDR). The present trial intends to establish the validity of CDRR method for comparison of both drugs.
MATERIAL AND METHODS: During induction for consenting patients with intravenous agents and nitrous oxide, fractional doses (n=3) were administered successively after a stable response. Using maximal effect assessed by electromyography, CDRR was calculated by solving Hill equation (γ= 4.75)[3]. Data for SDR was previously published[3 - 4]. T test and statistical comparisons for proportions were used for analysis and $p<0.05$ level for significance.
RESULTS: Total dose and maximal blockade during CDRR for MIV and ROC were 79±15 and 383±21 $\mu g.Kg^{-1}$ and 82±16 and 85±13% respectively. Neither cero nor 100% block were noticed. ED's for CDRR were significantly higher than SDR but their ratios at the three levels of potencies were not significant different. Potency ratio between MIV and ROC ranged between 0.26 and 0.31, not significantly different for all three ED's and methods. ED_{95}/ED_{50} ratio for either technique or drug did not differ statistically.
DISCUSSION: ED's from SDR were higher for ROC and lower than reported for MIV[1, 5], possible related to the slope of the curve (γ)[1], monitoring techniques[2, 5], arbitrary adjustment to maximal depression[1-5] and individual variability. After CDRR, potency for MIV and ROC is underestimated in comparison to single dose technique, as have been described[6]. Close similarity of proportions between single/cumulative ratios for both agents are remarkable, and probably explains the succeded CDRR calculations for MIV, a very short plasma lived drug. In conclusion: Although absolute potency for MIV and ROC can not be derived from CDRR, it is useful for comparisons during different conditions, provide an own control instead of historical data are made. Slope of the curve, arbitrary modifications to the data and other methodological features should be mentioned.
REFERENCES: 1) Anaesthesia (1996) 51: 41.- 2) Can J Anesth (1998) 45: 526.- 3) Can J Anesth(2003) 50: A61.- 4) Anesth Analg (2004) 98: S253.- 5) Anesth Analg (1993) 77: 570.- 6) Anesth Analg (1994) 78: 608

S-290.

THE SAFETY AND EFFICACY OF 5 DOSES OF SUGAMMADEX WHEN ADMINISTERED AT 1-2 PTC'S AFTER ADMINISTERATION OF ROCURONIUM:

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Introduction: Sugammadex (Org 25969) is the first agent in a novel class of drugs referred to as Selective Relaxant Binding Agents (SRBAs). It is a gamma cyclodextrin that forms inclusion complexes with rocuronium and other steroidal neuromuscular blocking agents. The encapsulated rocuronium does not have any effects on neuromuscular conduction or function. This agent complexes rocuronium, rather than simply antagonizing its action. It reduces the amount of rocuronium available to bind to nicotinic receptors therefore also be effective during deep neuromuscular blockade. This study was designed as a dose-finding study to assess the safety and efficacy of various doses of sugammadex in reversing a rocuronium induced deep neuromuscular block.
Methods: A Phase II, randomized, multi-center trial was undertaken to compare 5 doses of sugammadex in reversing a deep rocuronium induced neuromuscular block. IRB approval was obtained. Neuromuscular blockade was monitored by acceleromyography with the TOF-Watch® SX (Organon Ltd, Dublin, Ireland). Train of four measurements were obtained every 15 seconds during surgery. Intravenous agents and nitrous oxide were used for the maintenance of general anesthesia. Rocuronium (0.6 and 1.2mg/kg) was used to facilitate intubation and for maintenance of the neuromuscular block (0.15mg/kg). Reversal of the neuromuscular block was only permitted after a demonstrated Post-Tetanic Count (PTC) of 1-2. A randomized dose of 0.5, 1.0, 2.0, 4.0 or 8.0mg/kg of sugammadex was administered for reversal. Recovery was defined as the first of three consecutive TOF readings of T_4/T_1 ratio of 0.9.
Results: 29 of the 50 patients enrolled in this study had TOF-watch tracings which could be analyzed for recovery to a T_4/T_1 ratio of 0.9. The times of recovery are summarized in this table.

	0.5mg/kg	1mg/kg	2mg/kg	4mg/kg	8mg/kg
Number	4	5	8	4	8
Mean (mm:ss)	38:17	14:33	4:59	2:37	1:15
Range (mm:ss)	20:34-84:07	4:31-33:13	1:49-15:13	1:27-4:28	0:49-2:05

No drug related serious adverse events were reported.
Discussion: Sugammadex appears to be effective in rapidly reversing a deep rocuronium induced neuromuscular block. Doses of 4.0 mg/kg or greater can reverse a block with a PTC 1-2 in less than 3 minutes. Anticholinesterase reversal at this level of block is not possible. Doses ≤ 1.0 mg/kg of sugammadex can not bind enough rocuronium to reverse a deep block quickly. Sugammadex safely and reliably reverses a deep neuromuscular block at dose of 2.0 mg/kg or greater. More studies of this revolutionary new drug are warranted.

S-291.

AN ADVISORY SYSTEM FOR REMIFENTANIL ADMINISTRATION BASED ON THE GRADIENT BETWEEN STATE ENTROPY AND RESPONSE ENTROPY

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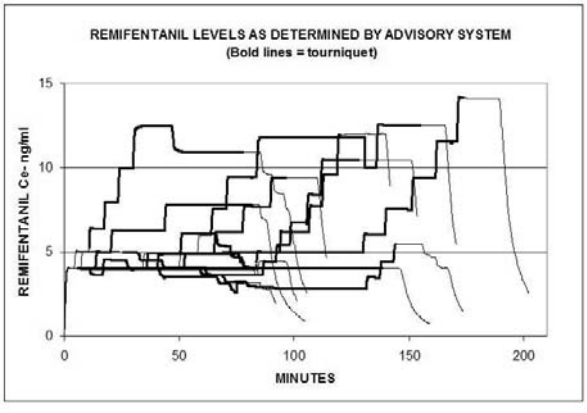
Introduction: Facial electromyographic (FEMG) activity is a potential source of information about patient reactivity to surgical stimulation and opioid may be titrated to suppress FEMG. The difference, or gradient, between state entropy (SE, M-ENTROPY, GE Healthcare, Waukesha, Wisconsin) and response entropy (RE) represents activity between 32-47 Hz, frequencies among those seen with FEMG activity. This study evaluates a remifentanil advisory system (RAS), which utilizes the gradient between SE and RE to guide the administration of remifentanil in a target-controlled infusion (TCI) system.
Methods: Patients undergoing anterior cruciate ligament reconstruction were studied. Anesthesia was induced with effect-site concentrations (Ce) of propofol 3.5 mcg ml^{-1} (Schneider kinetics), and of remifentanil 4.0 ng ml^{-1} (Minto kinetics), both via RUGLOOP (M Struys and T DeSmet, Ghent University Hospital, Belgium) TCI. Propofol Ce was adjusted to maintain a SE of 50. Remifentanil Ce was determined by an algorithm that advised a 25% increase if the entropy gradient increased above a threshold for a period of time and advised a 10% decrease if the gradient decreased below a threshold value for a period of time. A "lock-out" period following adjustments temporarily prevented further changes. At end of the procedure, both agents were discontinued simultaneously and time to eye opening to verbal stimulation and orientation were determined.
Results: 14 patients were studied. Case duration was 129 ± 38 min with a tourniquet time of 87 ± 18 min. The resulting remifentanil Ces are shown in the graph. Average propofol Ce (with SD) and average remifentanil Ce (SD), respectively, were: end of prep, 2.81 (0.66) and 4.14 (0.38), end of surgery, 1.81 (0.76) and 7.20 (3.33), eye opening, 1.01 (0.33) and 3.32 (2.46), and orientation, 0.84 (0.27) and 2.25 (1.65). Time to eye opening and orientation (25th percentile-median-75th percentile) were 3 - 4 - 9 min and 5 - 8 - 10 min, respectively.
Discussion: This "proof of concept" study demonstrates that anesthetic care guided by the RAS results in a decreased propofol and an increased remifentanil Ce compared with those at induction. Patients had clinically acceptable times to awakening and orientation. These data suggest that the gradient between SE and RE may be useful in determining adequacy of opioid administration and that it could potentially be utilized for closed-loop control of remifentanil administration.



S-292.

DOES THE "IDEAL" COMBINATION OF REMIFENTANIL AND SEVOFLURANE CHANGE AS THE DURATION OF SURGERY INCREASES?

AUTHORS: S. C. Manyam, **D. K. Gupta**, K. B. Johnson, J. L. White, D. R. Westenskow, T. D. Egan;
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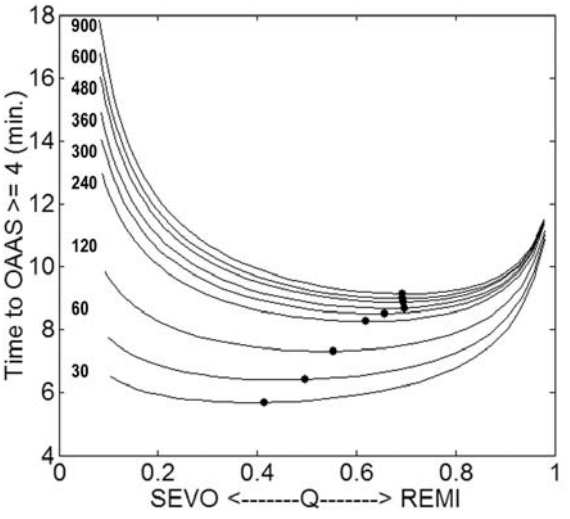
Introduction: Anesthesia is most often achieved by a combination of a volatile anesthetic and an opioid. Utilizing pharmacokinetic models and pharmacodynamic response surface models, it should be possible to determine the combination of sevoflurane and remifentanil that would result in the shortest time to awakening for anesthetics with different durations.
Methods: A response surface model that described the interaction between sevoflurane and remifentanil in preventing response to tetanic stimulation (a surrogate for surgical incision) based on volunteer data was generated and used to determine a variety of opioid/sedative ratios, Q, that produced clinically adequate anesthesia. (Q=0 for sevoflurane alone and Q=1 for remifentanil alone) Published pharmacokinetic models were used to simulate dosing regimens that maintained constant effect site concentrations that produced clinically adequate anesthesia as determined by our response surface models, across the entire range of Q. These simulations were used to identify the opioid/sedative mixture that yielded the fastest recovery (Observer's Alertness and Assessment Scale, OAAS ≥ 4) from anesthetics with durations varying from 30 to 900 minutes.
Results: The figure shows the time to achieve an OAAS ≥ 4 (Y-axis) versus the drug ratios (X-axis) for anesthetics of different lengths. The optimal sevoflurane-remifentanil combination for each anesthetic duration is depicted as the black dots. As the length of the procedure increased, faster recovery was produced by mixtures containing higher amounts of remifentanil. This trend plateaus at a ratio of 0.7 (0.68 ET% sevoflurane and 6.8 ng•mL^{-1} remifentanil).
Discussion: For longer duration anesthetics, the pharmacokinetic advantage of remifentanil becomes more apparent. However, the ratio (Q) that resulted in the shortest time to achieve OAAS ≥ 4 plateaus at 0.7 because opioids alone cannot produce complete sedation unless an extremely high concentration is achieved. Our simulations utilizing pharmacokinetic models and our response surface model showed a maximum MAC reduction of approximately 70% which has been observed by other investigators. Therefore this demonstrates the possible utility of this approach in determining the combination of an opioid and a potent volatile agent that minimizes the time to awakening.



S-293.

SIMULATION OF THE T_4/T_1-VERSUS-T_1 RELATIONSHIP: THE ROLE OF THE PROPERTIES TENTATIVELY ASSIGNED TO THE PRESYNAPTIC RECEPTORS

AUTHORS: **V. Nigrovic**[1], S. B. Bhatt[1], A. Amann[2];
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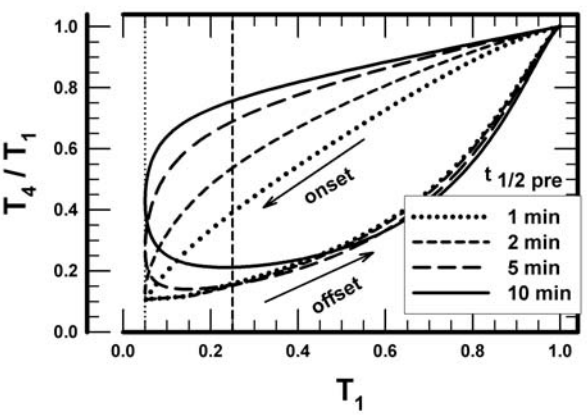
Introduction: During the offset of neuromuscular block (NMB) and for a given T_1, the T_4/T_1 ratio is similar for several muscle relaxants (MRs). For the same T_1, the ratio is higher and variable during the onset. Twitch fade, ie, T_4<T1, was interpreted from (i) acetylcholine (ACh) binding to and activating the presynaptic receptors, and (ii) MRs occupying the presynaptic receptors and inhibiting the facilitatory action of ACh. The details of the interaction of MRs with the presynaptic receptors are not known. The current study examines how the parameters of this interaction influence the T_4/T_1-versus-T_1 relationship.
Methods: The simulations were based on the following assumptions: (a) The first stimulus (S_1) releases a constant amount of ACh, while the amount released by the fourth stimulus (S_4) is reduced depending on the occupancy of the presynaptic receptors by the MR. (b) The rates of interaction of a MR with the postsynaptic receptors are fast, those with the presynaptic receptors are slow. Occupancy of the presynaptic receptor (a single site for a MR) was characterized by dissociation half-life of the complex ($t_{½diss}$ of 1, 2, 5, or 10 min), and equilibrium dissociation constant ($K_{Dpre}=1\cdot10^{-6}$ M). The MR binds to two sites at a postsynaptic receptor with different affinities ($K_{D1}=10^{-7}$ and $K_{D2}=10^{-6}$ M). (c) Following the release of ACh by S_1 or S_4, T_1 or T_4 were calculated from the peak concentrations of the postsynaptic receptors with both binding sites occupied by ACh (2). (d) The hypothetical MR (dose=ED95) was characterized by $V_C=0.05$ and $V_{SS}=0.25$ L·kg^{-1}, and plasma clearance=0.005 L·kg^{-1}·min^{-1}. Transport to the effect compartment was simulated as diffusion governed by the concentration gradient and the rate constant $k_{e1}=0.2$ min^{-1}.
Results and Discussion: The peak concentration of the MR in the effect compartment is reached at 3. 8 min. All conditions simulate a higher T_4/T_1 ratio during the onset than during the offset of NMB. During the onset of NMB and for any T_1, T_4/T_1 ratio increases with increasing $t_{½diss}$. We conclude that a slow interaction with the presynaptic receptors suffices to simulate the hysteresis loop of the T_4/T_1-versus-T_1 relationship.
References: (1) Bowman WC: Anesth Analg 59:935, 1980. (2) Nigrovic V, Amann A:J Pharmacokinet Pharmacodyn 30:23, 2003.



S-294.

ONSET TIME AND SPEED OF ACTION CHANGES: ADDITIONAL CLINICAL EVIDENCES

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INTRODUCTION: Initial speed of action (ISA) for muscle relaxants, ratio between fractional onset time (OT) and 80% blockade is by far faster than final (FSA): 80% to maximal effect (MAX) ratio or biphasic onset time (BOT). Consequently, resulting global speed of action (GSA: OT / MAX) is not significantly slower than ISA[1-3]. For a second dose (D2nd) of rocuronium however, GSA is similar to FSA during the first administration (D1st)[4]. When a D2nd is administered a remaining block is present and often overlooked during calculations[5]. The aim of the present trial is to afford additional clinical data in order to explain BOT using these findings.
MATERIAL & METHODS: During induction, 40 $\mu g.Kg^{-1}$ vecuronium was administered as D1st. Spontaneous recovery was allowed and patients randomly received either D2nd half of the initial at 50% recovery (Group 1, n=27) or a quarter at 25% recovery (Group 2, n=17). Using electromyography, time to 80% block, OT, MAX, and partial recovery were assessed. ISA, FSA and GSA were calculated as defined above. Remaining block were subtracted from actual effect for correcting GSA (©GSA). Analysis of variance, Student-Newman-Keuls and T test with $p<0.05$ level for significance, were used for statistical comparisons.
RESULTS: OT and GSA were faster after D2nd. ISA was several times faster than FSA. ©GSA in group 2 was significantly slower than group 1, but similar to FSA for both groups (Table 1).
DISCUSSION: As previously described[1] ©GSA truly represents the effect for D2nd, which is similar to FSA in group 2 (25% recovery), possible by sharing the same mechanism of action. But for group 1 (50% recovery), modifications on pharmacodynamic (sensitivity)[6] or pharmacokinetic (molecular concentration)[7] properties at the receptors and/or biophase would take place. These changes are different between group 1: 50 to 75% blockade and group 2: 75% to MAX. In conclusion: resulting findings support this previous hypothesis on BOT[4].
REFERENCES: 1) Anesthesiology 2003; 99: A1128. 2) Anesth Analg 2004; 98: S254. 3) Anesth Analg 2005; 100: S421. 4) Anesth Analg 2005; 100: S422. 5) Anesth Analg 2005; 100: S418. 6) Anesthesiology 1994; 81: 59. 7) Anaesthesia 1993; 48: 572
(*) & (**): .p= 0.0001.- (♠): seconds/%.- (♣): .p= 0.443.- (¶): 2)vs=1-3

Table 1 Group 1	OT	INITIAL♠ [1]	FINAL♠ [2]	GLOBAL♠ [3]	©GLOBAL♠
1st Dose	393±72*	3,27±0,9	10±4♣	$^{\alpha}$4,3±0,9*¶	
2nd Dose	259±95*			$^{\beta}$2,7±1*	5,9±2,5
Group 2					
1st Dose	357±66**	3±0,9	12±10♣	$^{\gamma}$3,9±0,9**¶	
2nd Dose	177±58**			$^{\chi}$1,9±0,65**	12±5♣
SIG		.p= 0.393	.p= 0.188	β)vs=α γ λ λ)vs=α γ	

S-295.

COMBINED INDUCTION OF PROPOFOL WITH MIDAZOLAM ATTENUATES HEMODYNAMIC AND HEART RATE VARIABILITY CHANGES DURING INTUBATION

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Introduction: Combined induction is the administration of a small dose of sedative agent or anesthetic prior to induction. Propofol and midazolam act synergistically hypnotic action in combination (1). Midazolam can reduce the responses caused by emotional and physical stress because of anxiolytic effect. The hypothesis of the study is induction of Midazolam with Propofol reduces the hemodynamic and Autonomic Nervous System (ANS) activity during intubation than Propofol alone.
Methods: After institutional approval, a prospective randomized double blind study, 20 patients were equally allocated into 2 groups. Induction was conducted with 2-2.5 mg/kg of propofol in group I and 0.1 mg/kg midazolam with 1-1.5 mg/kg of propofol in group II. Anesthesia was maintained at a rate of 6-8 mg/kg/hr of propofol and 100% oxygen in both groups. Targeting BIS index was 30-40, through out the study. Intubation was facilitated with vecuronium 0.2 mg/kg. The hemodynamic changes (Blood pressure; BP, heart rate; HR, Stroke volume; SV) and ANS activity were measured at baseline, after induction of anesthesia, during intubation and 1, 3, 5 min after intubation. Spectral analysis of heart rate variability {Low-frequency component (LF: 0.04-0.15 Hz), High-frequency component (HF: 0.15-0.4 Hz)} was assessed by MemCalc (Suwa Trust, Japan) as an index of ANS activity (2). The normalized unit (nu) power of LF was taken as an indicator of sympathetic activity or "sympatho-vagal balance" and nu HF as an indicator of parasympathetic activity. SV was measured non-invasively with Pulse Doppler Echocardiogram (ACUSON Cypress, USA). Repeated-measures analysis followed by Bonferroni correction was performed for between-group comparison.
Results: BP was equally decreased after induction in both groups. BP was more increased during and 1 min after intubation ($P < 0.05$) in group I. HR didn't change after induction in group I, but increased in group II. HR was more increased during intubation ($P < 0.05$) in group I. After induction, although equally decreased in cardiac output in both groups, SV was more decreased in group II ($P < 0.05$) compared with group I. During and after intubation, SV was equally increased. After induction, nu LF and nu HF were equally decreased in both groups but nu LF was more increased during intubation in group I ($P < 0.05$). There was no significant change of nu HF during and after intubation.
Discussion: Combined induction of Midazolam with Propofol attenuated the BP, HR and sympathetic action during intubation. After induction, decrease in SV with decrease in BP caused increase in HR. It means that compensated baroreflex activity of combined midazolam action. Equally increase in SV during intubation in both groups with different BP changes showed more increased systemic vascular resistance in propofol group.
References:
(1) Br J Anesth 67:539-45, 1991
(2) Anesth Analg 101:97-102, 2005

S-296.

TRANSDERMAL BUPRENORPHINE IN PATIENTS UNDERGOING OPEN-HEART SURGERY HAS NO EFFECT ON FAST-TRACK FENTANYL ANESTHESIA

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OBJECTIVE:
Evaluate, if simultaneous use of opioids with different pharmacological profile during anesthesia may lead to prolongation of effects. Assess if long-term use of transdermal buprenorphine may result in a reduced sensitivity to opioid anesthesia.
METHODS AND RESULTS:
In a prospective study, overhang of opioid effects and reduced vigilance was determined in patients (n=22) carrying a buprenorphine patch for at least 2 months for treatment of chronic pain, while undergoing a fentanyl-based fast-track enflurane anesthesia for open-heart surgery. Patients were compared with a control group (n=21) undergoing similar open-heart procedures with no other opioid than fentanyl on board. Time to extubation, total dose of fentanyl, postoperative blood gases, and Aldrete score were used to determine possible overhang of opioid effects and/or development of tolerance in the buprenorphine compared to the control group. Both groups had similar operation and anesthesia times and comparable doses of fentanyl (0.69 mg ±0.23 versus 0.67 mg ±0.16 SD). There was no significant difference in arterial blood gases (paO2 136 torr ±48 versus 128 torr ±35 SD; pCO2 43.3 torr ±3.3 versus 41.9 torr ±1.2 SD), time till extubation (27 min ±22 versus 33 min ±24), and vigilance and recovery score (6.8 ±1.0 versus 7.5 ±0.8 arbitrary units) between the two groups, 60 min following end of anesthesia.
DISCUSSION:
Due to adaptive mechanisms and the development of tolerance in patients with buprenorphine, respiratory depression or sedation does not project into the postoperative period. The high receptor affinity of the partial agonist buprenorphine results in a sufficient receptor reserve for additional opioid binding. The significant ($p < 0.05$) lower incidence of PONV in patients with transdermal buprenorphine is due to the development of tolerance during previous long-term opioid use.

S-297.

PROPOFOL IN A MODIFIED CYCLODEXTRIN FORMULATION: FIRST IN MAN PHARMACODYNAMICS

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Introduction: The currently marketed propofol formulation has a number of undesirable properties that are in part a function of the lipid emulsion formulation, including pain on injection,[1] serious allergic reactions,[2] and the support of microbial growth.[3] A modified cyclodextrin based formulation of propofol has been developed that may have some advantages over the current formulation by mitigating these formulation dependent problems. A recent study in a porcine model suggests that the pharmacokinetics (PKs) and pharmacodynamics (PDs) of the propofol in cyclodextrin formulation (PinCD) are substantially similar to the propofol in lipid formulation (PinL).[4] The aim of this study was to compare the PDs of PinL with those of the new PinCD formulation, particularly with regard to pain on injection. We hypothesized that the PinCD would be associated with less pain on injection and similar sedative, hemodynamic and respiratory effects compared to PinL.
Methods: Conducted with institutional approval and informed consent, this was a single-center, double-blind, two-period, randomized, dose-escalating study using a complete crossover design in young, healthy volunteers. Each subject was randomly assigned to receive bolus intravenous injections of either PinCD or PinL (dose escalation from 0.125 mg/kg to 2 mg/kg in groups of N=4); crossover injections were conducted 3 hours later. Pain at the injection site (assessed by both the subject and a blinded observer), sedative effect (as represented by the Bispectral Index Scale), hemodynamic and respiratory variables were the primary outcome measures. Pain on injection was compared using non-parametric tests (Wilcoxon Signed Rank Test); other variables were compared using standard analysis of variance methods.
Results: 24 subjects were enrolled and completed the study. Both formulations were generally well tolerated. Both formulations elicited pain on injection for all subjects. The pain scores for the PinCD formulation were statistically higher than the scores for the PinL formulation when evaluated over all doses. No statistically significant difference was observed between the formulations when assessed within dosage groups where the sample size was small (N=4). There were no differences between the formulations in sedative, hemodynamic or respiratory effects.
Discussion: The hypothesis that the PinCD formulation would exhibit less pain on injection compared to PinL was not confirmed. For the other PD measures, the formulations were not different.
References: 1. Anesth Analg 1993;77(4 Suppl):S3-9; 2. Anesthesiology 1992;77(2):275-80; 3. N Engl J Med 1995;333(3):147-54; 4. Anesth Analg 2003;97:72-9

S-298.

O.D. ON DEX

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A 59 year old male presented for stereotactic implantation of deep brain stimulating electrodes. His symptoms began with a right side writer's cramp which progressed to cervical torticollis, left arm flailing, and eventually generalized dystonia over a period of two years-to the point that he was unable to ambulate. He required sedation for the MRI due to his extreme degree of dystonia.
Initially, sedation was maintained with a propofol infusion. During the electrode implantation and deep brain stimulation, it was requested that propofol be discontinued. A dexmedetomidine infusion was initiated at 2.0mcg/kg/hr (instead of the planned 0.2mcg/kg/hr). This was supplemented with remifentanil at 0.005mcg/kg/min. 63 minutes later, the accidental overdosing was noted. The total amount of dexmedetomidine administered during this period was 167.5mcg. At this point, both infusions were stopped and for the next hour sedation was maintained with propofol at 20mcg/kg/min. After the second hour, all sedation was discontinued.
The patient remained well sedated with good respiratory effort, normal respiratory rate, no airway obstruction, stable heart rate, and stable blood pressure. After an additional two hours, the patient awakened and sedation was maintained with the combination of a propofol infusion supplemented with an intermittent remifentanil infusion. He was evaluated on post-operative days 1-2. His hospital course was uneventful. He was discharged home on postoperative day number two without complication.

S-299.

PRE-ANESTHETIC MANAGEMENT REDUCES HETEROTOPIC OSSIFICATION AFTER HIP ARTHROPLASTY

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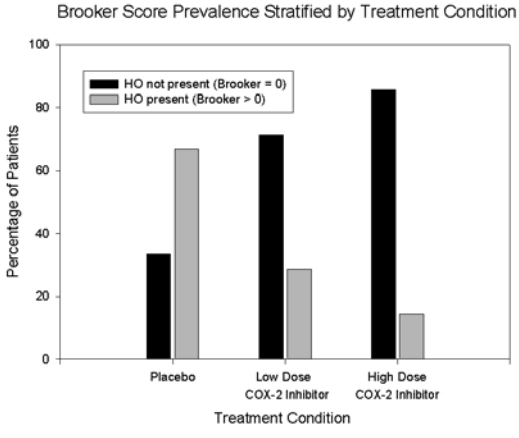
Introduction: Heterotopic ossification (HO), a formation of bone in the muscles and connective tissue surrounding joints, frequently follows hip arthroplasty, limiting motion and resulting in pain. The incidence of HO in untreated patients is 65% (Int J Radiat Oncol Biol Phys 1997;36:961). Long-term postoperative NSAID or cyclooxygenase-2 (COX-2) inhibitor treatment reduces the incidence of HO following hip arthroplasty to 14-18% (J Arthroplasty 2004;19:14). The present study investigates whether preoperative COX-2 inhibitor administration can reduce the incidence of HO.
Methods: After Institutional Review Board approval and signed consent, 27 osteoarthritis patients undergoing primary total hip arthroplasty were randomized to 3 groups: oral rofecoxib 50 mg each day for 4 days presurgery and on the morning of surgery (high dose group); oral placebo each day for 4 days presurgery and 50 mg rofecoxib on the morning of surgery (low dose group); oral placebo each day for 4 days presurgery and on the morning of surgery (placebo group). All prior NSAID and COX-2 inhibitor therapy was discontinued 14 days prior to surgery and postoperatively. All patients received spinal anesthesia (bupivacaine with fentanyl) and postoperative pain management with intrathecal bupivacaine and fentanyl. AP radiographs at 6 months post-surgery were reviewed by an investigator, blinded to the group allocation, to evaluate presence or absence of HO according to Brooker's criteria (J Bone Joint Surg Am 1973;55:1629). To quantify association between treatment groups, the treatment conditions were ordered with respect to increasing dose and then compared with presence or absence of HO, as assessed by the Brooker criteria, using a Mantel-Haenszel Chi-Square test.
Results: There was a significant difference between the 3 treatment groups and the presence or absence of HO (p=0.0336) (Figure). The incidence of HO at 6 months after surgery was significantly reduced by five-day preoperative dosing of a COX-2 inhibitor compared to placebo (p=0.0361).
Discussion: These results suggest that preoperative COX-2 inhibitor administration may be an effective measure for the prevention of HO. Although postoperative NSAID or COX-2 inhibitor administration, or postoperative irradiation, are also effective in reducing HO, preemptive treatment with a COX-2 inhibitor seems preferable, especially in view of other outcome benefits that have been demonstrated with use before other joint replacement surgery (JAMA 2003;290:2411).



S-300.

EVALUATION OF DILTIAZEM ON CARDIOVASCULAR RESPONSES TO TRACHEAL INTUBATION IN THE PATIENTS WITH CORONARY HEART DISEASE

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INTRODUCTION: As well-known the systemic hemodynamics stress, tracheal intubation will increase the risks of morbidity and mortality in patients with cardiovascular or cerebral disease. Diltiazem, a calcium channel blocker, has been demonstrated to be effective in stabilizing systemic hemodynamics during tracheal extubation. Therefore, we designed this randomized, double-blind, placebo-controlled study to evaluate the effect of diltiazem on cardiovascular stress to tracheal intubation in the patients with coronary heart disease.
METHODS: Fifty-two consented coronary heart disease patients scheduled for coronary artery bypass grafting procedure were enrolled in this prospective study. Premedication consisted of scopolamine 0.3 mg IM and morphine 10 mg IM. The study medication diltiazem (Diltiazem group) 0.2mg/kg IV or normal saline (Control group) 5 ML IV was injected slowly within 2 min before induction. Anesthesia was induced with midazolam 0.02 mg/kg IV, etomidate 0.2 mg/kg IV, and fentanyl 4 ug/kg IV. Intubation was facilitated with rocuronium 0.6mg/kg IV. Laryngoscopy and tracheal intubation were successfully performed within 30 sec. Dynamic electrocardiogram was continuously monitored during the study period. The mean arterial pressure (MAP), heart rate (HR), as well as the rate pressure product (RPP) (SBP multiple HR) were recorded at specific time points. In addition, the CMV1, CMV3, and CMV5 ST_T changes of DCG were analyzed to evaluate the incidence of myocardial ischemia. (a= $p<0.05$ vs baseline; b= $p<0.05$ vs control group).
RESULTS: The demographic characteristics were similar in both study groups. The dosages of etomidate, fentanyl, and rocuronium were also similar in each group. Patients who received saline experienced significant increases in MAP, HR and RPP associated with tracheal intubation than diltiazem. Furthermore, the percentage change of DCG ST-T was significantly higher in control group than diltiazem group (56% vs 26%). Two patients in control group were observed ST segment changes (vs no patients in diltiazem group).
DISCUSSION: Diltiazem can effectively prophylaxis cardiovascular stress to laryngoscopy and tracheal intubation in the patients with coronary heart disease.

	Control group (n=28)	Diltiazem group (n=24)
Age (yr)	61±11	59±11
MAP baseline (mmHg)	93±13	97±16
MAP intubation (mmHg)	102±24a	81±15b
MAP 1 min after (mmHg)	121±27a	92±23b
MAP 3 min after (mmHg)	114±23a	88±21b
HR baseline (bpm)	71±9	73±9
HR intubation (bpm)	86±17a	72±12a,b
HR 1 min after (bpm)	99±16a	81±16b
HR 3 min after (bpm)	94±18a	77±15b

S-301.

USE OF HERBAL REMEDIES, VITAMINS AND MINERALS IN PREOPERATIVE PATIENTS

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Introduction: Popularity of complementary and alternative medicine (CAM) and in particular the use of herbal remedies, vitamins, and minerals is steadily increasing.
Methods: During a 6-month period, patients of all ages presenting in our university-hospital anesthesia preoperative assessment clinic were asked to fill out a questionnaire about their use of dietary supplements. Additionally, information about the patients' level of education as indirect indicator for their social status were obtained.
Results: Data from 3982 patients (26.3% with a malignant tumor) could be analyzed. 18.0% of the patients took CAM on a regular basis (mostly valerian, St. John's wort, and garlic; vitamins; magnesium, calcium, and zinc). Older patients more often reported on CAM use (61-80 years: CAM use in 39.1% of patients; 41-60 years: 30.5%; 15-40 years: 17.1%; 6-14 years: 1.7%; and 0-5 years: 7.9%), and more women (55.3%) compared to men (44.7%). Main self-reported indications for CAM use were enhancement of immune function (26.6%) and use as dietary supplement (20.5%). Only 32.4% of CAM using patients voluntarily disclosed their CAM medication in the written preoperative anesthesia questionnaire and 47.1% only if specifically asked for CAM use by the anesthesiologist during preoperative assessment. There was no correlation between level of education and CAM use.
Discussion: Our results indicate that self-medication with CAM is common in preoperative patients - even children - consistent with the increasing popularity of CAM in the general population. Awareness about side effects and interactions of CAM with drugs used in anesthesia is accumulating. For example, many herbal remedies like garlic, ginseng, and gingko inhibit platelet function hence posing patients scheduled for spinal or epidural anesthesia at a potential risk for spinal/epidural hematoma formation. Even spontaneous epi-/subdural bleeding has been attributed to CAM intake, however currently, there do not seem to be specific concerns as to the timing of neuroaxial block in relationship to the dosing of herbal therapy, though data on the combination of CAM with anticoagulants are lacking (1). Other dietary supplements interact with concomitantly administered drugs, mimicking, magnifying or opposing their effects. Presently there are no valid data suggesting if and when to discontinue CAM before surgery. The ASA suggested that all herbal medicines should be discontinued two to three weeks before elective surgery to avoid potential harm to patients. For anesthesia providers obtaining a detailed history of CAM use must be a mandatory part of the preanesthetic evaluation, and patients should be cautioned against mixing herbs and pharmaceutical drugs (2).
References: 1. Reg Anesth Pain Med 2003; 28: 172-197; 2. Lancet 2000; 355: 134-138

S-302.

HAEMODYNAMIC RESPONSES OF PERIOPERATIVE INFUSION OF LIDOCAINE ON INTUBATION AND EXTUBATION

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Introduction: This study tested the hypothesis that an infusion of lidocaine effectively controls hemodynamic changes associated with intubation and extubation.
Method: Following IRB approval, 10 ASA I and II adult female patients, undergoing elective laparoscopy were selected. The patients were randomly divided into two groups and received the following:
Control Group A [n=5]: Normal saline bolus and infusion at comparable volume and rate as the study group.
Study Group B [n=5]: 1.5mg/kg IV bolus of lidocaine followed by infusion at the rate of 1.5mg/kg/hr till one hour postoperatively.
Anesthesia was induced with 2mg/kg of IV propofol and 0.1mg/kg of vecuronium bromide. Immediately after intubation, patients received a mixture of oxygen and nitrous oxide [40% and 60% respectively] and an infusion of propofol in step down manner [10 mg/kg/hr for first 10 minutes, 8 mg/kg/hr for next 10 minutes followed by a continuous infusion at the rate of 5mg/kg/hr.] Propofol infusion was terminated 3-5 minutes prior to conclusion of surgery. Reversal of residual neuromuscular blockade was achieved with neostigmine glycopyrrolate, 0.04 mg/kg 0.01 mg/kg respectively. Extubation of trachea was performed after having achieved TOF > 0.8 in a patient responsive to verbal command.
Data: Heart rate (HR) and Mean Arterial Pressure (MAP) were recorded immediately before starting the infusion of lidocaine, prior to induction of anesthesia, postinduction, after laryngoscopy and intubation subsequently at 3,5,10 minutes after intubation, Table I.
Periextubationperiod: HR and MAP were also recorded immediately prior to administration of reversal agent, immediately post extubation subsequently at 3,5,10 minutes after extubation Table II.
Fisher test was performed and p≥ 0.05 was taken as significant.
Conclusion: During intubation and extubation the pulse rate and mean arterial pressure rises above the control values with or without lidocaine infusion. However the magnitude of rise was less in patients receiving lidocaine infusion.

Table 1 Peri Intubation Period *p<0.05

GROUPS	CONTROL Pre Inf	PRE Induction	POST Intubation	3 Min Post Intub	5 Min Post Int	10 Min Post Int
A: HR (Saline)	85	85	115	111	106	93.5
B: HR (Lidocaine)	81	83	89*	83*	80.5*	74.5*
A: MAP (Saline)	91	88	108	102	96.5	95
B:MAP (Lidocaine)	90	86	91*	88*	86*	85*

Table II Peri Extubation Period, *p<0.05

GROUPS	Control, Pre-Rever	Post-Extu-bation	3 Min Post-extu	5 Min Post-Ext	10 Min Post- ext
A: HR (Saline)	77	118	110	105.5	97
B: HR (Lidocaine)	71.5	103*	92*	83*	72.5*
A: MAP (Saline)	94.3	111.5	106.5	100	96.8
B: MAP (Lidocaine)	88.7	99	94.5	85*	81.8*

S-303.

LIDOCAINE ATOMIZATION FOR TOPICAL AIRWAY ANESTHESIA IS NOT IMPROVED BY PRETREATMENT WITH GLYCOPYRROLATE

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Introduction: Antisialagogue premedication prior to the administration of topical lidocaine for airway anesthesia during fiberoptic bronchoscopy (FOB) and FOB intubation is widely taught and utilized. Antisialagogue premedication decreases pharyngeal secretions, which is reported to improve bronchoscopic visualization and increase topical transmucosal lidocaine absorption resulting in enhanced airway anesthesia. Unfortunately, the most commonly used antisialagogue, glycopyrrolate, an anticholingeric, is also associated with several adverse effects, most notably tachycardia. We sought to determine if the commonly used antisialagogue premedication, glycopyrrolate, increased absorption of lidocaine topical anesthesia atomized to the upper airway.
Method: In a two period cross-over designed study, ten subjects were randomized to receive intravenous normal saline or glycopyrrolate premedication 30 minutes prior to topical lidocaine atomization of the pharynx. Serum lidocaine levels were serially evaluated to determine the degree of mucosal absorption.
Results: There was no statistically significant difference in serum lidocaine concentrations with glycopyrrolate premedication (p-value 0.065). Glycopyrrolate premedication, however, did result in a statistically significant increase in heart rate (p-value 0.001.) Furthermore, there was a trend towards decreasing volunteer satisfaction with glycopyrrolate premedication.
Discussion: Glycopyrrolate premedication does not increase absorption of topically administered lidocaine anesthetic, but does increase heart rate and may decrease patient satisfaction.

S-304.

THIOPENTAL COMA IN REFRACTORY INTRACRANIAL HYPERTENSION - A REVIEW OF OUTCOMES AND COMPLICATIONS

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Introduction: Barbiturate coma is effective at lowering intracranial pressure (ICP) in patients with head trauma or intracranial hemorrhage [1]. It is, however, associated with adverse effects [2], and indicated only as second-line therapy in refractory intracranial hypertension [3]. There is relatively less published data on thiopental coma (commonly used in Australasia) compared to pentobarbital. We therefore investigated the clinical outcomes and adverse effects associated with thiopental coma in patients with refractory intracranial hypertension.
Methods: We conducted a retrospective cohort study of all patients receiving thiopental for control of refractory intracranial hypertension in a neurosurgical intensive care unit (ICU) from January - December 2004. Outcome measures studied included ICP reduction, survival to ICU and hospital discharge, Glasgow Coma Scale (GCS) at ICU and hospital discharge, Glasgow Outcome Scale (GOS) 6 months post-injury, and associated adverse effects (hypotension, ileus, infection, renal dysfunction and electrolyte abnormalities).
Results: 28 patients were studied. All values are expressed as median (IQR) or mean ± SD. Post-resuscitation GCS at hospital admission was 9(4-11) and the APACHE II score at ICU admission was 24 ± 4. The ICP prior to initiating barbiturate coma was 41 ± 16 mmHg. Duration of thiopental therapy was 51 ± 34 hours, with a maximum infusion rate of 294 ± 120 mg/h. Control of ICP to <25 mmHg was achieved within 36 hours in 22 patients (79%). All but 1 of the non-responders died in ICU. Sixteen (57%) patients survived to ICU discharge and 15 (54%) survived to hospital discharge. GCS at ICU and hospital discharge was 10(9-11) and 11(10.5-15) respectively. GOS at 6 months amongst survivors was 4(3-5). Twenty-seven (96%) received a norepinephrine infusion (maximum dose 0.19 ± 0.23 mcg/kg/min). Pneumonia occurred in 11 patients (39%) following institution of thiopental coma. Hypokalemia (2.1 ± 0.6 mmol/L) occurred in 20 patients (71%), and was associated with ventricular bigeminy in 1 patient. Ten (36%) patients had rebound hyperkalemia (5.7 ± 0.8 mmol/L) on weaning of thiopental infusion; non-fatal ventricular tachycardia occurred in 1 patient. Renal dysfunction (none requiring renal replacement therapy) occurred in 4 patients. Of the14 patients who received enteral feeding during barbiturate coma, intolerance was observed in 3 (21%).
Discussion: Survival in our series compares favorably to earlier reports [2,5], with relatively good outcome amongst survivors. Associated pneumonia has traditionally been a concern; however our observed rate was comparable to that seen in head-injured patients [4]. Our results suggest that judicious application of thiopental coma as second-line therapy in refractory intracranial hypertension is useful and may not necessarily be associated with an unacceptably high incidence of adverse effects.
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S-305.

PAIN ON THE INJECTION OF PROPOFOL: MODIFICATION BY ADMIXTURE TO THIOPENTONE

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Purpose of the study: Propofol is a commonly used anesthetic agent, that usually causes pain near the site of injection. We studied in a double blind- study the admixture of thiopentone to propofol aiming to reduce or eliminate pain from the propofol induction in anesthesia.
Materials and Methods: A double-blind study was performed on 60 ASA I-III ambulatory surgery patients, comparing the effectiveness in reducing pain of propofol bolus by administering thiopentone 2-3ml (100-150mg) in admixture with propofol 1.5mg/kg versus propofol 2.5mg/kg as a sole anesthetic agent. In Group A (n=30) propofol 1.5mg/kg mixtured with thiopentone 2-3ml was injected through an 18G iv catheter on the dorsal hand vein. In Group B (n=30) propofol 2.5mg/kg was injected the same way for induction in anesthesia. Level of anesthesia was monitored by the use of BIS and additional anesthetics were given if necessary. Opioids, midazolam and muscle relaxants were administered after injection of the induction agent. Patients were asked to describe the sensation of the induction agent, as "pain", "numbness", "burning" or "other feeling", as well as to evaluate quality of pain by a VRS pain scale from 1-10. During their stay in the ward they were asked to recall the memory of this sensation.
Results and discussion: Patients demographic characteristics were similar between groups. Statistical analysis: Chi-squared, Mann-Whitney Rank Sum tests.In Group A only 20% of patients exhibited mild discomfort during administration of the induction agent. In Group B all patients experienced some sort of discomfort; some mild (6.66%), other moderate (33.33%) but most of them severe (60%). As for the kind of discomfort in group B, it was pain in 83.33% of patients, numbnes (6.66%), burning (10%) or other (0%). In Group A, 6.66% of patients experienced pain, 3.33% numbness, 10% burning and 80.01% other kind of sensation.
All patients (100%) in Group A, as well as in Group B revealed recall of sensation during propofol injection.
Conclusion: Admixture of thiopentone to propofol effectively reduces or prevents pain on propofol injection.
References: (1) Can J Anesth, 2002; 49 (90001; A28-28, (2) Anesthesia 1994; 49: 817-818

	Severity of discomfort			
Group	No discomfort(%)	Mild(%)	Moderate(%)	Severe(%)
A (n=30)	80	20	0	0
B (n=30)	0	6.666	33.33	60

S-306.

PROPOFOL CARDIOPROTECTION FOR TYPE II DIABETICS (PRO-TECT II): A DOSE FINDING STUDY

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Propofol 50 -70 μM is required for experimental cardioprotection.[1,2] This study was to determine the dose response of a novel application of propofol in patients during CABG surgery requiring CPB to achieve this goal.
Methods: Following institutional approval, 24 patients scheduled for CABG surgery were randomized to receive propofol 1.0 mg/kg over 2 min followed by an infusion of 50 or 100 or 150 ug/kg/min from 10 min prior to initiation of CPB until 15 min following aortic declamping (R-15). Whole blood propofol concentration at R-15 was measured by capillary electrophoresis. Perioperative hemodynamics and drug support were recorded and results compared to a historic cohort treated with Isoflurane 0.5-2.0% (n= 27).
Results: Group demographics and intraoperative data were similar. The whole blood concentration of propofol at R-15 was 12.1±2.3, 16.4±10.7 and 50.1±29.1 μM for P50, P100, and P150, respectively. Cardiac index increased significantly after CPB ($P<0.05$), but there were no significant difference between groups. Pre- or post CPB LVSWI did not differ within or between groups. Inotropic support for postoperative stabilization was required for 0/7,1/9 and 1/7 patients treated with P50, P100, or P150 compared to 5/27 patients receiving isoflurane.
Conclusions: For a given dose of propofol, wide inter-patient variation in whole blood concentration occurs during CPB. P150 is required to consistently achieve a concentration of 50 μM. The transient application of P150 during CPB was not associated with increased risk of myocardial dysfunction or inotrope use compared to isoflurane anesthesia. Its use in diabetic patients is currently being studied.
References
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S-307.

THE EFFECT OF ISOFLURANE ON DISTRIBUTION OF CRYSTALLOID SOLUTIONS IN HUMANS

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Introduction: The current view is that fluid retention and postoperative tissue edema during surgery are caused by surgical trauma or mechanical ventilation and not by the administration of an anesthetic per se. However, our research group has conducted two recent studies in sheep that have demonstrated that the combination of isoflurane anesthesia and mechanical ventilation significantly alters the disposition of an infused fluid during anesthesia. In one of these studies, isoflurane was singled out as the cause for reducing urinary excretion and instead increasing peripheral fluid accumulation. We hypothesize that the same results will be found in humans.
Methods: Twelve volunteers of both sexes were included and assigned either to an awake or an isoflurane-anesthetized protocol during which they received 25 mL/kg of 0.9% saline during 20 minutes. Plasma volume measurements were performed using indocyanine green dye. Arterial blood was frequently sampled for massbalance- and volume kinetic analysis of the fluid distribution for the entire experiment of three hours. Hemodynamic parameters were in both protocols measured using ECG and a non-invasive bloodpressure device. Cardiac output was measured using an esophageal doppler catheter. Plasma vasopressin, renin, aldosteron and atrial natriuretic peptide were also measured at 0, 20, 60, 120 and 180 minutes.
In a subsequent study twelve volunteers will undergo a four arm randomized study with a antecendent hemorrhage. The subjects will be 1) awake, no fluid 2) awake, fluid bolus, 3) anesthetized, no fluid and 4) anesthetized, fluid bolus
Results: All subjects tolerated the study protocols well. The subjects in the anesthetized group urinated more than the awake group. Volume kinetic analysis showed extremely good curve-fitting and a more centralized location of the infused fluid. The elimination rate constant (kr) was decreased in the anesthetized protocol. Vasopressin and atrial natriuretic peptide were not affected but renin and aldosteron were significantly increased in the anesthetized protocols.
The subsequent hemorrhaged protocol has not yet started.
Discussion and conclusion: Inhalation anesthetic agents have inhibitory effects on urine output and contrary to the sheep studies the infused fluid is more centralized in anesthetized humans.
References:
1. Brauer, K.I., et al., Volume kinetic analysis of the distribution of 0.9% saline in conscious versus isoflurane-anesthetized sheep. Anesthesiology, 2002. 96(2): p. 442-9.
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Regional

S-308.

COMPARISON OF SUPPLEMENTATION RATES FOR PERIVASCULAR AXILLARY BLOCK AND DOUBLE-INJECTION INFRACLAVICULAR BLOCK VIA THE CORACOID APPROACH

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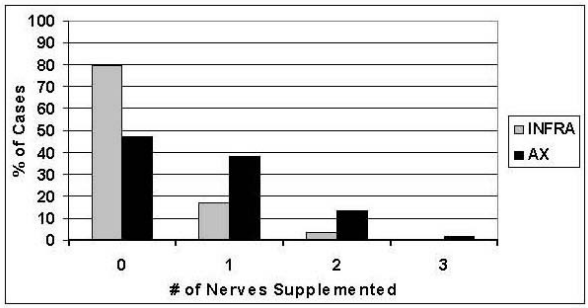
Introduction: Axillary and infraclavicular blocks provide effective brachial plexus anesthesia for similar surgical indications. Perivascular axillary block does not require special equipment and takes less time to perform while the infraclavicular block using a double-injection technique with a nerve stimulator has a high degree of success. We designed this study to determine which of these two techniques most consistently provides complete upper extremity anesthesia.
Methods: After IRB approval, we reviewed the regional anesthesia database of one staff anesthesiologist from a tertiary care university hospital collected over one year. Data from patients who received perivascular axillary or infraclavicular blocks were included. The primary outcome for comparison was rate of supplementation between the two groups presented as relative risk (RR) with 95% confidence intervals (CI). RR and 95% CI for incomplete regional anesthesia requiring conversion to general anesthesia were calculated as a secondary outcome. Postoperative data were collected by routine telephone survey the day after surgery. Patient reported satisfaction using a Likert scale (5=Outstanding to 1=Poor). Block duration was analyzed using Student's t-test.
Results: 141 consecutive axillary blocks and 157 consecutive infraclavicular blocks were studied. The number of nerves requiring supplementation for each block technique is displayed in the Table. Patients who received axillary blocks were 2.57 times more likely to require supplementation than those who received infraclavicular blocks (95% CI 1.82-3.64). Six patients with axillary block (4%) and 1 patient with infraclavicular block (0.6%) did not attain complete anesthesia despite supplementation and were converted to general anesthesia (RR=6.68, 95%CI 0.81-54.81). Block duration (12±8 hrs for axillary vs. 15±7 hrs for infraclavicular) and patient satisfaction (median 5/5 for both groups) did not differ significantly.
Discussion: Although the perivascular axillary block may be more efficient in terms of preparation time, the infraclavicular block using a double-injection technique requires less nerve supplementation. Despite the need for supplementation, the rate of incomplete anesthesia at the time of surgery was low in both groups, and patient satisfaction was not affected. Therefore, the perivascular axillary block technique remains a reasonable alternative to infraclavicular block particularly when time or special equipment (i.e. nerve stimulator) are limited.
References: 1) Atlas of Regional Anesthesia 1999;2nd ed:49-55; 2) Anesth Analg 1998;87:870-3; 3) J Clin Anesth 2004;16:251-6; 4) Anesth Analg 2004;99:1225-30. \



S-309.

SUCCESS RATES OF INFRACLAVICULAR BLOCKS WITH THREE DIFFERENT INSERTION TECHNIQUES

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In this prospective randomized ongoing study, 3 different techniques of infraclavicular approach of brachial plexus nerve block in terms of efficacy, ease of insertion, onset times and primary and secondary catheter failure rates are under study. It is hypothesized that ultrasound guidance will reduce the primary and secondary catheter failure rates as well as shorten the time required for the block inititiation.
A total of 60 patients undergoing upper limb surgery were randomly allocated to receive infraclavicular block+catheter by means of traditional coracoid approach with peripheral nerve stimulator (group traditional, n=20), coracoid approach with stimulating catheter (group stimulating, n=20) and ultrasound guided (group US, n=20). Nerve stimulator was used with all blocks and twitch at 0.6mA was accepted. All blocks were performed with 40 mls mepivacaine 1.5% with epinephrine 1:400K. Onset of block was defined as complete loss of motor and sensory function in the C5-T1 dermatome and was evaluated over a 30 minute period, at 5 minutes intervals. Incomplete blocks were supplemented after 30 minutes or given general anesthesia.
Preliminary results show that mean time to plexus location was 4.8 minutes in traditional group, 7.8 minutes in US group and 15.1 minutes in stimulating group (p=.007). Quality of axillary nerve block was inferior to that in other nerve territories in traditional group but not in US or stimulating group. There was secondary catheter failure rate in 18% of patients in US group, 29% in stimulating group and 88% in the traditional group. Post operatively in the US group, 64% showed complete spread and 34% showed posterolateral spread around the subclavian artery. The findings were similar in the stimulating group. In the traditional group, only 25% showed complete spread, 25% showed partial spread and 50% showed no spread after surgery. No major complications occured in any group. We conclude that stimulating catheters prolong time required for block initiation compared to traditional and ultrasound guided techniques. Ultrasound guided infraclavicular block provides a rapid and more complete primary block than traditional or stimulating catheter placement. Use of ultrasonography for catheter placement also reduces secondary catheter failure rate that could be of significance if it will be used for postoperative analgesia.

S-310.

REVERSAL OF INFRACLAVICULAR BRACHIAL PLEXUS BLOCK BY INJECTION OF NORMAL SALINE

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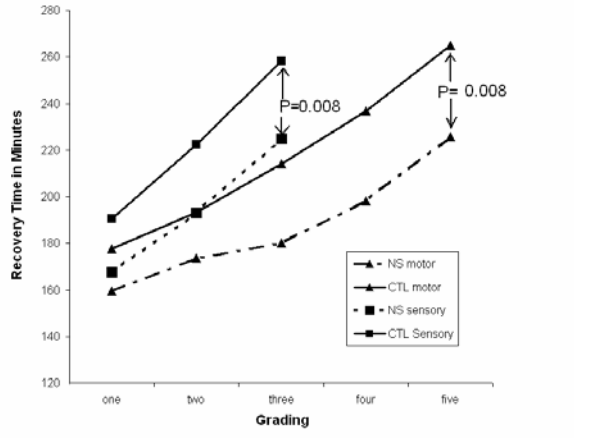
Introduction: Brachial plexus block is infrequently used in acute fractures as it may delay postoperative examination to rule out iatrogenic nerve injuries or mask a compartment syndrome. By injecting saline around nerves, the concentration gradient may be reversed leading to early recovery. The purpose of this study is to observe the effect of injected saline on recovery from local anesthetic.
Methods: After IRB approval, 50 patients undergoing upper extremity surgery using ultrasound guided infraclavicular block and catheter placement were randomly enrolled into two groups. Saline group had 100 ml saline injected through the catheter on arrival in PACU; sensory and motor examination of median, radial, ulnar, musculocutaneous and axillary nerves were performed every 10 minutes till recovery. Control group had no saline injection and neurological examination was performed every ten minutes. Motor power was graded as: 0- no muscle contraction, 1 - trace muscle contraction, palpable or visible twitch, 2 - able to accomplish motion with gravity, 3 - able to move against gravity, 4 - able to overcome moderate resistance, 5 - normal strength. Sensory function was graded as; 0 - no sensation of touch or pain (pin prick), 1 - perception of touch but no pain (pin prick), 2 - perception of touch and mild pain (pin prick), 3 - normal sensation to touch and pin prick. Recovery of sensory and motor blocks was compared between two groups using T -tests.
Results: The recovery times are shown in Table 1 and Figure 1. There was statistically significant reduction in both sensory and motor recovery times in Saline group.
Discussion: Early motor recovery was quicker than sensory recovery after saline injection. Overall sensory and motor recovery times were shortened by saline injection. The limitation of this study is caused by a variable time of saline injection.

Table 1

Nerve	Recovery grade	Saline group Mean ± SD time in min	Control Group Mean ± SD time in min	P values
Ulnar motor	5/5	218.1± 60.1	267.4± 40.3	0.0020
Ulnar sensory	3/3	230.3± 64.5	264.5± 39.6	0.0329
Radial motor	5/5	231.8± 60.7	274.5± 36.1	0.004
Radial sensory	3/3	218.2± 58.4	262.4± 35.4	0.002
Median motor	5/5	223 ± 58.6	266.1± 41.6	0.004
Median sensory	3/3	97.6 ± 56.7	258.2± 44.4	0.02
Musculocutaneous motor	5/5	107.6 ± 54.0	265.3± 41	0.02
Axillary motor	5/5	224.2 ± 56.9	260.7± 37.8	0.01

Graph1



S-311.

METHODS FOR ASSESSING GENERIC HEALTH STATUS OUTCOMES AND QUALITY OF LIFE AFTER THORACIC SYMPATHECTOMY FOR PALMAR HYPERHIDROSIS: A PROSPECTIVE 12-MONTH FOLOOW-UP STUDY

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Introduction: Palmar hyperhidrosis is a benign functional disorder regarded as a psychological and social handicap. Perspiration beyond physiological needs is barely tolerable and frequently interfered with daily activities. Neurolytic sympathetic block has been advocated for this condition. With this technique, however, the recurrence rate can be significant and injection of a neurolytic agent carries a high risk of producing complications. Techniques of neurolysis tend to be surgical, and thoracoscopic methods can provide direct vision. Thoracoscopic sympathectomy is a simple, fast, safe, and minimally invasive treatment for palmar hyperhidrosis. Improvement of the quality of life is a major goal of treatment. However, little attention has been given to quality of life after thoracoscopic sympathectomy. This study investigated the impact of thoracoscopic sympathectomy on subjective health-related quality of life (HRQoL) in patients with palmar hyperhidrosis. The value of self-report scales in predicting anxiety and depression was also assessed.
Methods: Thirty-two patients (11 males and 21 females) enrolled with palmar hyperhidrosis underwent thoracoscopic sympathectomy, 26 of whom were followed for 12 months. The procedure was performed under general anesthesia with double-lumen endotracheal intubation. Targeted T-2,3 ganglia were electrocauterized. All procedures were performed by the same pain clinicians (KM and KK). HRQoL measures were: the Medical Outcomes Study Short Form 36 (SF-36), the Spielberger State Trait Anxiety Inventory (STAI), and the Zung Self-rating Depression Scale (SDS). Patients were administered these 3 questionnaires before procedure and then again at 1, 3, 6 and 12 months following the procedure.
Results: All patients showed an increase in palmar skin temperature and displayed the disappearance of sweating, indicating that the sympathectomy was successful. Compensatory hyperhidrosis occurred in all cases. A comparison between the current sample and Japanese normative data for the SF-36 showed mild impairment of HRQoL before sympathectomy. However, it also showed significant improvement of the social functioning domain after sympathectomy. While there was worsening of the bodily pain and role physical domains 1 month after sympathectomy, both domains recovered 3 months after surgery. A comparison between preoperative and postoperative STAI showed improvement of both trait and state anxiety. However, the results of SDS showed patients remained neurotic throughout the period of assessment.
Discussion: This study demonstrated the pattern of impairment in health status and therapeutic impact in patients with palmar hyperhidrosis. Palmar hyperhidrosis is associated with mildly impaired HRQoL, as measured with generic instruments. It was also demonstrated that thoracoscopic sympathectomy is safe, minimally invasive, and improves HRQoL, even if compensatory hyperhidrosis occurs.

S-312.

ULTRASOUND VISUALIZATION OF CERVICAL PLEXUS BLOCK, C4 SINGLE INJECTION TECHNIQUE

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Introduction: Traditionally, cervical plexus blocks are performed using only surface landmarks to guide needle placement. (1) In this study, ultrasound was used to directly visualize the needle while the block is being performed. Ultrasound technology may improve the technique and minimize the complications associated with cervical plexus blocks.
Methods: After IRB approval, patients for carotid endarterectomy were selected. This operation is typically performed with cervical plexus block at our institution. A needle is inserted and advanced in real time along the ultrasound probe beam until contact with the lateral tip of the C4 transverse process is made. Once the needle tip has reached this target, local anesthetic is injected at incremental doses. The spread of local anesthetic within the neurovascular sheath is also visualized. Sensory block for surgery was assessed 15-20 minutes following administration. The patient is continuously monitored using standard ASA protocol guidelines and neurologically assessed throughout the procedure.
Results: Ultrasound visualization of C4 single injection cervical plexus block was done for 3 patients. In all patients, a complete surgical block of C2-C4 dermatomes was obtained. There were no complications of intravascular, intrathecal, cervical epidural, or local anesthetic toxicity as a result of the block. All patients had uneventful peri-operative course.
Discussion: Traditional approach for cervical plexus block is by palpation or with nerve stimulator guided by surface landmarks. We applied ultrasound technology to perform C4 single injection cervical plexus blocks. Ultrasound was used to directly image the C4 transverse process, interscalene space, and neurovascular sheath. Real-time visualization of needle insertion and advancement towards the interscalene space was achieved with the use of ultrasound technology. At the time of injection, local anesthetic spread and neurovascular sheath distention were also observed. Ultrasound imaging was helpful in avoiding intravascular, intrathecal, and cervical epidural needle placement associated with blind attempts. In summary, ultrasound allowed us to have direct real time needle visualization, observe local anesthetic deposition, and avoid potential complications associated with blind needle attempts.
References: (1) Anesth Analg. 1999 Dec;89(6):1366-70.

S-313.

THE "ROLLERCOASTER" SIGN: SONOGRAPHIC IMAGING OF THE OBTURATOR NERVE FOR REGIONAL BLOCK

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Introduction: Today there is a growing appreciation of the importance of the obturator nerve in clinical anesthesia.[1,2] The aim of this study is to describe the ultrasound appearance of the obturator nerve and to demonstrate the clinical utility of ultrasound imaging for these nerve blocks.
Methods: We scanned left and right inguinal regions of 20 volunteers lateral and distal to the pubic tubercle (PT) and assessed visibility, size and shape, and depth from the skin of common obturator nerves and their associated divisions. We also retrospectively reviewed a clinical series of patients who underwent obturator nerve blocks using similar scanning technique as our volunteers and collected data on the performed procedures.
Results: The obturator nerve can be visualized sonographically with its "rollercoaster" appearance: the anterior division descends toward the posterior division along the lateral border of the adductor brevis to form the common obturator more proximally. In this set of 20 volunteers, 25% (10/40) of common, 85% (34/40) of anterior and 87.5% (35/40) of posterior obturator nerves were sonographically identified. The common obturator nerve was visualized 1.3 ± 1.5 cm distal and 2.3 ± 1.2 cm lateral to the pubic tubercle (PT). Divisions were visualized 2.1 ± 2.0 cm distal and 2.1 ± 1.2 cm lateral to the PT. The nerves (common, anterior and posterior) averaged 2.7 ± 1.2 mm, 1.4 ± 0.6 mm, and 1.7 ± 0.6 mm in anterior-posterior dimension and 9.0 ± 4.3 mm, 9.6 ± 3.9 mm, and 10.9 ± 4.1 mm in medial-lateral dimension and were 25.9 ± 7.6 mm, 15.5 ± 3.9 mm, and 29.3 ± 7.9 mm below the skin surface. In the clinical setting employing the same ultrasound scanning technique that was used in the volunteer study we were able to identify the obturator nerves which aided in successful local anesthetic administration.
Discussion: The obturator nerve and its divisions are the flattest peripheral nerves yet described with ultrasound imaging. Knowledge of the obturator nerve's ultrasound appearance facilitates localization of this nerve for regional block and may increase the success rate for complete blocks.
References:
1. Should an Obturator Nerve Block Be Combined to Femoral and Sciatic Nerve Blocks for Knee Surgery Purposes? Anesthesiology 2003; 99: A1041
2. Postoperative analgesia after total knee replacement: the effect of an obturator nerve block added to the femoral 3-in-1 nerve block. Anesth Analg 2004; 99:251-4.

S-314.

HYPOTENSIVE BRADYCARDIC EVENTS AND PARAVERTABTAL BLOCKS IN THE SITTING POSITION

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Introduction: Paravertebral blockade for pain treatment has enjoyed a considerable resurgence of interest because of effectiveness and low complication rate. (1) Different techniques have been described including placing the patient in either the lateral or the sitting position. (2,3) D'Alessio et al reported sudden hypotensive/bradycardic events in the sitting position under an interscalene block. (4) Our experience indicates that patients undergoing paravertebral blocks in the sitting position are also prone to a similar complication, requiring pharmacological treatment. This study was designed to determine the frequency and contributing factors of hypotensive/bradycardic episode associated with the placement of parvertebral nerve blocks in the sitting position.
Method: We reviewed the block procedure notes of all patients undergoing a paravertebral block in the sitting position between 04/01/ 2005 and 07/30/2005. This included single and continuous paravertebral blocks performed for postoperative analgesia in patients undergoing thoracotomy, nephrectomy, cystectomy, prostatectomy, adrenalectomy, umbilical and inguinal hernia repair, exploratory laparotomy and esophagectomy. Patients receiving glycopyrrolate and/ or ephedrine preemptively were excluded from this analysis. Briefly, after appropriate informed consent and monitors placement (blood pressure, heart rate and SaO2), the patients were placed in the sitting position and paravertebral nerve blocks were performed according a classical approach. Hypotension and/or bradycardia were treated with glycopyrrolate, ephedrine and IV fluid bolus.
Results: 229 patients were included in the study. 21 patients developed episodes of sudden profound bradycardia and hypotension (9.17%). Gender and laterality were not a discriminate factors. In contrast 68.18% patients who developed this complication were elderly or very elderly. In these case heart rate, systolic and diastolic blood pressure dropped by 17.8%, 27.6% and 27.7%, respectively.
Discussion: Hypotensive/bradycardic episodes have been reported to occure in >20% of patients undergoing shoulder surgery performed in the sitting position under interscalene block.(5) Our data suggest that the frequency of hypotensive/bradycardic events is less with paravertebral blocks than with interscalene blocks. Every one responded to the treatment with glycoryrrolate and/or ephedrine and IV fluid bolus. No case was cancelled.
Reference:
1. Eason and Wyatt Anesthesia 1979; 34:638-42
2. Richardson et al Anesthesia 1996; 51:137-9
3. Naja et al Anesthesia 2005;60:680-4
4. D'Alessio et al. Reg Anesth 1995; 20:62-8
5. Liguori et al. Anesth Analg 1998; 87:1320-5

S-315.

WEIGHT HEIGHT & BMI ARE NOT STRONG PREDICTORS OF PARAVERTEBRAL DEPTH

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INTRODUCTION: Thoracic paravertebral nerve blocks have been reported as a technique simple to perform and easy to learn. They produce multidermatomal ipsilateral somatic and sympathetic nerve blockade suppressing the neuroendocrine stress response to surgery. [1-2] The effectiveness of this technique has been demonstrated in different surgical settings. [3-5] The aim of our study was to evaluate the depth of thoracic paravertebral spaces and asssess the relationship between weight, height and BMI and the paravertebral space depth (PVSD).
METHODS: 1407 consecutive paravertebral blocks injections were included. In all patients the paravertebral blocks were performed using a loss of resistance [2]. Demographic data (age, sex, weight and height), and PVSD at each level were recorded. A correlation between PDSV and weight, height, BMI (r) and r^2 were calculated. Pβ0.05 was set up as significant.
RESULTS: Median age was 61 years and median weight 82 kg, and height 175 cm. The median depth for the paravertebral space was 5cm: 4.5cm at T4 & T6, 5 cm at T5, T7, T8, T9 and T10, 5.2 cm for T11 and 6cm for T12. Table 1 shows the correlations between PVSD and weight at each thoracic level:
DISCUSSION: Naja et al [6] recently reported a relationship between depth and BMI except T7, T8 and T9. Our data demonstrate that a direct relationship between depth and weight, and no correlation between depth and height between T4 and T12. However, weight is a weak predictor of depth at any thoracic level.
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1. Anaesthesia,1995;50:118-21
2. Anaesthesia, 1979;34:638-42
3. Reg Anesth, 1992;17:348-50
4. Acta Anaesthesiol Scand, 1999;43:770-4
5. Brit J Hosp Med, 1993;50:114-20
6. Anesthesia, 2005:60:680-4

level	n	r	r^2	p
T4	83	0.644	0.415	p≤0.05
T5	96	0.589	0.347	p≤0.05
T6	97	0.534	0.285	p≤0.05
T7	86	0.461	0.213	p≤0.05
T8	92	0.658	0.433	p≤0.05
T9	172	0.447	0.200	p≤0.05
T10	305	0.213	0.045	p≤0.05
T11	274	0.241	0.058	p≤0.05
T12	202	0.474	0.225	p≤0.05
Total	1407			

S-316.

LOCAL ANESTHETIC-INDUCED CARDIAC TOXICITY: A SURVEY OF CONTEMPORARY PRACTICE STRATEGIES AMONG ACADEMIC ANESTHESIOLOGY DEPARTMENTS

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Introduction: The concept of "chain-of-survival" is well-established in Advanced Cardiac Life Support. However, local anesthetic (LA) cardiotoxicity warrants specific alternative considerations for successful management. While widely accepted preventive measures, new pharmacology and new techniques, may be improving the safety of regional anesthesia, the optimal approach to LA-induced cardiac toxicity remains uncertain. Accordingly, the aim of this study was to explore current approaches to LA cardiotoxicity in the United States by conducting a survey of academic anesthesiology departments.
Methods: A 19-question survey regarding regional practices and approaches to LA cardiac toxicity was mailed in the Fall of 2004 to 135 academic anesthesiology departments listed by the Society of Academic Anesthesiology Chairs (SAAC). Ninety-one anonymously completed questionnaires were returned for a response rate of 67%.
Results: The respondents were categorized into groups according to number of peripheral nerve blocks (PNBs) performed each month; 38%: >70 PNBs, 13%: 51-70 PNBs, 20%:31-50 PNBs, 23%: 11-30 PNBs, and 6%: <10 PNBs. To effect long-acting peripheral nerve blockade, the groups administering >70 PNBs were 1.5 times more likely to use ropivacaine than those programs administering ≤70. Anesthesia practices administering greater than 70 PNBs per month were 3 times more likely to consider administering intralipid for LA cardiotoxicity than all those administering ≤70 (1,2). Likewise, this group was 1.6 times more likely to have a plan established for mechanical cardiopulmonary support if necessary.
Conclusion: The diverse experiences and practices regarding the approach to LA cardiac toxicity suggest a lack of consensus among academic anesthesiologists. A "systems-based" approach may improve outcome from this rare but potentially devastating complication of regional anesthesia. While prevention of LA cardioxicity remains paramount, preparing an algorithm for the rapid treatment of LA cardiotoxicity, which incorporates a plan for instituting cardiopulmonary support, will allow the regional anesthesiologist to feel confident that a comprehensive strategy is available.
References:
1. Reg Anesth Pain Med 2003;28:198-202.
2. Reg Anesth Pain Med 2002;27:568-75.

S-317.

SYMPATHOVAGAL EFFECTS OF INTRATHECAL BUPIVACAINE SUPPLEMENTED WITH INTRAVENOUS OR INTRATHECAL FENTANYL ASSESSED BY HEART RATE VARIABILITY

AUTHORS: **Y. Fujiwara**, S. Kurokawa, Y. Wakao, Y. Asakura, T. Komatsu;
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Introduction:
Previous reports have found that the addition of intrathecal (IT) or intravenous (IV) fentanyl to spinal anesthesia (SA) improves the intraoperative and early postoperative quality of analgesia[1,2]. However, there is no information about sympathovagal effects of IT or IV fentanyl added to spinal anesthesia. The objective of this study was to determine if SA using 0.5% isobaric bupivacaine supplemented with IT or IV fentanyl affect autonomic nervous activity using heart rate variability (HRV).
Methods:
Thirty-six patients (ASA PS 1-2; 66±15 years) were assigned to two groups: (1) spinal anesthesia with 17.5mg of 0.5% isobaric bupivacaine (Group B), (2) spinal anesthesia with 17.5mg of isobaric bupivacaine supplemented with 20μg of intrathecal (IT) fentanyl (Group F). SA was performed at the L3-4 intervertebral level while patients were placed in a left lateral decubitus position. Thirty minutes after the injection, 50μg of fentanyl was administered intravenously (IV) in each group. The level of spinal block was evaluated by loss of painful sensation. Heart rate variability (HRV) was evaluated using MemCalc method, which is a combination of the maximum entropy method for spectral analysis and the non-linear least squares method for fitting analysis (Tarawa, Suwa Trust, Japan), for baseline, after spinal anesthesia and after intravenous fentanyl. Then the averaged entropy of RR interval (ultra short-term entropy; USen), the power of low frequency component (LF; 0.04-0.15Hz), high frequency component (HF; 0.15-0.4Hz) and LF/HF ratio for each period were calculated and compared.

Results: Data are shown in table below. (#: $p<0.05$ vs baseline)

Effects of SA supplemented with fentanyl on HRV			
GroupB	baseline	after SA	after IV fentanyl
spread of SA	NA	Th7.3±2.9	Th7.0±2.7
LF/HF	4.4±1.8	3.6±1.9	3.9±11
USen	44±9	42±8	44±7
Group F	baseline	after SA	after IV fentanyl
spread of SA	NA	Th7.2±2.3	Th6.8±1.9
LF/HF	3.9±1.8	3.3±1.8	2.2±1.2#
USen	37±11	37±13	39±11

Discussion:
In Group B, neither SA with bupivacaine alone nor SA supplemented with intravenous fentanyl affected LF/HF ratio. In Group F, although SA with intrathecal bupivacaine-fentanyl did not affect LF/HF ratio, supplementation with IV fentanyl resulted in decreased LF/HF without affecting USen. Contrary to previous reports[2], neither IT nor IV supplementation with fentanyl enhanced the spread of spinal anesthesia
References:
1. Eur J Anaesth 20: 294-7, 2003
2. Br J Anaesth 67:437-9, 1991

S-318.

EFFICACY OF POSTOPERATIVE PERINEURAL INFUSION OF BUPIVACAINE AND CLONIDINE FOLLOWING LOWER EXTREMITY AMPUTATION IN PREVENTING PHANTOM LIMB AND STUMP PAIN

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INTRODUCTION
Phantom limb and stump pain have been reported in up to 85% of amputees and is usually resistant to a wide variety of medical treatments (1). Although preoperative epidural blockade may prevent the development of phantom limb pain (2) its use in the setting of anticoagulation is contraindicated. The perineural administration of clonidine, an alpha-2 agonist, has been shown reduce neuropathic pain symptoms following nerve injury (3). We report the efficacy of the perioperative infusion of clonidine and bupivacaine for above the knee amputation (AKA) in a patient with a previous history of phantom limb pain in the same extremity. A 68-yr-old 91 kg male with a history of hypertension, diabetes, chronic atrial fibrillation, and a St. Jude aortic valve on daily warfarin therapy was scheduled for a left AKA. Following a left BKA 2 yrs ago, the patient continues to report both stump and phantom pain.
METHODS
Warfarin was withheld 6 days before AKA surgery and the patient received 1 mg/kg subcutaneous enoxaparin every 12 h. The patient underwent general anesthesia and prior to transection, the sciatic nerve was infiltrated with 5 mL 0.25% bupivavacaine and clonidine 50 mcg. After severing the nerve, a 20-gauge epidural catheter was inserted into the nerve sheath and externalized laterally through a separate skin incision. Prior to closure, 10 mL of 0.25% bupivacaine and clonidine 50 mcg was injected and 0.1% bupivacaine and clonidine 2 mcg/mL was infused at 10 mL/h for the first 96 h postoperatively. Pain scores (NRS) from 0-10, vital signs, and sedation scores were recorded every 4 h. Oxycodone 5-10 mg was prescribed every 4 h PRN for a NRS>3. During hospitalization, and at monthly intervals for 12 months after amputation, the patient was questioned for the presence of stump and phantom pain.
RESULTS
There were no incidences of hypotension, bradycardia, or sedation during the infusion period. The mean postoperative NRS for 96 h was 1.2 ± 0.7. The patient required a total of 10 mg oxycodone postoperatively. The patient did not report experiencing either stump or phantom pain for 12 months following surgery.
DISCUSSION
Perineural infusion of bupivacaine and clonidine may provide for effective postoperative analgesia following lower extremity amputation while reducing the incidence of stump and phantom pain. We are currently evaluating this technique in a prospective randomized investigation for lower extremity amputations.
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S-319.

A COMPARATIVE STUDY OF PROPHYLAXIS WITH CLONIDINE AND TRAMADOL FOR PERIOPERATIVE SHIVERING IN SPINAL ANAESTHESIA FOR T.U.R.P. SURGERY

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INTRODUCTION: Perioperative shivering, in patients undergoing transurethral resection of prostate under spinal anaesthesia is a common complication. Decreased core temperature secondary to peripheral vasodilatation from sympathetic blockade and/or use of cold irrigating fluids may lead to shivering. Prophylactic measures to reduce shivering could lead to decrease in the morbidity and mortality of such patients.
METHODS: In our double blinded, placebo-controlled study, 120 randomly chosen patients (ASA grade I-III), scheduled for transurethral resection of prostate under subarachnoid block were divided into three groups of 40 each. Group I received oral Clonidine 150micrograms, Group II received oral Tramadol 50 microgram, while Group III received a placebo. The shivering was graded from 0-4 (Wrench IJ et al). All the results were tabulated and analyzed using student's "t" test, "z" test, and ANOVA test.
RESULTS: In the clonidine and tramadol group, 38 patients (95%) and 37 patients (92.5%) did not shiver respectively. While in the placebo group, 24 patients (60%) exhibited no grades of shivering. The shivering was of significantly severe intensity and longer duration in the control group. While patients who were given clonidine or tramadol did not show any clinically significant collateral effects.
CONCLUSIONS: Both the drugs were comparable in respect to their effect in decreasing the incidence, intensity and duration of shivering when used prophylactically to prevent shivering in patients who were to undergo transurethral resection of prostate surgery under subarachnoid blockade.

S-320.

MORPHOLOGICAL FINDINGS OF THE CAUDA EQUINA IN THE LATERAL DECUBITUS POSITION IN THE CADAVERIC DISSECTION AND MAGNETIC RESONANCE IMAGE

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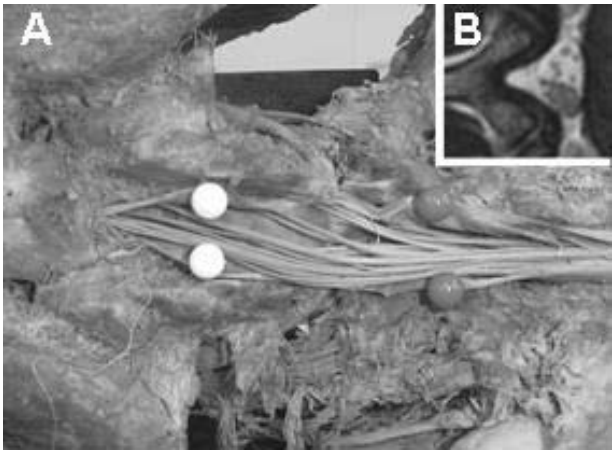
Introduction: Spinal anesthesia is usually performed in the lateral decubitus position. It is very important to know detailed information about movement of the cauda equina during the lateral decubitus position. To obtain it, we examined the movement of the cauda equina during the lateral decubitus position, using magnetic resonance (MR) images and the cadaveric dissection.
Methods: After obtaining the approval of the hospital ethics committee and informed consent, the present study was scheduled. 1) For the coronal view of the subarachnoid space, formalin-preserved cadavers were studied. Before the study, the laminectomy and incision of dura mater were carefully performed to observe the cauda equina. 2) For the axial view of the subarachnoid space, MR images in healthy volunteers were captured during the supine and lateral decubitus position.
Results: 1) The exposed cauda equina in the cadaver dynamically moved by changing position. During the lateral decubitus position, it shifted and sagged to the gravity-dependent side of the subarachnoid space (Fig. A). 2) MR images showed that the cauda equina moved to the gravity-dependent side of the subarachonid space by changing position. Although the cauda equina lay symmetrically at the dorsal side of the subaracnoid space during supine position, it moved to the left side of the subarachonid space during the left lateral decubitus position (Fig. B). **Discussion:** Our information obtained from the cadaveric dissection and MR images is very beneficial to image the morphology of the cauda equina for spinal anesthesia. Then, it may lead us to care about the specific gravity of local anesthetics and reduce possibility of the nerve root injury during spinal anesthesia.



S-321.

A RETROSPECTIVE STUDY OF CREATININE CLEARANCE IN POSTOPERATIVE TOTAL JOINT REPLACEMENT PATIENTS IN THE GERIATRIC AGE GROUP... A WORD OF CAUTION WITH THE USE OF ENOXAPARIN

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Introduction: Total Joint Replacement (TJR) patients are at increased risk for venous thromboembolism and fatal pulmonary embolism. Hence, these patients are frequently anticoagulated with low molecular weight heparins (LMWH). Renal failure is known to affect the pharmacokinetics of enoxaparin, yet the alterations of renal function in the postoperative TJR patients are not well characterized.
Methods: After IRB approval, retrospective data on renal function was collected on approximately 223 of the 1011 patients who had TJR surgery at our institution from January 1, 2005 to June 30, 2005. Of these 223 patients, 84 patients were greater than 70 years of age. The data collected was plasma creatinine values from the preoperative visit, postoperative day 1 & postoperative day 3.
Using the patient's age, gender, and weight, creatinine clearance was calculated using the Cockroft and Gault formula.
Results: Of the 84 patients of ages greater than 70 years, 14 patients [16.6%] had abnormal preoperative baseline creatinine clearance values. On postoperative day 3, 2 of these 14 patients [14.2%] had a further worsening in their creatinine clearances. The remaining 70 patients had normal baseline clearance values at their preoperative visit, but, on postoperative day 3, 6 of these 70 patients [8.5%] had abnormal clearance values. This study demonstrates that, in geriatric patients, 14.2% of patients with preoperative renal dysfunction will have further decrease in their renal function postoperatively, while 8.5% of patients with normal renal function will have postoperative impairment in their renal function.
Discussion: Clinicians should be aware of potential postoperative alterations in renal function in geriatric TJR patients. LMWH's are frequently dosed based on body weight and not on renal function. A select number of patients will have renal dysfunction during the postoperative course, which may require a dose adjustment to avoid potential life threatening complications, such as bleeding. Hence geriatric patients require monitoring of their postoperative renal function.

S-322.

ANESTHESIA AND ANALGESIA FOR SIMULTANEOUS BILATERAL TOTAL KNEE ARTHROPLASTY

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Introduction: The advantages of simultaneous bilateral total knee arthroplasty (BTKA) include high patient satisfaction and decreased length of stay.[1] Some studies have found no change in morbidity, others have shown a three-fold increase in cardiopulmonary complications and increased mortality.[1] Despite recent advances in analgesia for unilateral TKA, there have been no published series on anesthesia and analgesia for simultaneous BTKA.[2]
Methods: This is an IRB approved retrospective case series of consecutive patients undergoing simultaneous BTKA over 36 months. Patients were divided into two groups dependent on the mode of post-operative analgesia. One group (n=37) received bilateral femoral nerve blocks and catheters (FNB) for post-operative analgesia, while another (n=25) received bilateral FNB and bilateral single sciatic nerve block (FNB+SNB). Demographics, nerve block, and anesthesia data were recorded. Outcome measurements included length of stay (LOS), complications, pain scores (VAPS), and systemic opioid administration.
Results: Of 62 patients, 40% were male, the median age was 69, and the median ASA score was 2. The only statistically significant difference in demographics and pre-operative morbidity was a higher BMI in the FNB+SNB group (Median: 29.3 vs. 32.8, p=0.015). The types of anesthesia for the 62 patients were general anesthesia (n=21, 34%), spinal anesthesia (n=36, 58%), and epidural (n=5, 8%). The LOS was 4 days in both groups. No serious intra or post-operative complications were recorded. In the FNB group, the median dose of ropivacaine was 0.9 mg/kg compared to 1.8 mg/kg in the FNB+SNB group. There were no complications from regional analgesia in either group. There were no differences in median pain scores on day one (VAPS=3), day two (VAPS=3), and day three (VAPS=2). Supplemental opioid use showed no difference; for days 0, 1, 2, and 3, the overall patient group required a median of 0.2, 0.3, 0.2, and 0.1 mg/kg respectively. Flexion, extension, and other physical therapy scores were not significantly different.
Discussion: In this study, there were no noticeable differences in outcomes between the FNB and FNB+SNB groups, both techniques were safe and effective in simultaneous BTKA. Although the amount of local anesthetic is increased with simultaneous BTKA, there were no complications of local anesthetic toxicity. The results (pain scores, LOS, flexion, extension, and physical therapy scores) of regional analgesia for simultaneous BTKA compare favorably with those of unilateral TKA.[2] This study also demonstrated that spinal anesthesia can be used safely and efficaciously for simultaneous BTKA. This is one of the first studies to demonstrate that regional analgesia is safe and effective in simultaneous BTKA. Although retrospective, the findings suggest that prospective studies involving simultaneous BTKA can be undertaken.
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S-323.

WHAT IS THE BEST NERVE BLOCKADE FOR KNEE ARTHROPLASTY?

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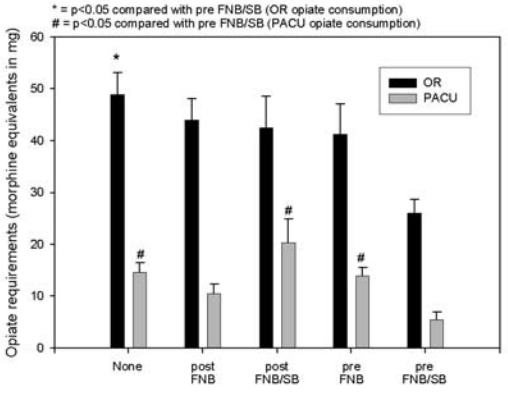
INTRODUCTION: Anesthesiologists frequently use peripheral nerve blockade for post-operative pain management in patients undergoing total knee arthroplasties (TKA). However, the optimal approach (type of block and time of placement) has not been defined. In addition, it is not known if the optimal approach would differ between primary and revision TKAs. We therefore studied effects on intra- and post-operative opiate consumption, as well as PACU utilization, of various types of nerve blockade for TKA.
METHODS: We retrospectively studied 128 consecutive patients who underwent primary or revision TKA over a ten-month period under general anesthesia with one of four different nerve blockade options: (a) None; (b) femoral nerve blockade instituted after the procedure (post-FNB); (c) FNB instituted prior to the procedure (pre-FNB); (d) FNB with sciatic nerve blockade instituted after the procedure (post-FMB/SB); and (e) FNB/SB instituted prior to the procedure (pre-FNB/SB). We determined time spent in PACU and opiate requirements, which were converted to morphine equivalents (ME) in mg. Groups were compared by t-test or one-way ANOVA, as appropriate.
RESULTS: There were no differences among groups in PACU utilization. We found no differences in opiate requirements among patients undergoing revision TKA, either during the procedure or in PACU; this may, however, be due to small numbers in the subgroups. For primary TKA, both OR and PACU opiate requirements were different among groups: requirements were reduced in those patients receiving FNB/SB prior to the procedure, as compared to the other approaches (Fig). As a result, this group was significantly different from groups None, post-FNB/SB, and pre-FNB in PACU opiate requirements, and from group None in OR opiate requirements. Interestingly, there were no differences between revision and primary TKA in any of the measurements.
DISCUSSION: Our data suggest that, although placing both femoral and sciatic nerve blocks prior to the procedure may be time-consuming, this approach minimizes both intra- and post-operative anlgesic requirements. However, this reduction in requirements is not associated with a decreased PACU utilization. There appear to be no differences in this regard between primary and revision TKAs.



S-324.

PILOT STUDY REVIEWING THE IMPACT OF A NEW REGIONAL ANALGESIA PRACTICE AT A UNIVERSITY MEDICAL CENTER

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Introduction: Regional anesthesia and its application as a method in providing postoperative analgesia in orthopedic patients is becoming a more common practice in today's care[1]. Femoral peripheral nerve catheters have been shown to impact analgesia and outcomes in patients following total knee arthroplasty (TKA)[2,3,4]. Preparing and training anesthesia residents for this practice often means introducing a new practice model to an already established program. As a pilot and first inquiry, we reviewed the impact, if any, on a newly introduced regional analgesia practice for patients undergoing unilateral TKA at a university medical center.
Methods: In a retrospective, cohort fashion, we studied a total of 67 patients who underwent elective, unilateral, primary TKA between April 2004 and November 2004. In August 2004, a new practice of postoperative analgesia provided via a continuous femoral perineural catheter infusion of local anesthetic (0.2% ropivacaine) for patients undergoing TKA was introduced. We compared our first 35 patients who received this technique (FNC group) with historical controls who received conventional, intravenous opioid-based patient controlled analgesia (IV-PCA group) who underwent TKA in the preceding 4 months (n=32). Surgical technique, incisional approach and type of prosthesis used were consistent and unchanged during the study period. Both groups received the identical physical rehabilitation program, including continuous passive range of motion devices. The criterion for discharge was unchanged over the course of the study period and was independently determined by the primary orthopedic surgeon.
Results: No difference was noted between the two groups in gender, age or ASA classification. In the FNC group the hospital length of stay (LOS) was 3.6 days; compared to the LOS of 4.2 days in the IV-PCA group ($p<0.04$). No falls or adverse events were recorded with either group. Performance in physical rehabilitation was no different between the two groups.
Conclusion: Implementation of a femoral peripheral catheter continuous infusion for postoperative analgesia in patients following TKA appears safe with respect to historical controls and is associated with earlier hospital discharge. This retrospective review will pilot a further investigation to explain these observations and further define outcomes in both morbidity and mortality; need for rescue intravenous opioids, use of antiemetics, physical rehabilitation achievements and educational challenges associated with establishing a new regional anesthesia/analgesia practice at a university medical center.
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S-325.

INTERSCALENE BLOCK WITH INTRA-LESIONAL INFUSION OF ROPIVACINE REDUCES PAIN AFTER ARTHROSCOPIC SHOULDER SURGERY

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Introduction: Arthroscopic shoulder surgery is often associated with severe postoperative pain and adequate postoperative pain control is important both for the patient's satisfaction and to shorten the length of hospital stay. We hypothesized that intra-lesional (IL) analgesia is effective to surgical lesion and a single-dose interscalene block (ISB) with long-acting local anesthetics can provide satisfactory analgesia to pain from outside of the shoulder joint in early postoperative periods. So we designed a prospective, randomized, case-controlled, double-blind study that compared the effectiveness of postoperative pain control of continuous IL infusion of local analgesics with intravenous (IV) PCA with or without a single-dose ISB.
Methods: Eighty four patients having arthroscopic shoulder surgery under general anesthesia were divided into four groups: IV, IL, ISB-IV and ISB-IL. In Group ISB-IV and Group ISB-IL, Interscalene block was performed before induction of general anesthesia. In Group IV and Group ISB-IV, IV PCA with fentanyl and ketorolac was started at the end of surgery. In Group IL and Group ISB-IL, IL infusion of ropivacaine was started and the catheter tip culture was done after the completion of intra-lesional infusion. Visual Analog Scale (VAS), supplemental analgesics and side effects were recorded at 1 h after and then every 8 h after surgery for two days.
Results: Group ISB-IV and Group ISB-IL showed lower VAS during 8 h after surgery and Group ISB-IL had the lowest VAS at 16 h and 48 h after surgery. Compared with Group IV and Group IL, lesser patients of Group ISB-IV and Group ISB-IL needed supplemental analgesics during 8 h after surgery. The incidence of postoperative nausea and vomiting were decreased in Group IL and Group ISB-IL. Two patients of Group IV and two patients of Group ISB-IV quit intravenous PCA because of postoperative nausea and vomiting. One patient of Group IV complained dizziness and one patient of Group IV had urinary retention. There was no catheter-related infection and no microbial organism was grown in the catheter tip culture.
Discussion: Major shoulder surgery is associated with severe postoperative pain, particularly in the first 48 hours and postoperative pain can interfere with initial rehabilitation. Single-injection interscalene block can be expected to provide not much more than 24 hours of pain relief even use of the long-acting local anesthetics. Continuous interscalene block can be an alternative that can provide prolonged postoperative analgesia. In conclusion, a single-injection interscalene block with intra-lesional infusion of ropivacaine provides pain control and diminishes supplemental analgesics used after arthroscopic shoulder surgery and shows few side effects and high patient satisfaction.

S-326.

EFFECTIVENESS OF A SOAKER CATHETER SYSTEM ON THE RECOVERY OF BARIATRIC SURGERY PATIENTS

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Introduction: The continuous infusion of ropivacaine is effective in controlling pain for a wide variety of surgical procedures, and reducing narcotic adverse effects and dependency (1). This study assesses ropivacaine infusion efficacy with the I-Flow® Dual Soaker Catheter System at the surgical site for bariatric surgery recovery. It is hypothesized that patients receiving ropivacaine will report lower levels of morphine use pain and hospital stays, and will ambulate quicker than patients in a control group.
Methods: Approximately 50 patients will be randomized to treatment groups. Prior to incision closure the surgeon infiltrates the surrounding tissues with 30cc of ropivacaine (.5%) or saline solution, followed by catheter placement in both the sub-fascial space and subcutaneously. After, the infusion pump is connected to the soaker catheters to complete the system design. This system delivers 2cc/hr through each catheter branch and remains in place for 72 hours. Pain scores are measured upon awakening in the recovery room and twice daily for 72 hours. In addition to the catheter system, all patients have access to PCA morphine for extra pain relief.
Results: T-tests were utilized for data analysis with p-values less than .05 considered statistically significant. Between treatment groups, significant differences were found in average pain levels immediately following surgery and length of time to ambulate. Other recorded pain levels, length of stay and morphine usage was not statistically significant. However, morphine usage was significantly different when comparing between surgery days.
Discussion: Nine patients have been randomized into treatment groups. Patients receiving ropivacaine reported higher pain levels immediately following surgery, but were able to ambulate quicker than patients receiving placebo. Patients who had surgery on Friday were found to use significantly more morphine immediately following surgery, at day 1 morning and afternoon, total morphine used on day 1, and total morphine use. Patients with Friday surgeries were found to use over three times more morphine immediately following surgery and almost twice as much morphine over the total 72-hour post-op period. This may be due to the depleted medical staff available during the weekend and suggests that these cases should be performed earlier in the week when surgical and medical staff is readily available.
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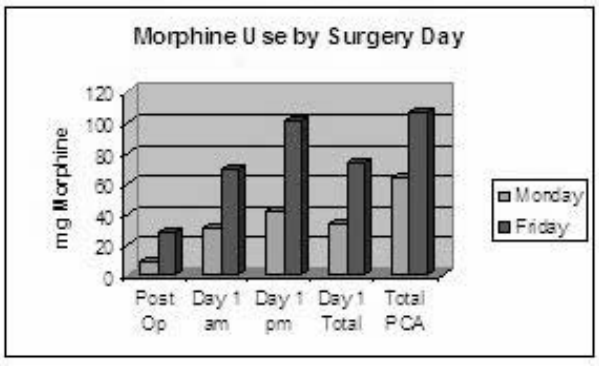

S-327.

CRITICAL APPRAISAL OF NERVE STIMULATORS

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Introduction: Nerve stimulators are essential for locating peripheral nerves in current clinical practice. When used appropriately, they improve both the success rate and the risk-benefit ratio of regional anesthesia (1). We tested the characteristics of a series of nerve stimulators available in France.
Methods: Twelve currently used nerve stimulators were subjected to a battery of specific tests (2) performed by two independent observers under standardised conditions using a digital oscilloscope (Tektronix TDS 3034), a calibrated resistance of 1 kΩ and a rigorous scoring system. Individual scores (0 = least satisfactory to 4 = most satisfactory) were assigned for the signal waveform, current intensity, impulse duration, maximal output load and reliability. The ideal nerve stimulator should deliver repetitive, rectangular, monophasic current impulses the duration of which needs to remain stable at each assigned intensity. The choice of a short duration of impulse ≤ 100 µs ensures the best discrimination of distance between needle and nerve. The greater the output load could be raised the more the device's performance determined its score for the criteria 'maximal output load'. Availability of audible/visible alarms, display of effective intensity and display of the selected duration were all taken into account when scoring reliablilty.
The overall score (sum of individual scores) was expressed as percentage of the maximum possible score. Nerve stimulators were ranked accordingly.
Results: A group of 'high performers' (overall score > 80%) has been identified: Stimuplex HNS 12 (B Braun), Plexival (Vygon, Medival) and MultiStim Vario (Pajunk). 'Poor performers' (score < 50%) included: TOF-Watch (Organon Teknika) and Stimuplex Dig RC (B Braun). 'Average performers' were: Plexygon (Aryon, Vygon), Stimuplex HNS 11 (B Braun), MultiStim Plex (Pajunk), Polystim (Polymedic), Tracer III and II (Life-Tech), Polystim II (Polymedic).
Discussion: In order to achieve consistently safe and successful nerve blocks, the operator should be aware of the design and functional limitations of the stimulator being used in that particular clinical setting. Manufacturers should equally standardise nerve stimulator features.
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S-328.

RELATIONSHIP BETWEEN LUMBAR PLEXUS AND PARASACRAL SCIATIC DEPTH

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INTRODUCTION: The parasacral approach to the sciatic nerve has been reported as a technique easy to teach and to perform, with a high success rate (93%-100%). [1] Compared to other sciatic approaches, the parasacral approach allow the block of the sciatic nerve and the posterior femoral cutaneous nerve of the thigh. [2] Therefore, the combination of parasacral sciatic approach and the lumbar plexus block represent an important anesthetic and postoperative analgesic technique for lower extremity surgery. When performing parasacral blocks there is a theoretical risk of pelvic viscera injury. [3] The aim of our study was to assess the relationship between the lumbar plexus depth and the parasacral sciatic nerve depth.
METHODS: We retrospectively evaluated 100 consecutive patients undergoing major surgeries of the lower extremity combined with both a lumbar plexus block and a parasacral sciatic block (April-June 2005). Demographic data, anthropometric data and depths of the lumbar plexus and the sciatic nerve were recorded. A correlation between the depth of the lumbar plexus and the sciatic nerve was also assessed using Pearson correlation coefficient (r). The contribution of either weight or height in predicting the depth using r^2. $P \leq 0.05$ was set up as significant.
RESULTS: Fifty-five females, forty-five males were included; median age was 65 years and median weight 85 kg, and height 170 cm. Ninety patients underwent a total hip replacement. The median depth for both the lumbar plexus and parasacral was 9 cm. There was a positive linear correlation between weight and depth of the lumbar plexus ($r = 0.631$; $p \leq 0.05$; $r^2 = 0.398$) but no correlation between height and the lumbar plexus depth ($r = 0.169$). Furthermore, there was a linear and positive correlation between the depth of the lumbar plexus and the depth of the sciatic nerve when using a parasacral approach ($r = 0.595$; $p \leq 0.05$; $r^2 = 0.354$).
DISCUSSION: This study provides original finding on the respective depth of the lumbar plexus and parasacral sciatic nerve depth. Weight only predicts 39.8% of the lumbar plexus depth and the depth of lumbar plexus predicts 35.4% of the sciatic nerve depth using a parasacral approach.
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S-329.

SONOGRAPHIC VISUALIZATION OF THE LATERAL FEMORAL CUTANEOUS NERVE: A VOLUNTEER STUDY WITH DESCRIPTIVE CLINICAL CORRELATE

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Introduction: The lateral femoral cutaneous nerve (LFCN) is known for its anatomic variability as it exits the pelvis.[1,2] The aim of this study is to describe the ultrasound appearance of the lateral femoral cutaneous nerve and to demonstrate the clinical utility of ultrasound imaging for these nerve blocks.
Methods: We scanned left and right sides of 20 volunteers and assessed visibility, size and shape, and depth from the skin of LFCNs as they entered the thigh from the level of the anterior superior iliac spine. We also reviewed a clinical series of patients who underwent LFCN blocks using similar scanning technique as our volunteers and collected data on the performed procedures.
Results: In this set of 20 volunteers, 57.5% (23/40) LFCNs were sonographically identified 0.6 cm $\pm$ 0.7 medial and 2.3 $\pm$ 1.2 cm distal from the anterior superior iliac spine (Figure, between arrows). The nerves averaged 1.1 ± 0.5 mm in anterior-posterior dimension and 3.7 ± 2.2 mm in medio-lateral dimension and were 5.2 ± 1.6 mm below the surface of the skin. In the clinical setting all the LFCN blocks using the same imaging ultrasound guidance technique as in the volunteer study proved successful.
Discussion: The LFCN is challenging to sonographically image.[3] It is best visualized superficial to the sartorius muscle, just medial to the anterior superior iliac spine. Knowledge of the LFCN's ultrasound appearance facilitates localization of this nerve and may increase success of such block procedures.[4]
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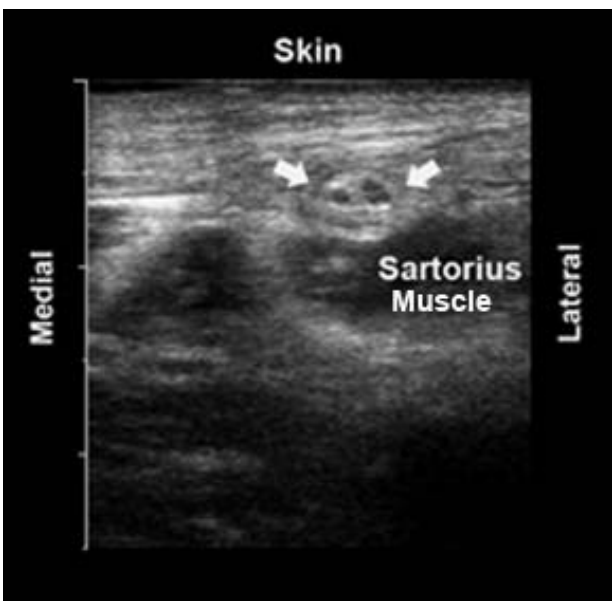

S-330.

THE TRENDELENBURG POSITION WITHOUT LUMBAR LORDOSIS AS A RESCUE ATTEMPT TO INCREASE THE SPINAL ANALGESIA LEVEL FOLLOWING SPINAL BLOCK

AUTHORS: J. Kim[1], S. Kim[1], M. Bae[1], J. Shim[2], C. Kim[3], **J. Bahk**[3];
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Introduction: When spinal analgesic level appears to be too low to perform a surgery following intrathecal injection of hyperbaric anesthetics, patients are usually placed in the Trendelenburg position. However, cephalad spread of the hyperbaric spinal anesthetics may be limited by the lumbar lordotic curvature. The Trendelenburg position without lumbar lordosis, which was positioned by flexing the hips and knees in addition to the head down position, was evaluated as a method to extend the analgesic level after intrathecal injection during single shot spinal anesthesia.
Methods: When spinal analgesic level was lower than T10 at 5 min after intrathecal injection of 13 mg hyperbaric bupivacaine at the L4-5 interspace of the sitting patients, the patients were recruited and randomly allocated to one of the two positions: Trendelenburg position with flexion of the hips and knees (Group TF, n=20) and Trendelenburg position without flexion of both joints (Group TNF, n=20) because the lumbar lordosis can be minimized by the hip flexion (1,2). The 15-degree head down tilt position was maintained for 5 min regardless of lumbar lordosis. After the Trendelenburg positioning, all patients returned to the horizontal supine position with the legs straightened. Spinal block level was assessed by pinprick sensation and modified Bromage scale
Results: The initial analgesic level of the recruited patients [median (range)] was L5 (S4-T12) in Group TF and L5 (S5-T11) in Group TNF, respectively. After Trendelenburg positioning, the analgesic level was more rapidly elevated in the TF group than in the TNF group. The maximum levels of analgesia [median (range)] were T4 (T8-C6) in the TF group and T7 (T12-T4) in the TNF group ($P < 0.001$). Complete motor block was achieved in all patients of the Group TF, whereas the motor block was incomplete in 4 patients of the Group TNF during the study. There were no cases of lower back pain or postdural puncture headache in the postoperative period.
Discussions: With regard to elevating the block height during spinal anesthesia with a hyperbaric drug, the Trendelenburg position combined with flexion of the hips and knees was more effective than simple Trendelenburg position. When spinal analgesic level is anticipated to be lower than necessary, flexion of the hips and knees in the Trendelenburg position may be useful as a rescue attempt to increase the spinal analgesic level.
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