PEDIATRIC ANESTHESIA POSTER DISCUSSION 1
Saturday, June 20
10:15 AM - 12:00 PM
Room: Parliament Foyer

Moderators:
Carolyn Montgomery, University of British Columbia
Marie-Andrée Girard, University of Montreal

Objective:
At the end of this session, participants will be able to:
• Discuss presented research presentations in pediatric anesthesia with author(s) and attendees.

75867 - PRACTICE IMPROVEMENT BY TRACKING PEDIATRIC TONSILLECTOMY OUTCOMES
Primary Author / Presenting Author: Robin Cox, University of Calgary, Calgary, Alberta
Co-Authors(s): Jon McMann, Michael Letal, Diane Duncan, Adam Spencer, Lara Cooke

82398 - PEDIATRIC DIFFICULT AIRWAY MANAGEMENT IN A TERTIARY CARE CENTER
Primary Author / Presenting Author: Cengiz Karsli, The Hospital for Sick Children, Toronto, Ontario, Ontario
Co-Authors(s): Preethy Mathew, Carlyne Pehora, Adel Al-Izzi, Kamran Kianfraz, Armando Ponte, Fettah Efdogan

84713 - ANTRAL SONOGRAPHY IN PEDIATRIC PATIENTS WITH LARGE GASTRIC VOLUMES
Primary Author / Presenting Author: Adam Spencer, University of Alberta, Calgary, Alberta
Co-Authors(s): Andrew Walker, Alfred Yeung, David Lardner, Kevin Yee, Jamin Mulvey, Anahi Perlas

85940 - PROPHYLAXIS OF POSTOPERATIVE VOMITING IN CHILDREN WITH DEXTROSE.
Presenting Author: Kelly Anne Fedoruk, Department of Anesthesiology, Perioperative Medicine and Pain Management, University of Saskatchewan, Saskatoon, Saskatchewan
Primary Author: Andrea Vasquez, Department of Surgery, University of Saskatchewan, Saskatoon, Saskatchewan
Co-Authors(s): Jonathan Gamble, Grant Miller

85975 - PEDIATRIC MODIFIED MAGILL FORCEPS AFFECT ON NASAL INTUBATION TIME
Primary Author / Presenting Author: Farrukh Munshey, University of Saskatchewan, Saskatoon, Saskatchewan
Co-Authors(s): Jonathan Gamble, William Mckay

86072 - COMPARISON OF USG VS LANDMARK TECHNIQUE FOR IL/IH BLOCK IN CHILDREN
Presenting Author: Ganga Prasad, New Delhi, India
Co-Authors(s): Avilie Nisa, Mahesh Kumar. Arora, Lokesh Kashyap, Avilie Nisa, MK Arora, Lokesh Kashyap
86103 - PHARMACOKINETICS OF TRANEXAMIC ACID IN PEDIATRIC SCOLIOSIS SURGERY.
Primary Author / Presenting Author: Susan Goobie, Boston Children's Hospital, BOSTON, Massachusetts
Co-Authors(s): Luis Pereira, Brenda Barton, Amanda Whipple, Robert Brustowitz, MaryEllen McCann, Michael Glotzbecker, John Emans, David Zurakowski, Daniel Hedequest, Navil Sethna, Timothy Hresko, Lawrence Karlin

86105 - PREDISPOSING FACTORS OF EMERGENCE AGITATION IN PEDIATRIC ANESTHESIA
Primary Author / Presenting Author: Patcharee Sriswasdi, Boston Children's Hospital, Newton, Massachusetts
Co-Authors(s): Elizabeth Carpino, Sean Sinnott, Mark Breibart, Rebecca Lekowski, Joseph Cravero, Joseph Cravero
75867 - PRACTICE IMPROVEMENT BY TRACKING PEDIATRIC TONSILLECTOMY OUTCOMES

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Introduction: One method of improving anesthesia practice may be to provide outcome data to individual anesthesiologists and groups of anesthesiologists, causing them to reflect on their own practices, as well as systemic factors in the perioperative environment. We undertook to evaluate a group of pediatric patients undergoing tonsillectomy and perform a detailed analysis of their perioperative experience and outcomes with the purpose of providing feedback to anesthesiologists on their own practice and those of their peers. The expectation was that this would provide a stimulus for personal educational objectives, and changes in practice to improve perioperative and postoperative outcomes for children.

Methods: Local research ethics committee approval was obtained for the study. Over a six month period, willing parents or guardians of all children undergoing tonsillectomy at a free-standing children’s hospital provided written informed consent to participate. Data collected included demographics, anesthetic techniques, in-hospital outcomes as well as outcomes for the first day postoperatively. The practice of all 19 consenting anesthesiologists in the group was included. Parents/guardians received a structured telephone questionnaire on the first postoperative day, which included quantitative and qualitative data. Confidential individual patient outcomes, as well as aggregate group data, were provided to anesthesiologists, both in written format and at a facilitated group discussion session.

Results: 89% (263/296) of eligible families consented to participate in the study. 243 families completed the study. 78% of parents were very satisfied and 2% were quite dissatisfied with the care they received. Individual anesthesiologists were able to reflect on their own practice, considering items such as premedication, parental presence at induction, the use of cuffed tubes, analgesic and antiemetic regimes, and fluid management. Individual comments from families were made available to the anesthesiologist who provided care to their child. Specific findings of note were a postoperative vomiting rate of 22% over 24 hours, and a mean "worst" pain score of 6.9/10, which was felt to be unacceptably high. Cuffed tubes were used in 61% of cases, parental presence in 44%, and deep extubation in 76%.
Discussion: Anesthesiologists found the ability to reflect on the outcome data of their own patients, as well as their peers to be a powerful way to stimulate practice improvement. Individual comments from families were also valued highly by participating anesthesiologists. If such models of providing outcome data to anesthesiologists were more widely made part of everyday practice, this might well lead to an improvement in patient and family satisfaction. As an example, the unacceptably high pain scores encountered in the first 24 hours will need new strategies to manage. It is hoped that tracking of perioperative outcome data will become the standard for all children in the institution.
Introduction: This study identifies the incidence, common features and clinical management of difficult intubation in children treated at a pediatric tertiary care center over a two-year period.

Methods: With REB approval the anesthetic records of patients aged 0 to 17 years undergoing general anesthesia between December 2009 and December 2011 were reviewed. Cases with documented difficult airway (C-L grade 3 or more) were identified and analyzed for incidence, demographics, airway history, physical assessment, airway management details, and complications. Descriptive statistics were used to analyze the data.

Results: The total number of anesthetics was 22766. Ninety-four patients with difficult airway underwent 125 anesthetics, for an incidence of 5 in 1000 anesthetics. The highest proportion of children with difficult airway was in adolescents greater than 13 years of age (49%), with infants less than one year representing 21% of cases. A difficult intubation was anticipated in 80.6% of cases. Seventy (74.4%) of the difficult airway patients had previous anesthetics. Figure 1 outlines the history and physical findings in those patients.

In 76 (60.8%) of patients spontaneous respirations were maintained for intubation. Sevoflurane and propofol were used as induction agents with similar frequency and rocuronium and remifentanil were administered in 31.2 and 22.4% of patients, respectively. Muscle relaxation had been administered to all but 4 of the 25 unanticipated difficult airways.

Ninety one percent of the patients with difficult airways were managed with tracheal intubation, 5.6% with an LMA, 1.6% with nasal prongs and 1.6% with face mask. Of those patients with an anticipated difficult airway, DL was the first intubation method of choice in 53 patients (42.4%). Four emergency tracheotomies and 2 rigid
bronchoscope intubations were performed, each after at least one failed intubation attempt. Of the 38 anesthetics in patients aged 14-17 years, six intubations were performed awake after airway topicalization.

Postoperatively 34 (27.2%) of patients were admitted to the pediatric intensive care unit, 2 (1.6%) of which were unplanned admissions.

**Discussion:** The almost 20% incidence of unanticipated difficult intubation in this series is in contrast to the adage that difficult airways are almost always predictable in children. Over half the patients with a difficult airway had at least one prior anesthetic in which intubation difficulty was not an issue, suggesting that reliance upon prior anesthetic history alone is insufficient and careful physical assessment is essential. In most of the patients with a known or suspected difficult airway direct laryngoscopy was still chosen as the first choice despite the increasing number of fiberoptic and videolaryngoscopic intubating devices available on the market.

**Conclusion:** Even in a tertiary care pediatric center the rate of unanticipated difficult intubation remains considerable.

**References:**
84713 - ANTRAL SONOGRAPHY IN PEDIATRIC PATIENTS WITH LARGE GASTRIC VOLUMES

Author(s)
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Anahi Perlas - Toronto Western Hospital, University Health Network

Introduction: Ultrasonography is a non-invasive tool to assess gastric fullness and aspiration risk at the bedside in adults and pediatric patients (1, 2). The aim of this study was to evaluate the performance of a 3-point grading system in the prediction of full stomach in the pediatric population by correlating antral grade with gastric volume assessed by suctioning under gastroscopic vision.

Methods: Local ethics board approval was obtained and legal guardians and/or patients scheduled to undergo elective upper gastroscopy provided written informed consent for the study. Following induction of anesthesia, gastric sonography was performed using a Phillips CX50 system (Philips Healthcare, Andover MA, USA) with a curvilinear (low frequency 2-5 MHz) or a linear (high frequency 7-12 MHz) transducer with the patient in both supine and right lateral decubitus (RLD). A video clip and three still images of the antrum between peristaltic contractions were recorded for each patient. Immediately following sonographic assessment, gastric contents were suctioned under gastroscopic guidance and the volume was measured. Qualitatively, the antrum was classified as empty (grade 0) if it appeared flat, with the anterior and posterior walls juxtaposed during a dynamic scan in both supine and RLD. The antrum was deemed to contain fluid if it appeared to have an endocavitary lumen with hypoechoic content and distended walls. In a grade 1 antrum, fluid was visualized only in the RLD position. In a grade 2 antrum, fluid was observed in both supine and RLD positions. A Mann-Whitney U test was completed using SPSS 19.0 (IBM, Armonk NY, USA).

Results: One hundred fasted pediatric patients (aged 11-216 months) presenting to a tertiary hospital for upper gastrointestinal endoscopy were included in the final analysis. A qualitative (content) and quantitative (volume) assessment of the gastric antrum was completed in the supine and RLD positions for each patient. 10% of patients presented with suctioned gastric volumes > 1.12 mL/kg, which is used as our full stomach cutoff volume (3). 0% (0/54), 10.8% (4/37) and 55.6% (5/9) of grade 0, grade 1 and grade 2 classified patients, respectively had suctioned volumes > 1.12 mL/kg. One patient with a
full stomach was not graded as fluid was observed only in the supine position. Specifically, within the nine graded patients with a full stomach, a significant difference \((p < 0.05)\) was noted in suctioned volumes between grade 1 \((x = 1.20 \pm 0.06 \text{ mL/kg}, 95\% \text{ CI} = 1.10-1.30)\) and grade 2 \((x = 2.05 \pm 0.87 \text{ mL/kg}, 95\% \text{ CI} = 0.97-3.13)\).

**Discussion:** These results suggest that a 3-point grading system (grades 0-1-2) based on qualitative gastric sonography may be a good predictor of gastric fullness and aspiration risk in pediatric patients. However, caution must be taken in the interpretation of significance in gastric volumes between grade 1 and grade 2 full stomach patients given the small size of this cohort. This suggests a larger study with appropriate statistical power is warranted to assess the utility of antral ultrasound in this population. Greater awareness and the ability for risk stratification could eventually influence a provider's choice of sedation, anesthetic, and airway management.

**References:**

85940 - PROPHYLAXIS OF POSTOPERATIVE VOMITING IN CHILDREN WITH DEXTROSE.

Author(s)
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Background: Post-operative vomiting (POV) in children is a frequent (8.9-42%) and common indication for unexpected hospital admission (1-3). Intravenous (IV) fluids containing dextrose are commonly used in children. Studies using these IV fluids in the perioperative period have shown improvement of POV in adults (4, 5). Similar studies have not been done in paediatric patients.

Objective: To investigate the efficacy of intraoperative IV dextrose for antiemetic prophylaxis in children undergoing ambulatory surgery.

Methods: Local Research Ethics Board approved this double-blinded randomized control trial on 290 healthy children (3-9 years old) with low risk of POV undergoing ambulatory dental surgery. Patients were randomized into two groups based on antiemetic prophylaxis. The control group received dexamethasone (0.15 mg/kg IV) and ondansetron (0.05 mg/kg IV); the intervention group received dexamethasone (0.15 mg/kg IV) and intravenous 5% Dextrose in 0.9% normal saline (D5NS) maintenance fluid (6).

The primary outcome, emesis in the post anaesthetic care unit (PACU), was compared using Chi-Square. The secondary outcomes were analysed by T-test and non-parametric analysis where appropriate. Non-inferiority analysis of intraoperative IV dextrose relative to ondansetron was conducted with δ = 10 % as the non-inferiority limit.

Results: Data from 289 patients were analyzed (intervention group 144, control group 145). Demographics and intraoperative anaesthetic management were similar. Results are displayed in Figure 1. Emesis in PACU was not different between groups (p = 0.11)
The 95% CI upper limit of the POV proportion was below the non-inferiority margin (7 vs 21.7), demonstrating that intraoperative IV dextrose was non-inferior compared to ondansetron. Patients who vomited in the PACU were 6.2 times more likely to vomit at 24 hours (p=0.015). POV within 24 hours of surgery occurred in 36 participants (12.4%).

**Conclusion:** This study demonstrates that IV dextrose is not less effective than ondansetron in preventing POV. The effectiveness, different mechanism of action, and safety profile of IV dextrose may lead clinicians to consider this as an alternative, or additional therapy for POV prophylaxis.

**References:**


Introduction: Magill Forceps (MF) are commonly used as an adjunct in nasal tracheal intubation (NTI). (1) No literature has investigated whether the design of the forceps can be altered to account for differences in adult versus pediatric airway anatomy. Knowing that the pediatric larynx and trachea are angled posteriorly, we hypothesized that a +45° change to the MF tip would ease manipulation of the nasal RAE tube, preventing it from getting caught on the anterior trachea and thus, reduce time to intubation TTI. (2)

Methods: Following local research ethics board approval, an open label study enrolling 100 consenting patients was conducted. Subjects were randomized to NTI via an aMF or conventional MF. Randomization was conducted using a computer generated randomization list. Group assignment was blinded using sealed opaque envelopes. Inclusion criteria comprised patients aged 0-15yrs and ASA ≤ 2. Exclusion criteria included patients with upper airway abnormalities, risk factors for aspiration or known difficult airway. All intubations were performed by staff anesthesiologists and TTI was recorded via a stopwatch with a sole operator.

Results: Data from 52 patients in the aMF group and 48 patients in the MF group were analyzed using non parametric tests. Using intent to treat analysis, the median TTI and interquartile ranges for the MF and aMF were 8.89s (6.52s - 12.51s) and 10.48s (7.07s - 14.29s), respectively (p=0.23). A subset analysis of the data excluding all subjects in whom the corkscrew technique was used to facilitate passage of the nasal RAE tube showed the median TTI for the aMF to be slightly less than the MF, although not statistically significant.

Discussion: NTI of pediatric dental surgery patients using an aMF compared to a traditional MF did not result in a significant reduction in TTI. Several pediatric anesthesiologists, however, felt the aMF to be a handy alternative in certain patients. Having mastered using the conventional MF from years of experience, most anesthesiologists in the study felt there was a slight learning curve to using the aMF. This may have contributed to the difficulty in trying to detect a reduction in TTI, if one exists. Nonetheless, equivalence with minimal training was seen. Further studies comparing the aMF with the conventional MF in novice laryngoscopists may be warranted.
References:
Introduction: Ultrasound guided IL/IH nerve block is gaining popularity for pediatric groin surgery with success rate more than 95 % in experience hand. However, despite the benefits, the absence of ultrasound machine should not hinder the provider from performing an IL/IH nerve block, considering that many institution are not able to afford an ultrasound machine. The main aim of this study was to assess the accuracy of needle tip in anatomical landmark technique and to compare the efficacy and success rate of IL/IH nerve block using ultrasound guidance and anatomical landmark technique.

Methods: Ethics committee approval was attained and 40 children (1-8 yrs) posted for inguinal hernia day care surgery were divided into 2 groups, group A (ultrasound) and group B (anatomical landmark). Following induction of general anesthesia, group A received IL/IH nerve block under ultrasound guidance. Group B received IL/IH nerve block using conventional landmark technique and ultrasound scan was done to assess the accuracy of needle tip before injecting the LA. The distance of needle tip from IL/IH nerve and plane of needle tip were recorded and LA were injected irrespective of the position of needle tip. 0.5% ropivacaine (0.25ml/kg) were used in both groups with maximum volume of 5 ml. Perioperative opiod requirement and duration of analgesia were recorded.

Results: IL/IH were visualized in all 40 Patients. The success rate was 90 % in group A and 60% in group B. Needle tip were seen between internal oblique and transverse abdominis in all 20 patients (100%) in group A and in 15 patients (75%) in group B. The duration of analgesia (p= 0.025) and intra-operative (p= 0.029) and post-operative (p= 0.019) opioid consumption were significantly lesser in the group A. In group B, needle tip was placed in internal oblique muscle in 2 patients, external oblique/internal oblique plane in 1 patient, transverse abdominis muscle in 1 patient and peritoneum in 1 patient.

Conclusion: Ultrasound guided IL IH nerve block is superior to anatomical landmark technique for IL/IH nerve block in terms of efficacy and success rate. However, in case of non availability and lack of experience in handling ultrasound machine, landmark-
based technique can be used with lesser success rate for IL/IH nerve block for day care inguinal hernia repair.
Background: Tranexamic Acid (TXA) is a potent Antifibrinolytic, which is efficacious at decreasing blood loss and transfusion of blood products in pediatric cardiac, craniofacial and orthopedic surgery. To date conclusive evidence from a well-designed trail is lacking to support it’s efficacy in Adolescent Idiopathic Surgery. The primary aim of this study is to determine if tranexamic acid is efficacious in this setting. Secondary aims are to determine the pharmacokinetic profile of Tranexamic acid in this specific group.

Methods: This prospective study randomized double blind study will enroll 120 children and adolescents ages undergoing scoliosis repair with the diagnosis of idiopathic scoliosis. This initial report will define the pharmacokinetic (PK) profile of TXA in children and adolescents will be determined and therefore the optimum dose will be predicted. These results are part of a larger efficacy and safety trial.

Results: With local institutional board approval and patient/parent consent; we have recruited 79/120 patients to date. We have completed an interim pharmacokinetic analysis of our plasma levels in 34 patients in the treatment group receiving tranexamic acid; 50 mg/kg loading dose and 10 mg/kg/h infusion for the duration of the surgery. The study investigators have remained blinded. Plasma samples were assayed for the drug with a validated LC/MS methodology. All plasma levels of TXA are above the recommended lowest therapeutic concentration to inhibit fibrinolysis. The highest concentrations reached at the end of the loading dose averaged 226 ug/mL (min=151; max=318). During the constant rate infusion till the end of the surgery, steady state concentrations were achieved, averaging 82 ug/mL (min=47; max=139). Post-infusion the concentrations decayed exponentially with a terminal half-life of 2.1 h (min=1.1;
max=2.7). Interpatient variability is less that 20%, not yet factoring any demographic covariates. Based on previous experience and published information, a population analysis upon full enrollment will certainly shrink this variability based on expected covariates, such as patient's body weight. The TXA plasma ccn vs time graph is presented in Figure 1. This raw data will be further analyzed to determine the population Pk parameters for TXA, devise a model to predict and recommend the lowest therapeutic dose of TXA for adolescents having AIS surgery; in a similar fashion to our previous report (1).

**Discussion:** This is the first report of the pharmacokinetic profile of tranexamic acid in children undergoing idiopathic scoliosis surgery. We will develop a model to predict the lowest optimum therapeutic dose for this patient population.

**References:**
86105 - PREDISPOSING FACTORS OF EMERGENCE AGITATION IN PEDIATRIC ANESTHESIA

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Introduction: Perioperative identification of children at risk of poor post-anesthetic outcome allows the anesthesia team to use appropriate intervention or prevention measure to reduce the incident of poor outcome, thereby enhancing the quality of the anesthetic experience. We defined one aspect of poor post-anesthetic outcome among pediatric anesthesia practice as the presence of emergence agitation. We conducted a prospective observational study to identify perioperative factors predictive of post-anesthesia agitation in children. In the last two years all patient encounter information for patients undergoing anesthesia in our institution has been placed in electronic format. Our research group has taken this information and added supplemental information on the preoperative temperament of children as well as their post-operative behavior, to create a comprehensive anesthesia outcomes analysis database for children undergoing selected surgeries.

Methods: After IRB approval and informed parental consent, we conducted a single-center prospective observational cohort study in 613 patients from age 2–21 years, undergoing a defined set of surgical procedures between August 2013 and May 2014. Preoperative factors included age, gender, weight, The American Society of Anesthesiologists physical status (ASA) classification, history of delayed development, baseline behavior and type of surgery. We also collected information about patient compliance during mask induction (using the Induction Compliance Check list (ICC)), anesthetic agent used and post-anesthetic parental satisfaction score. We defined poor pain control as high level pain (scores of 7 or more) in post-anesthetic care unit (PACU) and agitation as high Pediatric Anesthesia Emergence Delirium (PAED) scale score in PACU (score of 10 or more last longer than 10 minutes). A multivariable ordinal logistic regression model was generated and the performance of the multivariable model was evaluated by the c statistic.

Results: Among the 592 patients with pain data, 159 (26.9%) had high-level pain (scores of 7 or more for more than 10 minutes). Among the 429 patients with agitation data, 170 (39.6%) had high agitation score (scores of 10 or more) (95%
Testing all patients by multivariate logistic regression modeling revealed that only age between 2-6 years (adjusted odds ratio (OR): 2.8, 95% CI: 1.7-4.4, P < 0.001) and tonsillectomy and adenoidectomy surgery (TNA) (adjusted OR: 3.2, 95% CI: 2.0-5.1, P < 0.001) were an independent predictor of agitation. When evaluating first 410 patients by multivariate logistic regression modeling high PAED score was independently related to high-level pain (OR: 4.3, 95% CI: 1.6-11.5, P = 0.003). There was no correlation between emergence agitation and post-hospitalization behaviors or family satisfaction.

**Discussion:** Our observational results show a relationship between age, TNA surgery, high-level pain and emergence agitation. The use observational data has been associated with helpful outcome analysis and results have been shown to correlate with Randomized Controlled Trials.

**References:**

REGIONAL ANESTHESIA POSTER DISCUSSION 2
Saturday, June 20
10:15 AM - 12:00 PM
Room: Parliament Foyer

Moderator:
Dr Kwesi Kwofie
Dalhousie University

Objective:
At the end of this session, participants will be able to:
• Discuss presented research presentations in regional anesthesia and acute pain with author(s) and attendees.

80406 - ANALGESIA FOR PRIMARY TOTAL KNEE ARTHROPLASTY
Primary Author / Presenting Author: Sanjay Aragola, University of Manitoba, Winnipeg, Manitoba
Primary Author: Benjamin Arenson, Medical Student, University of Manitoba, Winnipeg, Manitoba
Co-Authors(s): Thomas Turgeon, Eric Bohm, Marshall Tenenbein, Eric Jacobsohn, Amir Esmail

82201 - THE IMPACT OF TRANSVERSUS ABDOMINIS PLANE BLOCKS ON LENGTH OF STAY
Primary Author / Presenting Author: Kathryn Wheeler, University of Ottawa, Ottawa, Ontario
Co-Authors(s): Daniel I. McIsaac, Elizabeth Miller, Jiye Joo

84261 - PAIN FOLLOWING UNILATERAL TOTAL KNEE ARTHROPLASTY
Primary Author / Presenting Author: Richard Bowry, North York General Hospital, Toronto, Ontario
Primary Author: Mona Sawhney, School of Nursing Queens University, Toronto, Ontario
Co-Authors(s): Maurice Bent, Joyce Choy, Gregory IP, Daisy Joo, Brian Kashin, Hossein Mehdian, Jason Proudman, Linda Jussaume

84341 - SPREAD FOLLOWING INADVERTENT INTRATHecal INJECTION IN SPINE MODELS
Presenting Author: Jason A. Vaz, Department of Anesthesiology and Pain Medicine, University of Alberta, Edmonton, Alberta
Primary Author: Ban C.H. Tsui, Department of Anesthesiology & Pain Medicine, University of Alberta, Edmonton, Alberta
Co-Authors(s): Ban Tsui

85349 - PERIOPERATIVE FASCIA ILIACA BLOCKS FOR HIP FRACTURES
85881 - LOCAL INFILTRATION ANALGESIA FOR KNEE REPLACEMENT: A META-ANALYSIS
Primary Author / Presenting Author: Mandeep Singh, University of Toronto, Toronto, Ontario
Co-Authors(s): Kathleen Nelligan, Liza Tharakan, Reva Ramlogan, Bradley Johnston, Marina Engleskasis, Richard Jenkinson, Colin McCartney

86119 - IMPROVEMENT OF HEARING LOSS FOLLOWING EPIDURAL BLOOD PATCH
Presenting Author: Caroline Borkett-Jones, Lister Hospital, East and North Hertfordshire NHS Trust, Herts, United Kingdom
Primary Author: Shanmugusundaram Gowrie-Mohan, North & East Herts NHS Trust, Hitchin, United Kingdom
Co-Authors(s): Mohammed Cassim, Kiran Jani
Introduction: Total Knee Arthroplasty (TKA) is associated with moderate to severe pain. Multimodal analgesia is commonly used perioperatively along with a Periarticular Injection (PI) or Femoral Nerve Block (FNB)\textsuperscript{1,4}. FNB is not without risk\textsuperscript{5} and opinion is still divided as to which of the two is better\textsuperscript{6}. This study is a prospective double blinded randomized controlled trial comparing PI with combined Continuous Femoral Nerve Block and Posterior Capsular Injection (NB+PCI) with postoperative follow-up for 1 year.

Methods: Appropriate ethics approval was obtained. Both groups had preoperative oral analgesia with Controlled Release Hydromorphone (CRHM), Celecoxib & Acetaminophen; NB placed by ultrasound or nerve stimulator guidance or both; standardized spinal anesthesia and sedation; Intravenous Patient Controlled Analgesia (IVPCA) with HM on postoperative day 0 (POD-0); Oral analgesia with CRHM, Immediate Release HM, Celecoxib and Acetaminophen from POD-1 onwards. These treatments were the same for all patients in the study.

Patients were randomized and had either 20 ml of 0.2% Ropivacaine through the FNB catheter or saline as a loading dose in the OR in the NB+PCI & PI groups, respectively. The FNB catheter was infused with either 0.2% Ropivacaine or saline at 15 ml per hour until POD-1 morning, followed by 10 ml per hour until POD-2 morning. Either 20 ml of 1\% Ropivacaine or periarticular solution was injected in the posterior capsule of the knee and a sham PI with saline or a solution containing Ropivacaine, preservative free Morphine, Ketorolac and Epinephrine was infiltrated around the joint and skin in the NB+PCI & PI groups, respectively. Physicians, patients and assessors were blinded to the group assignment.

Pain was assessed at rest and during movement twice daily on POD-1 & 2 by a Numerical Rating Scale (NRS). The worst pain experienced between the two time points, number of patients reporting mild, moderate & severe pain in each group, knee range of motion (ROM), quadriceps strength, walking distance, narcotic usage & side
effects, hospital length of stay (LOS) and patient satisfaction were also assessed. Pain
score, patient satisfaction, Oxford Knee Score (OKS) and ROM were assessed again at
1 year post TKA. The study was powered to detect a 2 point difference in NRS at rest
and with motion between groups (p=0.05, beta=0.2).

Results: 72 ASA 1-3 patients under the age of 70 years were recruited. 39 were
randomized in a concealed manner to the NB+PCI group and 33 to the PI group.
Baseline differences between groups were not significant. A statistically but not clinically
significant trend towards reduced pain on POD-2 for PI versus NB+PCI was seen.
There were small differences in IVPCA HM usage on POD-0, (2.9 +/- 2.4 mg in PI group
vs 4.4 +/- 3.2 mg in NB+PCI group, p= .03), and knee flexion at 1 year (119.9 +/- 10.9° in
NB+PCI group vs 109.9 +/- 22.4° in PI group, p= .03). There were no significant
differences in other outcome measures.

Discussion and Conclusion: There was no demonstrated improvement in pain control
with the use of NB+PCI versus PI when both groups had a background of multimodal
oral analgesia. The chosen technique should have the least potential for serious
complications and least impact on work flow.

References:

1. Hebl JR, Dilger JA, Byer DE et al. A pre-emptive multimodal pathway featuring
peripheral nerve block improves perioperative outcomes after major orthopedic

2. Raphael M, Jaeger M, van Vlymen J. Easily adoptable total joint arthroplasty

knee arthroplasty: periarticular infiltration vs continuous femoral nerve block. Br J
Anaesth 2010;105 (2): 185–95

4. Toftdahl K, Nikolajsen L, Haraldsted V et al. Comparison of peri- and intra-
articular analgesia with femoral nerve block after total knee arthroplasty. A

Introduction: Several systematic reviews exist which support the role of transversus abdominis plane (TAP) blocks in improving postoperative pain scores, and decreasing opioid consumption, nausea, and vomiting (1,2,3). However, the impact of TAP blocks on postoperative functional recovery and resource utilization, such as length of stay (LOS), is not often reported and has not been reviewed. The purpose of this systematic review and meta-analysis is to determine whether TAP blocks lead to a reduction in LOS following elective abdominal surgery. The results of this study may help to identify the impact of TAP blocks on LOS or highlight the need for further research on resource-related outcomes.

Methods: A literature search was performed in the following databases: MEDLINE, PUBMED, CINAHL, EMBASE, Web of Science, CENTRAL, PROSPERO, US Clinical Trials Database, and WHO ICTRP. A systematic review protocol was developed and registered with PROSPERO. Given the nature of the study, ethical approval was deemed unnecessary. From our literature search, two investigators will independently identify all RCT and cohort studies that report LOS and meet our inclusion criteria (Table 1). These investigators will independently and sequentially review all identified titles, then abstracts, and finally identify full text reports (including data extraction). Disagreement will be settled through a tie-break by a third investigator. Using a data collection form specifically developed and piloted for this review, data will be extracted from tables or text of the identified full text reports. Risk of bias will be assessed using the Cochrane risk of bias tool for quality assessment of RCTs and the ACORBAT-NSRI and Newcastle-Ottawa Scale for cohort studies. Quality of evidence for each study will be documented using the GRADE approach.

Results: Literature search yielded 3,712 articles and 384 registered systematic reviews and clinical control trials. Identification of studies which meet the study inclusion criteria is currently underway. A random effects model will be used to meta-analyze data extracted from included studies. As LOS data are typically right-skewed, data will be log transformed and meta-analysis performed using the geometric mean and associated standard deviations to allow meaningful comparisons of standardized mean differences. Primary outcomes data (PACU LOS and hospital LOS) will be analyzed separately.
Planned sub-group analyses include inpatient vs. outpatient surgery, laparoscopic vs. open and upper vs. lower abdominal procedures, single-shot vs. continuous infusion of local anesthetic, and pre- vs. post-operative block placement.

**Discussion:** The TAP block has established efficacy for improving pain outcomes following lower abdominal surgery. An understanding of the effect of TAP block on resource utilization such as LOS is needed. Knowledge of the effect of TAP block on discharge time may highlight the need for further research on resource-related outcomes and may be beneficial in understanding the role of this intervention in Enhanced Recovery Programmes.

**References:**
2. Colorectal Dis 2012 4(10): e635-42
84261 - PAIN FOLLOWING UNILATERAL TOTAL KNEE ARTHROPLASTY

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Introduction: Total knee arthroplasty (TKA) is a painful surgery but it requires early mobilization for successful joint function. Therefore, effective pain management is essential for rehabilitation. Multimodal analgesia including: spinal anesthetic, nerve blocks, periarticular infiltration, opioids, and co-analgesics have been shown to effectively manage post-operative pain. One of the criticisms of nerve block is the potential to impair quadriceps muscle strength which limits mobility. (1-3) Both adductor canal (AC) and peri-articular infiltration (PI) have been shown to manage pain without impairing motor function. (4-7) However, it is unclear which technique is most effective. The purpose of this 3 arm trial was to examine the effect of both AC+PI vs AC vs PI. The primary outcome was pain on walking at post-operative day (POD) 1.

Methods: Following Ethics Board approval, patients undergoing unilateral TKA were approached to participate in this trial. Inclusion criteria included: 18 years or older, ASA I-III, able to speak and read English. Patients were excluded if they had a contraindication to regional anesthesia/local anesthetics, chronic pain not related to their knee, were using opioids for 3 months or longer, or had a peripheral neuropathy. The sample size was calculated based on the primary outcome, and with a c0.5 and 15% attrition rate, a sample of 159 participants was required. Eligible and consenting participants were randomized into 1 of the 3 groups. On the day of surgery, the participant was admitted to the 'block room' where they received either AC block with 30mL of 0.5% Ropivacaine or sham block. PI was performed intra-operatively with a 110mL solution of Ropivacaine 300mg, morphine 10mg, ketorolac 30mg, in normal saline. Those patients randomized to AC only received normal saline. Outcomes measured on POD 1 and 2 were pain, analgesic consumption, distance walked and pain related interference.
Results: A total of 159 participants consented and 144 completed the trial. The mean age was 67 years, and 63% were female. On POD1 participants who received AC+PI reported statistically lower pain on walking (3.3) as compared to those who received AC (6.2) or PI (4.9). Participants who received AC reported statistically higher pain scores at rest and knee flexion as compared to those who received AC+PI or PI. On POD2 participants who received AC+PI reported statistically less pain on walking (3.3), as compared to those who received AC (6.2) or PI (4.9). On POD2 there was no difference between the groups for pain at rest, or flexion. Participants who received AC used more IV PCA on POD 0. There was no difference between the groups regarding distance walked.

Discussion: Participants who received both AC + PI reported statistically less pain on walking on POD1 and 2. There was no difference between the groups on distance walked, however, this was only reported 1 time per day and did not capture distance walked over a 24 hour period if the participant walked multiple times.

References:

Introduction: Rapid high spinal blockade (HSB) can result from bolus injection via inadvertent misplacement or migration of an epidural catheter into the intrathecal space. As spinal curvature may also influence such local anesthetic spread in the intrathecal space, it is important to predict how positioning affects cephalad spread in a clinical condition with altered spinal curvature, as with obstetric patients. Pregnancy is known to induce spine flattening in a supine position. Since it would be challenging to study clinically, we attempted to investigate how anatomical changes of spine curvature in different postures would affect the spread time of local anesthetic in an in vitro setting.

Methods: We simulated unrecognized placement of a lumbar epidural catheter into the intrathecal space in a straight spine (i.e., laboring patient in supine position) and a spine with normal lordosis (control). A modified model of the intrathecal space made from clear polyvinylchloride tubing filled with 115 mL 0.9% normal saline (Sp. gr 1.006) was constructed and maintained at 37°C to simulate cerebrospinal fluid (Sp. gr 1.0069). Relative degrees of kyphosis and lordosis in both spines (supine) were replicated from previously published MRI data. With spines in the supine, upright, and semi-seated (30° head-up incline) positions, a bolus of 4.9 cc of 0.25% isobaric bupivacaine with 0.1 cc of 1% methylene blue marker was injected at a constant rate of 8.5 mL/min through a length of 5 cm of 19G epidural catheter inserted into the normal saline column. Time for the bolus to reach T3-T4 (cardioaccelerator fibers) and C3-C4 (diaphragmatic innervation) was recorded. The experiment was repeated four times.

Results: The bolus did not spread to the thoracic or cervical space in either spine when supine. In the straight spine, mean time of cephalad spread to T3-T4 (97 s upright, 69 s incline; p=0.11) and C3-C4 (140 s upright, 124 s incline; p=0.43) was not significantly different with respect to position. In the normal lordosis spine, mean time for the dye to reach T3-T4 (86 s upright, 144 s incline; p=0.009) and C3-C4 (122 s upright, 255 s incline; p=0.003) was significantly different in the cephalad spread depending on position. As illustrated in Figure 1, it was only in the semi-seated position that we observed a delay in spread to T3-T4 and C3-C4 (both p < 0.05) with the normal lordosis spine.
Discussion: Our simplified model of the intrathecal space demonstrates that spinal curvature appears to affect spread of isobaric solution in a normal saline column. A clinical implication is that keeping the patient supine prevents cephalad spread. In addition, maintaining spinal lordosis is important when bolusing local anesthetic with the patient in a semi-seated position. This may delay the spread of large quantities of isobaric solution within the intrathecal space in the event of inadvertent intrathecal catheter tip placement. Since the onset of HSB following a local anesthetic bolus is multifactorial, further clinical study is needed to confirm results of the study.

References:


Introduction: Over 12000 patients experience hip fracture in Ontario each year. This will increase to over 88 000 by 2041 at a cost of $37 000. Indirect anesthetic costs include timing of surgery and the impact of anesthetic technique on recovery. The Ontario Hip Fracture Quality Based Procedure handbook recommends fascia iliaca blocks (FICBs) to improve analgesia, reduce opioids reduce incidence and severity of delirium and decrease length of stay. We describe the challenges of implementing perioperative FICBs in a community hospital.

Methods: REB approval was approved for this project. A group was created with orthopedic, anesthetic, pharmacy, nursing, administrative and a quality improvement specialist. Lean – Six Sigma methodologies were utilised to identify improvement opportunities.

Define
A standardized evidence base approach to managing perioperative pain management for patients suffering from hip fracture in order to reduce perioperative morbidity, delirium and pain.

Measure / Analyze
A process map was created. Contact with specialist consult teams including the acute pain service were identified. Operating room time is provided daily between 1pm and 6pm so the best time to perform FICB is between 1-4 pm. The on-call and trauma anesthesiologist are able to perform the blocks with help from Anesthesia Assistants and registered nurses.

A chart review identified common risk factors. Many patients received opioids as their primary mode of analgesia and many were unsuitable for multimodal analgesic agents. Neuraxial anesthesia with spinal morphine use was typically used for intra/postoperative analgesia. Regional anesthesia to reduce opioid use was uncommon.
A scorecard was created to streamline data collection including; arrival time, time to the surgery, length of stay and discharge destination.

Literature Review: FICB is a superficial peripheral nerve block using a large volume of dilute local anesthetic to block the femoral, lateral cutaneous and obturator nerves. Ultrasound guidance increases success.

Patient Safety: It was agreed FICBs could be performed in the emergency department or the ward. Monitoring and ultrasound will need to be available in both locations. Education on local anesthetic systemic toxicity (LAST) will be provided. Patients will require 20 minutes monitoring after the block. LAST therapy will be immediately available. 30-40ml of ropivicaine (0.25%) will be used. Exclusions include anticoagulation, patient refusal or neurological compromise.

Results: Improve We have now put in place the framework for implementation of a perioperative fascia iliaca block program led by the Department of Anesthesia. We believe the intervention will improve both preoperative and postoperative analgesia and the reliance on opiate medications for these patients.

Control
We will be using the following clinical markers of success:
-Pain scores (using the numerical rating scale).
-Incidence of delirium (using the Confusion Assessment Method).
-Length of stay.

Discussion: Although QBP handbooks provide best evidence, the implementation varies between institutions. Adoption of best practices provides anesthesiologists and excuse to escape from the operating room define our role as perioperative physicians.

References:

Introduction: Total knee arthroplasty (TKA) is a common surgical procedure that can result in severe postoperative pain. Local infiltration analgesia (LIA) has recently gained popularity due to the lack of undesirable motor-related adverse events associated with peripheral nerve blocks. Despite these benefits, it remains unclear whether LIA provides pain relief comparable to femoral nerve block (FNB) or another regional anesthetic technique.

Materials and Methods: Electronic literature search of Medline, Embase, CENTRAL and Cochrane Database of Systematic Reviews databases for articles on LIA published before April 2014 was conducted. Clinical trial registries and international conference abstracts published over the last five years were also searched. Randomized controlled trials comparing LIA against no injection, placebo or regional anesthesia in adults (>18 years) undergoing elective unilateral primary TKA were included. Studies investigating unicompartmental TKA, using only intra-articular LIA or comparing two different LIA methods without a control group were excluded. Outcomes included pain scores at rest and with movement and cumulative morphine consumption at 8 and 24 (+/- 4) hours postoperatively; length of hospital stay; functional outcomes and complications. Data extraction and risk of bias assessment were performed by two independent reviewers. A random-effects meta-analysis of eligible studies was conducted. The requirement for IRB approval was waived as this was a systematic review of already published studies and de-identified data was used for meta-analysis.

Results: 1670 studies were identified and screened in two stages. A total of 24 studies including 1617 patients undergoing unilateral TKA were included. Of these, 753 patients were randomized to the LIA group. Eight studies compared LIA to placebo, 10 studies compared LIA to FNB, and 6 studies compared LIA to a neuraxial technique. When compared to placebo/no injection, LIA was associated with reduced pain scores at rest at 8 hours (SMD −1.68; 95% CI −3.10, −0.27) and 24 hours after surgery (SMD −0.85; 95% CI −1.48, −0.22). Similarly, reduced pain scores with movement at 8 and 24 hours...
were noted. Compared to FNB, LIA was associated with decreased pain at 8 hours at rest (SMD -2.55 (95%CI -4.22,-0.89) and with movement (SMD -0.58 (95% CI -0.99, -0.18). By 24 hours, pain scores were reduced in the FNB compared to LIA (SMD 0.44; 95%CI 0.23, 0.65). Cumulative oral morphine equivalent consumption was lower with LIA compared to placebo (SMD -49.03 mg; 95% CI -92.84, -5.23) and neuraxial techniques (SMD -1.07 (95% CI -1.68, -0.46) over 24 hours but not when compared to the FNB. Length of stay was similar between LIA versus placebo, FNB or neuraxial techniques. Functional outcomes were qualitatively better with LIA. Long-term outcomes were lacking.

**Discussion:** LIA reduces short-term pain compared to placebo and provides improved early postoperative pain relief compared to FNB but this is reversed by the first postoperative day. Future research should focus on uniform assessment and long-term follow-up of pain and function.

**References:**
2. Singh M et al. Does local infiltration analgesia (LIA) provide clinically effective analgesia in the postoperative period for patients undergoing total knee arthroplasty? A systematic review protocol. PROSPERO 2015:CRD42015006378
Introduction: Hearing loss may complicate spinal anaesthesia with a reported incidence ranging between 0.4-40%. Hearing loss relates to the degree of CSF leak and varies with size and type of needle used. The association of hearing loss and Post Dural Puncture Headache is less well described. The aim of this study is to investigate the incidence of hearing loss and the improvement after epidural blood patch.

Methods: Appropriate ethical approval was obtained for this study. One hundred and ten patients who had symptoms of severe post dural puncture headache following accidental dural puncture with a 16G Touhy needle were recruited for a prospective observational study. Patients were excluded who could not co-operate with audiometric testing. Patient characteristics and symptoms were recorded. Each patient was evaluated by an audiologist and tested on the same audiometric equipment. Audiometry was performed in the sitting position one hour before and 24 hours after epidural blood patch. Results were analysed by students T-test, and the hearing threshold was considered to have changed if the difference between the two tests was at least 10dB in the same direction at two or more frequencies.

Results: Thirty four patients spontaneously complained of hearing loss. On direct questioning 91 of the 110 patients felt that their hearing was impaired post dural puncture. Statistical analysis of the Audiometric data showed a significant improvement in Audiometry post epidural blood patch (p < 0.0001) in the low frequency range (< 1000Hz). 86 of the 110 patients had an improvement of ≥ 10dB at two points in the low frequency range post epidural blood patch. All patients who had complained of hearing loss felt it had returned to normal levels post epidural blood patch.

Discussion: The mechanism of hearing loss associated with dural puncture is thought to be transmission of reduced CSF pressure to the inner ear by the cochlear aqueduct, an anatomical connection between the subarachnoid space and inner ear present in most individuals. Alteration in inner ear pressures distorts the basilar and vestibular membranes and auditory hair cell function.
This study would suggest that hearing loss after accidental dural puncture may be more common than appreciated, and that audiometric testing may have a future roll in diagnosis and management of this problem.

References:

PAIN POSTER DISCUSSION 3
Saturday, June 20
1:00 PM - 2:45 PM
Room: Parliament Foyer

Moderator:
Dr Ciaran Twomey, University of Alberta

Objective:
At the end of this session, participants will be able to:
• Discuss presented research presentations in pain: acute – basic & clinical and chronic basic & clinical

83581 - STANDARDIZATION OF ANALGESIC ORDERS FOR JOINT REPLACEMENT SURGERY
Primary Author / Presenting Author: Rosa Reyes, Department of Anesthesia, Cumming School of Medicine, University of Calgary, Calgary, Alberta
Co-Authors(s): Ryan Endersby, Andrew Walker, Kayla Denness, Rosa Reyes

84215 - CAPS - CARDIAC ACUTE PAIN SERVICES A NATIONWIDE SURVEY
Presenting Author: Naveen Eipe, The Ottawa Hospital, Ottawa, Ontario

84860 - CAUDAL BLOCK FOR POST OP ANALGESIA IN ANKYLOSING SPONDYLITIS PATIENTS
Primary Author / Presenting Author: Mahesh Kumar. Arora, All India Institute of Medical Sciences, New Delhi, India
Co-Authors(s): Sumit Bansal, Lokesh Kashyap, Ganga Prasad, Anjolie Chhabra

85831 - ACUTE PAIN MANAGEMENT IN MORBID OBESITY- AN EVIDENCE BASED UPDATE.
Presenting Author: Adele Budiansky, McMaster University, Hamilton, Ontario
Author: Naveen Eipe, The Ottawa Hospital, Ottawa, Ontario

Track: Pain: Chronic - Basic & Clinical

85981 - COMPETENCY BASED EDUCATION IN ULTRASOUND GUIDED PAIN INTERVENTIONS
Presenting Author: Colin RJ. PHillips, Schulich School of Medicine and Dentistry, London, Ontario
Primary Author: Geoff Bellingham, Assistant Professor Department of Anesthesia and Perioperative Medicine Western University, London, Ontario
86004 - POST-OPERATIVE OPIOID USE AFTER CARDIAC AND THORACIC SURGERY
Primary Author / Presenting Author: Peter MacDougall, Dalhousie University, Halifax, Nova Scotia
Co-Authors(s): Andrew D. Milne, Paul Brousseau, Andrew Milne, Paul Brousseau

86106 - INTRATHECAL INFUSION FOR PAIN IN ELDERLY AND MALIGNANCY - CASE REPORTS
Primary Author / Presenting Author: Sadegh Abdolmohamamdi, Notre-Dame Hospital, CHUM (Centre Hospitalier de l'universite de Montreal), Montreal, Quebec
Co-Authors(s): Gilbert Blaise, Pierre-Olivier Hetu, Andree Neron

86225 - RETROLAMINAR PARAVERTEBRAL VERSUS EPIDURAL INFILTRATION IN PAIN
Presenting Author: Gilbert Blaise, Centre hospitalier de l'université de Montréal, Montreal, Quebec
Primary Author: Sadegh Abdolmohamamdi, Notre-Dame Hospital, CHUM (Centre Hospitalier de l'universite de Montreal), Montreal, Quebec
Introduction: A common care pathway for total joint procedures has been widely adopted within our region that includes standardized postoperative orders. However, orders are subject to individual interpretation, potentially contributing to omissions of certain aspects of multimodal analgesia. Additionally, responses from postoperative visits suggest that not all patients have received postoperative analgesia to their satisfaction. This study sought to evaluate and improve postoperative pain management of total hip and knee joint replacement (THR/TKR) and to develop and incorporate an analgesic pathway into the postoperative care plan following THR/TKR that will facilitate best care of each patient that is tailored to their needs and expectations.

Methods: Categorization of quality assurance provided ethics review exemption. Sixty patients undergoing THR (n = 22) or TKR (n = 38) were consecutively recruited. Baseline pain assessments and quality of recovery (QoR) scores were acquired preoperatively. American Pain Society patient outcome questionnaires and visual analog scale (VAS) pain scores were completed and acquired daily during inpatient stay. QoR scores were acquired on postoperative (POD) day 1 and day of discharge. Additional pain assessments were completed on post-discharge days (PDD) 1, 3 and 5 and a final QoR score acquired on PDD 5. Statistical analysis was completed using SPSS 19.0 (IBM, Armonk, NY, USA).

Results: Median (IQR) THR and TKR length of stay (LOS) was 3.08 (0.22) and 3.21 (1.71) days, respectively. Median THR and TKR VAS pain scores on POD 1, 2 and 3 were 1, 2, 2 and 2, 3, 3, respectively. 45.5% and 54.3% of THR and TKR patients presented with high nausea scores (≥ 5 on a 0-10 scale) on POD 1. Significant differences (p < 0.05) were found between POD 1 QoR and all other QoR scores for both THR and TKR patients. Specifically, mean THR QoR scores were 124.2 ± 13.4 (preoperative), 97.6 ± 20.6 (POD 1), 119.7 ± 17.5 (day of discharge) and 125.7 ± 13.5 (PDD 5). Mean QoR scores for TKR were 126.7 ± 14.9 (preoperative), 97.3 ± 23.2 (POD 1), 122.1 ± 19.8 (day of discharge) and 121.9 ± 23.3 (PDD 5). 86.7% and 90.3% of THR and TKR patients were satisfied with their level of pain control on PDD 1, rising to 100% and 91.7%, respectively, on PDD 5. 18% of TKR and 36% of THR patients were ordered NSAIDs as part of their analgesic protocol. 50% of patients had
simultaneous orders of Tylenol#3, acetaminophen and Percocet for breakthrough pain control.

**Discussion:** THR/TKR LOS were in close alignment with pathway goals. Patients displayed high satisfaction in postoperative analgesia, although 100% satisfaction was not achieved for TKR. Of concern were elevated levels of high nausea incidence and the percentage of suboptimal dosing of breakthrough analgesics, necessitating adjustment on POD 1. The absence of clear orders for breakthrough pain control leads to nursing-implemented analgesia administration. Despite providing some degree of autonomy, this can be confusing, especially for junior staff. We plan to implement an analgesic order set that incorporates equipotent doses of opioids, nonsteroidal analgesics and acetaminophen and complete a similar follow-up analysis.
Author(s)
Naveen Eipe
The Ottawa Hospital
Presenting Author

Introduction:
Acute Pain Services (APS) have been well established in Canada and their services improve the management of postoperative pain. The availability and use of APS in cardiac surgery units however is less widespread and even where present may be provided less consistently. We undertook the first nationwide survey from Canada to assess the current clinical practice of pain management after cardiac surgery.

Methods:
The Survey was approved by the IRB. The questionnaire was drafted by two anesthesiologists working in pain management and reviewed for content validity by a domain specialist. The twenty items that were retained covered structure, functioning and demographics of the pain services. A list of all the national centers performing adult cardiac surgery in Canada was drafted and their lead anesthesiologists identified by direct contact. The survey questionnaire was then sent electronically and results collected.

Results:
We received completed questionnaires from all 32 centers achieving a response rate of 100%. Nine centers (29.0%) stated that they had an organized Acute Pain Service (APS). Eight centers (25.8%) stated that they did not have an APS and 14 centers (45.1%) sited “other”. “Other” referred to the fact that the hospital had an APS service but that it covered only non-cardiac surgeries or that they consulted to a neighboring institute when required. For the 9 centers that had a cardiac APS service 3 (33%) had been running for more than 5 years, 2 (22%) for 2 to 5 years and 3 (33%) had been running less than 2 years. One center did not answer this question. For those centers with an organized Cardiac Acute Pain Service (CAPS) 4 had a physician only model and 5 had a combined physician and nurse CAPS, however in only 2 of 9 centers were greater than 50% of the patients receiving APS care after cardiac surgery. Each of the 9 centers had an anesthesiologist assigned to daily APS rounds. On-call coverage, nights and weekends, was the responsibility of the on-call anesthesiologist in 3/9 centers, of the in-house physician in 3/9 centers and of the dedicated APS physician in 3/9 centers.

Discussion:
Acute pain services in Canadian cardiac care centers are varied in both structure and functioning with nearly as many variations as there are sites. In general pain management is a protocol driven activity. Further identification of patients at risk, surgical procedures with severe acute neuropathic pain or chronic post-surgical pain and therapeutic modalities with proven benefit in the non-cardiac surgical population; may improve the care and outcomes of patients undergoing cardiac surgical procedures.
The development and standardization of Cardiac Acute Pain Services will be important to achieve these and the findings of this Survey provide useful first steps in this direction.

References:

84860 - CAUDAL BLOCK FOR POST OP ANALGESIA IN ANKYLOSING SPONDYLITIS PATIENTS

Author(s)
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Introduction: There is ossification in spinal ligaments thus caudal space can be used as an alternative site for insertion of epidural catheters in patients with ankylosing spondylitis as the sacrococcygeal membrane is usually not ossified.

Objective: To compare the efficacy of 0.125% bupivacaine alone or in combination with 50 mcg/kg of morphine.

Methods: Prospective, double blind, randomized controlled trial with 31 ASA I and II adults patients, aged 18-60 years, diagnosed with ankylosing spondylitis and scheduled to undergo total hip replacement surgery. Caudal epidural catheter was placed in lateral position after induction with GA. After establishing a negative test dose, 12ml of 0.25% bupivacaine was administered prior to skin incision. Patients in Group B (n=15) were administered epidural 0.125% bupivacaine and in group BM (n=15) 0.125 % bupivacaine with 50 mcg/kg morphine. After the completion of surgery of dye spread through the epidural catheter was ascertained.

Results: VAS scores were comparable between the two groups in postoperative period. Intraoperative and postoperative fentanyl requirement was comparable between the 2 groups i.e. 126.92±33.80 mcg in group B as compared to the 136.67±29.87 mcg in group BM (p=0.887) and 413.00±105.48 mcg as compared to the group BM 426.67±89.87mcg (p=0.82) respectively. The incidence of postoperative urinary retention was minimally higher in the group BM 7/15 (46% ) as compared to group B 4/13 (30%). (p>0.005)

Conclusion: Caudal bupivacaine with or without morphine was found to provide adequate post operative analgesia in patients of AS for total hip replacement.

References:
Introduction: The management of acute pain in patients with morbid obesity (MO) is complicated by the perception of increased sensitivity to the respiratory depressant effects of opioids. The goal of this review was to present an evidence based clinical update on the management of acute pain in patients with MO.

Methods: We performed a search of peer reviewed literature for the relevant keywords (morbid obesity, postoperative pain, acute pain and bariatric anesthesia). We screened the abstracts for population (obese, morbidly obese), intervention (study drug for acute/postoperative pain management), comparisons (placebo or standard of care) and outcomes (pain scores, analgesic consumption, side effects, LOS, Satisfaction and Recovery Scores). We did not apply any limitations to study design. The study findings were reviewed and a summary of level of evidence and grade of recommendations for each modality was prepared.

Results: Our initial search resulted in approximately 600 citations. After removing duplicate studies and lower levels of evidence, we prepared a narrative review summary based on 48 studies. Majority of the studies of pain management in obesity relate to bariatric anesthesia and weight loss surgery [1]. Evidence confirms the role of multimodal analgesia with the goal of reducing opioid analgesics [1, 2]. Patients with MO have an increased risk of postoperative sedation and respiratory depression, airway obstruction and hypoxemia. Regional anesthesia (central, neuraxial and plexus) techniques have been used successfully [3]. A step wise approach to systemic analgesia for acute pain improves patient safety and outcomes. Recognition of acute neuropathic pain and pronociception has led to the widespread use of “adjuvant” drugs-ketamine, lidocaine, dexmedetomidine and pregabalin [4, 5]. These anti-nociception medications are very effective in further reducing pain, analgesic requirements and improving enhanced recovery outcomes. Opioid use in morbidly obese patients is safe if used judiciously [6]. When parenteral opioid therapy is required in the postoperative period IVPCA’s (without continuous infusions) increase the safety of opioids in MO. We also list the risk factors for poorly controlled pain and emphasize importance of the accurate diagnosis (and appropriate management) of OSA and its relationship to opioid analgesic use in the perioperative period.

Conclusions: Acute Pain management in morbid obesity requires careful adherence to
standardized protocols and care plans. Risk identification & appropriate pre-emptive multidisciplinary approach improves safety and outcomes related to pain management. Opioid sparing and opioid free protocols can be used effectively in some patients undergoing certain procedures- systemic multimodal analgesia can provide high quality pain relief with both short and long term benefits. Evidence for individual modalities is lacking and role for novel regional anesthesia techniques is evolving.

References:

Introduction: The use of ultrasound (US) guided interventional pain procedures has become increasingly popular. Transition to a competency based education model to teach this skill set requires sufficient exposure to procedures for US image acquisition as well as visualization of needle insertion and injection. Published recommendations for US-guided training in pain medicine do not provide estimates on the number of training images and procedures to perform. (1) Our goal is to propose these estimates based on existing pain medicine literature to begin the design of a competency framework at our institution. Furthermore, in our review of the literature, we hope to incorporate complimentary methods of education in US guided procedures into our competency based framework.

Methods: Our objective was to search the existing literature on the teaching of US-guided pain interventions, including peripheral and axial structures as well as musculoskeletal applications. This included articles from radiology, rheumatology, physiatry, and chronic pain literature.

Results: One feasibility study provided a learning curve for US-guided intra-articular injections to the sacroiliac joint. Success increased from 60% to 93.5% when the number performed increased from 30 to 60 blocks in the hands of experienced radiologists. (2)

Discussion: There is a paucity of literature that informs the number of image acquisition scans and procedures required to construct a competency based educational program. The only article available studied learning curves in a feasibility study with experienced radiologists, which is not representative of the novice learner or an educational program. Estimates for training will have to be initially obtained from evidence for teaching US-guided regional anesthesia, which ultimately depends on the quality of didactic sessions, learner variability, and quality of evaluation and feedback. (3) Block performance skill acquisition based on available regional anesthesia literature could be estimated to require 30 procedures. (4,5).

As indicated in the literature, we feel there are several methods that can be used to assess and evaluate learners on a continual basis. Ultimately, these can be used to aid
in the determination of competence. Most importantly, learners should be encouraged to keep a detailed log of patient encounters and procedures. For procedures that are performed infrequently, novel methods of evaluation will be required. One such approach may be to videotape a procedure, and have that video evaluated from an external source, thereby assuring an unbiased evaluation.

**References:**
2. J Ultrasound Med 2003 22: 553-559
Introduction: Opioid use in Canada is of considerable concern to the public and to prescribers. The use of opioids has increased dramatically in the past 20 years in North America (1). Chronic pain after surgery has been recognized as a significant problem over the same period of time (2). Reviews of perioperative data (3) have demonstrated that the overall use of opioids at 6 months after surgery is very low. Factors predicting long term opioid use after surgery are not yet clear. Our study examines this question in 2 surgical groups with minimal opioid use prior to surgery.

Methods: REB approval was obtained. The COAP dataset was created from the merger of the Anesthesia Information System and the prescription monitoring program database. Data from 2006 to 2010 was matched. Patients with a single surgery during admission were included. Four tolerance groups based on preoperative opioid prescribing for 3 months before surgery—naïve, acute, intermittent, chronic were identified. Data was reviewed at one month intervals for 3 months prior to and 6 months after surgery. Logistic regression analysis was used to determine whether demographic and perioperative factors were independently associated with post-operative opioid use at 6 months.

Results: 1028 thoracic cases and 1333 cardiac cases were reviewed. More than 90% of patients did not use opioids or used them only intermittently. Table 1 shows the logistic regression analysis results. Age and gender were not predictive of postoperative opioid use at 6 months after cardiac or thoracic surgery. Use of opioids at one month after surgery was a predictor of opioid use at 6 months after cardiac and thoracic surgery. Chronic and acute preoperative use and was predictive of use at 6 months after thoracic but not cardiac surgery. No opioid use and use of opioids for less than 3 months was reduced the log odds of being on opioids at 6 months after cardiac and thoracic surgery.

Discussion: Most patients undergoing cardiac and thoracic surgery do not regularly use opioids for the 3 month period prior to surgery. They are at considerable risk of developing chronic pain syndromes after surgery (4). Preoperative opioid use is not an independent predictor of opioid use at 6 months after cardiac and thoracic surgery.
Use of opioids at one month is the only independent predictor of use at 6 months. Use of opioids for more than one month after surgery should prompt consideration of a chronic pain states and exclusion of other causes of pain.

References:

3. BMJ 2014, 348:g1251
86106 - INTRATHECAL INFUSION FOR PAIN IN ELDERLY AND MALIGNANCY - CASE REPORTS

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Introduction, Achieving effective, durable, and safe pain relief, especially in the older adults and end stage malignancies, can be a clinical challenge\(^1\). We present an alternative method, based on time-limited intrathecal infusion of an analgesic mixture.

Method, Three old patients (64-94 y/o), admitted in hospital for intractable pain due to metastatic malignancy or fracture, became candidate. We obtained an informed consent from the patients. An intrathecal catheter 20G was placed by percutaneous approach while tunneled subcutaneously and fixed to skin. A preservative-free mixture of bupivacaine 1mg/ml, naloxone 0.02 ng/ml, ketamine 100 microg/ml, morphine 0.01 mg/ml and clonidine 0.75 microgram/ml was infused by an external pomp with a rate of 1-2 ml/h that was decreased during the following days due to patients' requirement. Mixture stability was assessed during five days.

Results, In all patients, pain was successfully controlled without any major complication such as lower limb muscles weakness, sphincter dysfunction, constipation and cognitive or mood dysfunction. In two patients, catheter was removed after four weeks before leaving hospital. (In one of them, catheter was infected on the fourth week following an urinary infection so it was removed. Infection was treated and cured completely. In the second patient, it was removed following complete pain control). In the third one with cancer, the catheter was kept in place up to five months out of the hospital under the supervision of a family physician. The patient then died of his cancer.

Discussion, The evidences show better result for intrathecal approach in comparison to epidural (2B+ and 2C+ respectively\(^2\)). Morphine, clonidine and bupivacaaine have been widely used by intrathecal way\(^3\). Naloxone in ultra low-dose helps controlling pain and prevents from hyperalgesia by multiple mechanisms\(^4,5\). Ketamine has an analgesic and anti-hyperalgesic effects via NDMA receptors. It could be used as intrathecal approach in end-stage cancer related pain. Our doses are much less than what have been already recommended\(^3\) (Table-1). Regarding to very low concentration of drugs, absorption and systemic effect could not explain analgesic effect of the mixture. Synergic effect and different mechanisms of action by spreading in cerebrospinal fluid could explain sufficient analgesic effect of the mixture.

Conclusion, Short-term intrathecal infusion could be considered as an alternative
method in advanced-age and end-stage malignancy pain management. The advantages of this method are better pain control and because of lower prescribed doses, less systemic side effects. Further studies are required in order to determine the type of mixture and related doses for the best pain-control conditions with the least side effects.

References:

**Introduction:** By some estimates, the annual cost of treating back pain alone exceeds $100 billion with more than half due to lost productivity. Recently, the Food and Drug Administration (FDA) issued a letter warning that the injection of corticosteroids into the epidural space of the spine may result in rare, but serious adverse events, including "loss of vision, stroke, paralysis, and death" (1). In this retrospective study we compare retrolaminar paravertebral infiltration (PVI) of a non-steroid-mixture with conventional epidural steroid infiltration (EPI).

**Method:** All participating patients have signed an informed consent. We identified 31 patients registered in our data bank, suffering from chronic lumbar or cervical radicular pain referred to the pain clinic between 2009-2014. These patients received retrolaminar PVI with a mixture of morphine 1 mg, ketamine 10 mg, neostigmine 0.5 mg, naloxone 2 ng and bupivacaine 10 mg. The control group, matched for gender, age and DN4 sub-scale score at baseline, consisted of 31 patients with the same pathology, pain and period and was treated by epidural steroid infiltration. Principal pathologies in both groups were disc disorders and/or foraminal stenosis. All cases with malignancies, congenital anomalies, infection and past history of lumbar or cervical operation were excluded. All patients received only one infiltration during the six months following the initial visit. Pain intensity was assessed at the first visit and in six months follow-up using a Numeric Rating Scale (NRS-11). BPI, PCS and SF-12 were compared in both groups. Overall satisfaction in pain relief in six month was assessed with a scale of 1 (very unsatisfied) to 6 (very satisfied). (Statistical analysis software SAS version 9.3)

**Results:** Average NRS scores for last seven days preceding the first visit were 7.5 (SD=1.7) and 7.2 (SD=1.9) in the case and the control groups respectively. At the six month follow up visit, these scores were 6.9 (SD=1.9) and 6.2 (SD=2.4) respectively (Fig-1). No significant changes were noted in NRS scores at the 6 month visit between two groups. Overall satisfaction from pain relief in six months were 3.8 (SD=1.8) and 4.5 (SD=1.5) in the case and the control group respectively. There is no significant difference in satisfaction score between 2 groups.

**Discussion/conclusion:** Neither of the two methods was shown to be superior to the other in pain relief and overall treatment satisfaction after six months. Analgesic and/or anti-hyperalgesic effect of morphine, ketamine, neostigmine and ultra-low dose of
naloxone have been already reviewed in the literature. Considering possible complications and side effects of EPI, PVI infiltration with non-steroid mixture could be considered as an alternative method. Possibility, multiple PVI could further decrease pain. Well designed studies are needed to evaluate this hypothesis.

References:

NEUROANESTHESIA POSTER DISCUSSION 4
Saturday, June 20
1:00 PM - 2:30 PM
Room: Parliament Foyer

Moderators:
Dr Andrea Rigamonti, University of Toronto
Dr Marie-Hélène Tremblay, Laval University

Objective:
At the end of this session, participants will be able to:
• Discuss presented research presentations in neuroanesthesia with author(s) and attendees.

82991 - NOVEL METHOD TO MEASURE CEREBROVASCULAR REACTIVITY USING MRI AND CO2.
Presenting Author: Lakshmikumar Venkat Raghavan, Toronto Western Hospital, University of Toronto, Toronto, Ontario
Co-Authors(s): Olivia Sobczyk, David Mikulis, Joseph Fisher

83115 - SUMATRIPTAN IMPROVES QUALITY OF RECOVERY AFTER CRANIOTOMY
Primary Author / Presenting Author: Lakshmikumar Venkat Raghavan, Toronto Western Hospital, University of Toronto, Toronto, Ontario
Co-Authors(s): Lawrence Li, Tania Bailey, Jigesh Mehta, Pirjo Manninen, Michael Tymianski

84628 - IS SERUM LACTATE A POTENTIAL BIOMARKER OF NON-GLIAL BRAIN TUMORS?
Presenting Author: Suparna Bharadwaj, Toronto Western Hospital, University of Toronto, Toronto, Ontario
Primary Author: Lakshmikumar Venkat Raghavan, Toronto Western Hospital, University of Toronto, Toronto, Ontario
Co-Authors(s): Gelarah Zadeh

84641 - AWAKE CRANIOTOMY: PROPOFOL-REMIFENTANIL VS DEXMEDETOMIDINE
Presenting Author: Suparna Bharadwaj, Toronto Western Hospital, University of Toronto, Toronto, Ontario
Primary Author: Pirjo H. Manninen, Toronto Western Hospital, University Health Network, Toronto, Ontario
Co-Authors(s): Nicolai Goettel, Lashmi Venkatraghavan, Jigesh Mehta, Mark Bernstein
85573 - THE ROLE OF ASTROCYTES IN POSTANESTHETIC MEMORY LOSS
Primary Author / Presenting Author: Sean C. Haffey, University of Toronto, Toronto, Haiti
Co-Authors(s): Irene Lecker, Gang Lei, Beverley Orser

85896 - MAGNETIC RESONANCE BRAIN STRESS TESTING IN ADOLESCENT CONCUSSION
Presenting Author: Brian D. Gregson, University of Manitoba, Winnipeg, Manitoba
Primary Author: W. Alan Mutch, University of Manitoba, Winnipeg, Manitoba
Co-Authors(s): Michael Ellis, Lawrence Ryner, M. Ruth Graham, Thomas Hall, Martin Bunge

86081 - BRIEF MIDAZOLAM EXPOSURE PERSISTENTLY INCREASES TONIC GABA CURRENT
Primary Author / Presenting Author: Irene Lecker, University of Toronto, Toronto, Ontario
Co-Authors(s): Dianshi Wang, Sean Haffey, Beverley A. Orser

86259 - GABAA RECEPTORS CONTRIBUTE TO DEPRESSIVE BEHAVIORS IN MICE
Primary Author / Presenting Author: Stephen W.P. Kemp, University of Toronto, Ajax, Ontario
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82991 - NOVEL METHOD TO MEASURE CEREBROVASCULAR REACTIVITY USING MRI AND CO2.

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Introduction: Cerebrovascular reactivity (CVR), defined as a change in cerebral blood flow in response to a vasoactive stimulus, reflects the vasodilatory reserve capacity of cerebral vessels. CVR impairment has shown to be an important prognostic marker of several diseases including stroke. Several techniques have used to measure CVR but the lack of appropriate reproducible stimuli and noninvasive CBF measurement methods limit the routine use of CVR measurement in clinical practice. We have developed a non-invasive method of mapping CVR using a precise targeting of CO2 and BOLD-MRI. Aim of our study was to investigate the feasibility of measurement of CVR using sequential breathing circuit for precise targeting of CO2 in mechanically ventilated patients.

Methods: After IRB approval, patients with known cerebrovascular disease needing general anesthesia for BOLD MRI were included in the study. All patients had standardized general anesthesia care. BOLD-MR imaging was performed in 3.0 Tesla magnet while precise targeting of CO2 was achieved using a custom made sequential breathing circuit and a computer controlled gas blender. Three different PETCO2 targets (normocapnia (baseline resting Co2), Hypercapnia (baseline +10mmHg), and Hypocapnia (baseline -5mmHg) were achieved. MRI and PETCO2 data were imported into custom software (Labview, TX) for creating CVR maps. The BOLD-MRI signal from each voxel was then correlated to the PCO2 and the correlations (positive and negative) were color coded to generate a CVR color maps.(Fig 1). In addition, we also measured the changes in CBF under both propofol and sevoflurane anesthesia using ASL –MRI sequence.

Results: We recruited four patients (1 male and 3 female) with mean age of 20 years. All patients had Moyamoya disease with history of previous strokes and cerebral revascularization procedures (EC-IC bypass). All patients had both step and ramp changes in PETCO2and targets were achieved within 2 breaths in all patients. BOLD signal changes correlated with the changes in PETCO2. Impaired CVR with evidence of steal physiology was seen in 3 patients (Fig 1). Under propofol anesthesia, CBF values ( ml/100gm of brain tissue) were lower when compared to sevoflurane ( 38.4 vs 56.6 in Grey matter and 31.6 vs 42.5 in white matter). In addition, even with hypercapnia, CBF values under propofol anesthesia were lower than the sevoflurane anesthesia under normocapnia.
**Discussion:** Our pilot study showed that using precise targeting of Co2 and BOLD-MRI, measurement of CVR is feasible in mechanically ventilated patients. This combined technique may be complementary in identifying vulnerable brain regions and thus constitute a "Brain Stress test." Non-invasive measurement of CBF is possible using ASL-MRI technique. Cerebral blood flow values (both normocapnia and hypercapnia) were lower under propofol anesthesia compared to sevoflurane.

**References:**

3). *Cerebrovasc Dis Extra 2013; 3*: 55-64
4) *J Physiol 2007; 581*: 1207-1219
SUMATRIPTAN IMPROVES QUALITY OF RECOVERY AFTER CRANIOTOMY

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Background: Microvascular decompression (MVD) is a surgical treatment for trigeminal neuralgia and hemifacial spasms. Current surgical approach is via a small craniotomy which often results in minimal surgical site pain, easily managed with conventional analgesics. However, these patients often experience post craniotomy headache which is a more complex type of pain reminiscent of a migraine headache and is associated with other unpleasant symptoms such as photophobia, nausea and vomiting. This headache may affect the quality of recovery and has the potential for development of chronic pain. Sumatriptan is used to treat migraine-like headaches in various settings. We conducted a randomized controlled study to investigate the effects of subcutaneous sumatriptan administration on post-operative headache and on the overall quality of recovery after MVD surgery.

Methods: This was a single centre, prospective, randomized double blind clinical trial. After REB approval and patient consent, fifty patients who complained of postoperative headache after MVD were randomised to receive a subcutaneous injection of sumatriptan (6 mg) or saline in the post-operative period. The primary outcome was quality of recovery as measured by the QoR-40 score at 24 hours. The QoR-40 is a validated tool to measure quality of recovery and has been used successfully following neurosurgery. The other outcome measures were pain and headache scores, total opioid consumption and hospital discharge times. Statistical analysis were using unpaired t-test, Mann-Whitney test, chi square test or Fischer’s exact test where appropriate. P value < 0.05 was considered significant.

Results: Fifty patients were randomised to the sumatriptan group (n=25) and placebo group (n=25). There were no statistically significant differences in demographics between the two groups. The QoR-40 scores were significantly higher in the sumatriptan group (median 184; interquartile range 169 – 196) than the placebo group (133; 119 – 155, p < 0.01), suggesting higher quality of recovery (table 1). The median scores for the individual aspects of the QoR-40 (physical comfort, emotional state, physical independence, patient support and pain) were all higher in the Sumatriptan group as compared with the placebo group. The sumatriptan group also had...
significantly lower headache scores at 4, 6 and 24 hours postoperatively. There were no significant differences in other secondary outcomes. The median duration of stay was 2 days (range 1 to 3 days) in both groups with no statistical differences ($p = 0.7$). There were no adverse events related to the use of sumatriptan in the study.

**Conclusions**: Our study showed that the use of Sumatriptan improves the quality of recovery as measured by the QoR-40 at 24 hours post-operatively. This may present as a useful alternative treatment for post-craniotomy headache. The precise mechanism remains unknown but may be related to reduction in headache, or mood modulation mediated by a serotonin effect.

**References**:

5. Anesthesiology 2001;862–7.
Introduction: Serum Lactate, an end product of anaerobic metabolism, is used as an indicator of poor tissue perfusion and a measure of severity of the illness. Malignant tumors often switch to aerobic glycolysis for their energy needs producing lactate even in the presence of oxygen. This phenomenon is called Warburg effect. We have shown that increased serum lactate can be used as a potential biomarker of high grade brain tumors (gliomas). The aim of this study was to determine if serum lactate can be used as a biomarker for non-glial cell brain (NGC) tumors.

Materials and methods: After IRB approval and patient consent we conducted a prospective observational study in patients undergoing craniotomy for brain tumors. We collected intra-arterial blood samples after induction of anesthesia and measured serum lactate values. We excluded patients with heart failure, renal or liver dysfunction and those needing inotropic support. Lactate >2 mmol/L was considered as elevated. Statistical analysis was done to calculate the incidence of elevated serum lactate in NGC tumors and to determine the correlation between elevated lactate and tumors of different non glial cell origin.

Results: During the study period (September 2013 to August 2014), we collected data from 121 non-glial brain tumor patients (Meningioma (n=28), Pituitary (37), Metastasis (17) and others (39)). Mean age of study population was 48.7(±13), weight 76.7(±12), M: F 59:62. Overall incidence of elevated lactate in NGC tumors was 34% with varying incidence among the individual tumor groups (meningioma 21%, pituitary 32%, metastasis 70% and others 36%). Patients with metastatic brain tumors had significantly higher baseline serum lactate levels as compared to patients with meningioma and pituitary tumors (p= 0.001, p=0.009 respectively). There was a statistically significant association of metastatic brain tumors with elevated serum lactate (p=0.002, odds ratio=5.4, CI=1.76-16.61, sensitivity 54.5%, specificity 81.8% and PPV 12%.

Discussion: Our study showed that the incidence of elevated serum lactate in NGC tumors was 34%. This finding is similar to variable incidence of brain lactate peak observed on MR spectroscopy of meningioma, pituitary and brain metastatic tumors.
Future studies comparing serum lactate and MR spectroscopic analysis in brain tumor patients are needed to correlate brain and serum lactate. As per our results there is no association between individual brain cell types and baseline serum lactate levels. However brain metastatic tumors had significant association with high baseline serum lactate demonstrating notable Warburg phenomenon. Tracking Warburg effect helps to analyse response to treatment in patients with brain tumors. Hence serum lactate level in non-glial tumor patients may be considered a potential biomarker for quantification of Warburg phenomenon.

References:

Introduction: Awake craniotomy for brain tumors in close proximity to areas of eloquent brain function is performed to minimize neurological injury during resection. 1 The aim of conscious sedation is to have an awake and alert patient during brain mapping. 2 The purpose of this study was to compare the efficacy of propofol-remifentanil (PR) versus dexmedetomidine (Dex) based sedation during awake craniotomy for tumor resection. The primary endpoint was the assessment of ability to perform intraoperative brain mapping and secondary endpoints the incidence of complications and patient satisfaction and outcome.

Materials and Methods: After IRB approval and written informed consent, we conducted a prospective, double blind randomized study. Patients were randomized to the PR or the Dex group. After placement of standard monitors in operating room, each patient received fentanyl 50mcg IV. Group PR received infusions of remifentanil (0.01-0.1mcg/kg/min) and propofol (25-100mcg/kg/min) for 10min, and then titrated to effect. Group Dex received Dex bolus 1mcg/kg for 10min, followed by infusion at 0.2-1mcg/kg/hr and propofol. In both groups additional analgesia and/or sedation when required was with fentanyl 0.5-1.0mcg/kg and/or propofol bolus (20-40mg). Local anesthesia (0.25% bupivacaine and 2% lidocaine with 1:200,000 epinephrine) was injected by the surgeon for pin insertion and infiltration of incision ringblock. At 10min prior to brain mapping, propofol infusion was stopped. Minimal infusion rates of R and Dex were continued. Data collected included intra and postoperative (2hr) hemodynamic and respiratory variables, intraoperative sedation, pain, anxiety and mapping scores, and all complications. At 1hr and 24hr patients were assessed with mental status questionnaire and recall and satisfaction scores. Statistical analysis was performed.

Results: 50 patients (PR (25): Dex (25)) were studied. One patient (Dex) was excluded from analysis due to conversion to general anesthetic at the onset by surgeon’s request.
Demographics and results are in Table. There were no significant differences between the groups with respect to mapping, postoperative complications, and postoperative patient recall and satisfaction scores. Intraoperative heart rate (HR) (80vs65, p =0.001) and mean blood pressure (MAP) (89vs82, p=0.047) were significantly lower in group Dex. Intraoperative respiratory complications (5vs0, p=0.021) were significantly more in the PR group.

**Discussion:** Both PR and Dex based sedation showed good efficacy for intraoperative brain mapping and postoperative patient satisfaction and outcome. Incidence of respiratory complications was more with group PR. In the Dex group overall MAP and HR were lower but did not require treatment. Most of the complications were quickly recognized and easily treated. Optimal dose regimen of sedatives and careful vigilance are the keys for successful conscious sedation for awake craniotomy.

**References:**


2. Annals Pharmacotherapy;2013;47:1391
85573 - THE ROLE OF ASTROCYTES IN POSTANESTHETIC MEMORY LOSS

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Introduction: Many patients who undergo surgery with general anesthesia experience memory deficits that persist for days to months\textsuperscript{1,2}. However, mechanisms underlying anesthesia-induced memory loss remain poorly understood. Animal models show that memory deficits following anesthesia are associated with a persistent increase in γ-aminobutyric acid type A (GABA\textsubscript{A}) receptor activity\textsuperscript{3}. The goal of this study was to use a cell culture model to elucidate the molecular mechanisms by which anesthetics increase GABA\textsubscript{A} receptor activity. We hypothesized that glial cells, such as astrocytes, may play a key role in triggering anesthetic-induced increase in GABA\textsubscript{A} receptor activity. Furthermore, since astrocytes express GABA\textsubscript{A} receptors\textsuperscript{4}, we postulated that anesthetics could exert their action by directly acting on astrocytes.

Methods: The study was approved by the local ethics committee. Cultures of hippocampal neurons, cortical astrocytes, and neuron-astrocyte co-cultures were prepared from embryonic mice. Cells were treated with the anesthetic etomidate (1 μM) or vehicle for 1 h and whole-cell currents were recorded from hippocampal neurons 24 h later. All data are expressed as mean ± SEM and were analyzed by Student’s t-test or ANOVA (p < 0.05)

Results: Etomidate increased tonic current in neurons that were co-cultured with astrocytes by 75% (Control: 1.1±0.5 pA/pF; Etomidate: 1.9±0.9 pA/pF, n = 11, p < 0.05) but had no effect in cell cultures containing only neurons. In addition, application of supernatant collected from astrocyte cultures treated with etomidate unto neurons significantly increased tonic current (Control: 1.1±0.2 pA/pF; Etomidate: 1.5±0.2 pA/pF, n = 6, p < 0.05). This effect was abolished when bicuculline, a competitive GABA\textsubscript{A} receptor antagonist, was co-applied with etomidate in both co-cultures and supernatant paradigms.

Discussion: These findings suggest that astrocytes are necessary for the etomidate-mediated increase in tonic current. Furthermore, these results indicate that activation of GABA\textsubscript{A} receptors on astrocytes triggers the release of soluble factors that subsequently increase tonic current in neurons. Finally, our study provides a new model for understanding the interactions between astrocytes and neurons that are perturbed during general anesthesia.
References:

2. Anesthesiology 2008 108:1-17
Introduction: A quantitative test to diagnose concussion remains elusive. Here we summarize the feasibility and results of a repeatable CO2 brain stress test employing blood oxygenation level-dependent (BOLD) MRI. This test may potentially aid in management of post-concussion syndrome (PCS).

Methods: Local Ethics Committee approval was obtained. Fourteen adolescent PCS patients and 14 healthy control subjects underwent anatomical MRI and MRI brain stress testing using controlled CO2 challenge and BOLD MRI. A sequential hypercapnic challenge was delivered using a respiratory gas blender, individualized for each subject using a model-based end-tidal targeting system. Post-hoc processing was by statistical parametric mapping to determine voxel-by-voxel responsiveness of the brain to the CO2 stimulus (increase in BOLD signal) or the inverse (decrease in BOLD signal).

Results: All subjects received an equivalent CO2 stimulus, and all studies were well tolerated without any serious adverse events. Anatomical MRI was normal in all subjects. Between group comparisons at the p=0.005 level revealed a mean voxel count of 1745±1208 (PCS group) vs 103±281 (control group) for individual response greater than the control atlas (p=0.042) and a mean voxel count of 219±299 (PCS group) versus 3±6 (control group) for individual response less than the control atlas (p=0.017). Individual analysis confirmed changes in BOLD response for every patient, but with a pattern of abnormalities unique to each individual.

Discussion: The results reported here provide empirical evidence that post-concussion syndrome in adolescents is associated with abnormal cerebrovascular responsiveness. In addition, the resolution of this investigation method revealed that each patient had a unique pattern of abnormal BOLD signal with important regional differences, sometimes
showing simultaneous excessive and diminished responses in different areas of the brain, compared to the control atlas. These abnormalities in cerebrovascular responsiveness can be safely and reliably detected in adolescent PCS patients with the novel MRI brain stress test protocol described here.

The attached figure is a representative example of the second level analysis of a PCS patient to the atlas of normal controls, examined at the p=0.005 level. Voxels with a BOLD response greater than or less than that seen in the control atlas are displayed as hot and cold scale, respectively. PCSS: post concussion symptom score.

References:
2. Neuroimage 2012 2:791-800
86081 - BRIEF MIDAZOLAM EXPOSURE PERSISTENTLY INCREASES TONIC GABA CURRENT

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Introduction: Anesthetics and sedatives are administered to over 234 million patients each year to allow them to tolerate surgery\(^1\). Unfortunately, many patients experience memory deficits that persist long after the anesthetic has been metabolized\(^2\). It was previously shown that the GABAergic anesthetics isoflurane and etomidate cause long-term memory deficits in animal models\(^3\). However, it is unclear whether benzodiazepines and non-GABAergic anesthetics also cause persistent memory deficits. Anesthetic-induced memory deficits have been attributed to a persistent increase in tonic current mediated by \(\gamma\)-aminobutyric acid type A (GABA\(_A\)) receptors\(^3\). Specifically, brief exposure to etomidate was shown to increase tonic GABAergic current in neuronal culture and \textit{ex vivo} brain slices as well as induce memory deficits in mice 24 h after treatment\(^4\). The goal of this study was to determine whether the benzodiazepine midazolam, the non-GABAergic anesthetic ketamine, and the endogenous agonist GABA also trigger a persistent increase in tonic current

Methods: This study was approved by the local ethics committee. Whole-cell voltage clamp techniques were used to record tonic currents from cultures of hippocampal neurons and neuron-astrocyte co-cultures. Cells were treated with midazolam (200 nM), ketamine (300 µM), GABA (0.5 µM) or vehicle for 1 h and currents were recorded from hippocampal neurons 24 h later. All data are expressed as mean ± SEM and were analyzed by Student’s \(t\)-test or ANOVA when appropriate (\(p < 0.05\)).

Results: Midazolam increased tonic GABAergic current by 44\% 24 h after treatment (Control: 0.9±0.3 pA/pF; Midazolam: 1.3±0.6 pA/pF). In contrast, ketamine and GABA alone had no effect on tonic current (Control: 1.3±0.5 pA/pF; Ketamine: 0.9±0.3 pA/pF; GABA: 1.3±0.3 pA/pF).

Discussion: This is the first evidence that midazolam, but not ketamine, causes a persistent increase in tonic GABAergic current. Considering the widespread use of benzodiazepines, this finding could have significant clinical implications for long-term memory loss after sedation.

References:
1. Lancet 2008 372: 139-144
2. Prog Brain Res 2008 169: 409-422
86259 - GABAA RECEPTORS CONTRIBUTE TO DEPRESSIVE BEHAVIORS IN MICE

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Introduction: One of the most exciting recent advances in modern anesthesiology and psychiatry is the discovery that a single low dose of ketamine is effective in treating refractory depression. This discovery has opened the door to the development of newer, faster-acting, and more effective antidepressant drugs. Accumulating evidence suggests that reduced function of the inhibitory neurotransmitter g-aminobutyric acid (GABA) system contributes to the pathogenesis of depression. In particular, the a5 subtype GABA_A receptor has been implicated in both depression and anxiety-related disorders. Thus, repurposing anesthetics that target a5 subtype GABA_A receptors is a novel therapeutic target for treating mood disorders. The goal of this study was to determine whether reduced expression of a5GABA_A receptors leads to a depressed and/or anxiogenic behavioral phenotype.

Methods: Approval from the local animal care committee was obtained for all experiments. Mice were randomly assigned to one of three experimental groups (n=10 per group): a5 wildtype (a5+/+); a5 knockout (a5-/-); a5 heterozygous (a5+/−). The experiments were designed to assess whether genetic manipulation of the a5 receptor are associated with depression and anxiety states. In addition, animals were assessed on executive function memory tasks, which have been shown to be impaired in depressed patients. Animals were serially assessed in a battery of behavioral tests which included: (1) open field test (OFT); (2) light-dark maze; (3) puzzle box; (4) elevated plus maze (EPM); (5) forced swim test (FST), and; (6) tail suspension test (TST). The same cohort of animals was tested on each behavioral paradigm.

Results: There was a significant group effect in the OFT [F(5,51)=6.94, p < 0.001]. Specifically, a5−/− mice displayed a higher rate of defecation in the OFT as compared to a5+/+ animals, a variable which has been previously associated with high anxiogenic behavior in rodents. Preliminary results indicate that a5−/− animals are cognitively impaired compared to a5+/+ animals in measures of executive functioning such as the puzzle box.

Discussion: A genetic knockdown of extrasynaptic a5GABA_A receptors causes an axiogenic phenotype in mice. These results suggest that pharmacological manipulation
of these receptors by positive allosteric modulators such as general anesthetics may alleviate depressive and axiogenic symptoms.

**Clinical Relevance:** Depression is a highly debilitating and pervasive illness which affects over 350 million people worldwide. The monetary costs of depression and related mood disorders that result from reduced productivity, job loss, hospitalization, and drug treatment exceeds well over 40 billion dollars annually. Repurposing anesthetic drugs that selectively act on extrasynaptic a5GABA<sub>A</sub> receptors may provide a novel alternative therapy for patients with depression. This strategy may enable the development of low-cost treatments that can be rapidly scaled up to address the global burden of depression.
EDUCATION AND SIMULATION POSTER DISCUSSION 5
Sunday, June 21
9:45 AM - 11:30 AM
Room: Parliament Foyer

Moderators:
Dr Zeev Friedman, Mount Sinai Hospital
Dr Peter Moliner, University of Sherbrooke

Objective:
At the end of this session, participants will be able to:
• Discuss presented research presentations in education and simulation with author(s) and attendees.

76409 - KNOWLEDGE RETENTION BY ANESTHESIA RESIDENTS AFTER FOCUS TTE TRAINING
Primary Author / Presenting Author: Rob Tanzola, Kingston General Hospital, Queen's University, Kingston, Ontario
Co-Authors(s): Tarit Saha, Devin Sydor, Dale Engen, Rene Allard

78734 - SPACE, TIME ET AL.: WHY MORNING INTERPROFESSIONAL ROUNDS FAIL
Primary Author / Presenting Author: Elise Paradis, The Wilson Centre, Department of Anesthesia, and Postgraduate Medical Education, Toronto, Ontario
Co-Authors(s): Myles Leslie, Michael A. Gropper

81361 - TRANSITIONING TO A REDUCED CALL MODEL AMONGST ANESTHESIA RESIDENTS
Primary Author / Presenting Author: Heung Kan Ma, McMaster University, Toronto, Ontario
Co-Authors(s): James Paul

84009 - MENTORSHIP IN CANADIAN ANESTHESIA RESIDENCY: A NEEDS ASSESSMENT
Primary Author / Presenting Author: Justin Duthie, Memorial University, St. John's, Newfoundland
Co-Authors(s): Sonia Sampson, Sarah Molloy
84908 - DOES VIDEOLARYNGOSCOPY ACCELERATE LEARNING OF DIRECT LARYNGOSCOPY?
Primary Author / Presenting Author: Branislav Telgarsky, University of Toronto, Toronto General Hospital, University Health Network, Toronto, Ontario
Co-Authors(s): Jennifer Sainsbury, Matteo Parotto, Ahtsham U. Niazi, David T. Wong, Richard M. Cooper

85720 - MENTORSHIP IN ANESTHESIOLOGY: BOTH SIDES OF THE RELATIONSHIP
Primary Author / Presenting Author: Sarika Alisic, University of Ottawa, Ottawa, Ontario
Co-Authors(s): M. Dylan Bould, Sylvain Boet, Stephanie Sutherland

86029 - PATIENTS' AWARENESS AND KNOWLEDGE OF ANESTHESIOLOGY
Primary Author / Presenting Author: Meredith J.L. Briggs, Queen's School of Medicine, Kingston, Ontario
Presenting Author: Sneha Lohan, Queen's School of Medicine, Kingston, Ontario
Co-Authors(s): Tarit Saha, Ronald Holden, Anthony Ho, Brian Milne, Rob Tanzola, Jorge Zamora

86211 - PEER VERSUS INSTRUCTOR DEBRIEFING FOR SIMULATED CRISES.
Primary Author / Presenting Author: Sylvain Boet, The Ottawa Hospital, Ottawa, Ontario
Primary Author: Morgan Jaffrelot, Centre de Simulation en Santé, Université de Bretagne Occidentale et Centre Hospitalier Universtaire, Brest, France
Co-Authors(s): Yolande Floch, Daniel Dubois, Nitan Garg, Violaine Laparra, Lionel Touffet, M. Dylan Bould
Introduction: Focused transthoracic echocardiography (TTE) is a valuable diagnostic tool for anesthesiologists treating patients with hemodynamic instability. Previous studies have demonstrated that training residents to perform and interpret TTE is both feasible and effective (1,2). We recently introduced a 4 week focused TTE rotation in our anesthesiology residency training program, after which our residents are able to integrate this modality into their clinical practice. However, the ability to retain information and the degree of knowledge retention after their rotation has not been assessed. This is important, because while many educational interventions have shown immediate gains in knowledge or skills, these gains are often subject to subsequent decay over a period of non-use (3). Therefore, this study's aim was to assess knowledge retention at 6 months following the TTE rotation, and to assess any modifying any factors.

Methods: Approval was obtained from the local Research Ethics Board. Residents in their postgraduate years 3-5 who had successfully passed the TTE rotation were recruited to fill out a brief questionnaire and complete a written multiple-choice exam 6 months after the end of the rotation (EOR). Residents were asked about their current self-rated knowledge and comfort level, the number of times that they used TTE since the rotation, and barriers to the use in practice. The written exam assessed ultrasound fundamentals, anatomy and imaging windows, as well as interpretation of static images and video clips of both normal and abnormal findings. Results were compared to their EOR exam results.

Results: To date, 8 residents have completed both their rotation and 6-month follow-up assessments. The average EOR exam score was 43.8 (87.6%) versus the 6-month score of 43.7 (87.4%) (P=0.9). The EOR self-rated knowledge was 7.9 out of 10, compared to a 6-month self-rated knowledge score of 6.0 out of 10. At the EOR, all resident felt comfortable using TTE in their clinical practice. At 6 months 7 out of 8 residents still felt comfortable. At 6 months, all the residents had used TTE after their rotation in their practice, with an average frequency of 3.7 times. The most cited reason that residents did not use TTE more frequently was that there was no perceived clinical need.
**Discussion:** One goal of medical education is to promote long-term knowledge and skill retention. Residents in this study were able to maintain their exam scores 6 months after the completion of a TTE rotation. Whereas infrequently used knowledge generally decays over time, this was not the finding in this study. This may be due to the fact that all residents have incorporated focused TTE in the clinical setting since their rotation. Dispersed learning and reinforcement in this manner has been shown to improve long-term knowledge retention (5). Another explanation may be the robustness of the initial training that included a dedicated 4 weeks of study and practice to learn the required knowledge and skills. Over-learning in the initial phases of knowledge acquisition has been associated with strong long-term memory (6). Further study is required to determine if long-term retention is in fact related to clinical proficiency with focused TTE.

**References:**

2. Intensive Care Med 2007, 33: 1795-1799
5. Medical Teacher 2010, 32: 250-255
Introduction: Patient rounds are a cornerstone of both the education and care functions of teaching hospitals. Beyond this, there is little consensus about rounds in theory or in practice. In intensive care units (ICUs), debates continue about who should participate and what those participants should contribute. Multiple studies have identified rounds as the sites of interprofessional conflict,\(^1\)\(^-\)\(^4\) yet explanations for why this is the case and how the functions of rounds might be optimized have been elusive. Our research sought to address this gap in understanding. Through a close study of ICUs, we tracked the form and functions of interprofessional rounds in 4 teaching hospitals, and sought to understand how and why morning interprofessional rounds are contentious, we sought to identify their functions and associated sources of conflict.

Methods: Our data were collected in a yearlong observational study of team interactions in 4 ICUs at 4 academic hospitals. Ethics approval was obtained at all sites. The 4 ICUs were purposively recruited to match on medical specialty, beds, and staff rosters. All 4 deployed high intensity ICU physician staffing in which dedicated specialists managed or comanaged ICU patients. Our research followed best practices in healthcare qualitative research,\(^5\)\(^-\)\(^6\) and included 576 hours of observation, 56 interviews, and 47 shadowing sessions conducted by 2 ethnographers. In the analysis for this paper, all rounds-associated field notes and interviews were extracted and coded iteratively by the first two authors using the constant comparative method.

Results: Rounding practices varied widely according to the preferences of attending physicians. Attending physicians considered education for medical trainees to be a critical function of rounds – a function that was compromised by the involvement of other professionals, especially in light of important time constraints. Meanwhile, interprofessional collaboration during rounds was constrained by space and by the unsystematic participation of nurses and other healthcare professionals.

Discussion: The sub-optimal nature of rounds may be attributed to the misalignment of their form and functions: there are too many things to do, too little time, and too little space. Those engaged in rounds may be trying, ineffectively, to serve two masters: care and education. In an era of increasing interprofessionalism and commitment to patient-
centered care, new and empirically tested structural models for rounds are urgently needed.

References:


Introduction: Considerable controversy exists regarding the optimal work hours of physicians and surgeons in training. The current concerns in residency training committees is determining appropriate resident duty hours. How many hours should residents be working and how will this impact the residents, delivery of quality healthcare, and patient safety. A recent meta-analysis reported that reduced call hours showed little improvement on healthcare and even a negative effect in most aspects including patient safety, and resident wellness, burnout and education (1,2).

Extensive research has recently examined the issues associated with making changes, but none have specifically looked at the field of anesthesia. The primary objective of this study was to assess anesthesia residents' opinions and perceptions on wellness/burnout, fatigue, education, and patient safety after the initiation of a reduced call model (16 hour call).

Methods: After appropriate ethics approval was obtained, a prospective cohort study was conducted at three time points in the 2013-2014 academic year. A web-based questionnaire consisting of 23 questions (an adaptation of the already validated survey produced by Drolet et al. in the NEJM) was electronically distributed to all anesthesia residents from postgraduate years 1 to 5 who were part of the active call roster (n=84) (3). Descriptive summaries were calculated, counts and percentages were used for categorical variables, and answers to open text questions were reviewed for themes.

Results: A response rate of 67% was obtained for this study. The majority of anesthesia residents (65%) approved a 16-hour call schedule, and felt that their overall quality of life of a junior (PGY2 and below) or senior resident (PGY3 and above) had improved (55% and 73% respectively). They reported overall feeling less fatigued.

Most respondents indicated that the quality of education remained unchanged (47%), or had improved (31%) (Figure 1).

Most felt better prepared for the royal college exam (52%).

Most thought patient safety had improved or was unchanged (48%).
Conclusion: Our study demonstrated that 16-hour call improved resident wellness, reduced burnout and fostered an environment where residents are less fatigued and more satisfied with their educational experience and promoted an environment of patient safety. Overall, the anesthesia residency group demonstrated that a 16-hour call model is not only preferred but beneficial. The study has several implications: it can inform the active policy debate, guide ongoing implementation of the current duty hour requirements, and direct future policy. Limiting duty hours represents a necessary paradigm shift in the medical environment, and change will take time. As the pendulum on duty hour swings, it is important to continue to teach clinical medicine, but foster an environment where residents thrive, and patients are safe.

References:


3. NEJM 2010 363(23):e34.
Mentorship in medical education is an important factor in deciding choice of specialty and direction of clinical practice (1) and can provide social and professional benefits for both mentor and mentee (2). Studies have described the importance of mentorship in medicine and its aspects including mentor selection, characteristics of the mentoring relationship and barriers to the success of the mentorship (3,4), but there is little anesthesia resident-specific mentorship literature.

The primary goal of this study was to determine which mentorship program characteristics are most important to mentees in Canadian English-language anesthesia residency programs.

The authors have no conflicts of interest to declare.

Methods: Local Research Ethics Board approval was obtained. Since no validated appropriate survey existed, input from focus groups and a literature review was used to develop a questionnaire. Applicable anesthesia program administrators were emailed a link to an electronic survey (www.fluidsurveys.com) and a description of the project to be forwarded to the program’s residents. The survey included questions on demographics, initiation of mentorship and desirable characteristics of a mentor, and space for free text. Residents who completed the survey were eligible to win an iPod Nano or a Starbucks gift card.

Results: 134 residents (of a total of 531) from 14 different programs responded to the survey; 12 respondents completed only the demographic information and were excluded. Results were reported as a percentage of those who responded to the question. 66% felt that mentorship pairing should occur in the second year of residency, and 58% felt that mentorship pairings should be formally assigned. 88% felt that it was important or very important for a mentor to provide inspiration, and 92% felt that it was important or very important for a mentor to provide support during times of professional or personal stress. 98% felt that staff participation in mentorship should be voluntary, and 62% felt that anesthesia staff should be educated on how to mentor. Please see Table 1 (attached) for other results.

Discussion: This qualitative study is the first to investigate the characteristics desirable
for a mentorship program in an anesthesia residency using a sample of Canadian anesthesia residents. Our findings suggest that a small majority may favor formally assigned pairings which conflicts with suggestions in the current literature (5,6), and the results suggest that characteristics such as voluntary anesthesia staff participation, mentor education, and delay of mentorship initiation until second year may contribute to satisfaction with these relationships. This information will be used to improve the local mentorship program. Our findings have limitations including the use of an original questionnaire and a 23% response rate. Further studies are needed to delineate how to best assess the success and effectiveness of mentorship programs.

References:

(1) Anaesthesia 2004 59: 411

(2) Curr Opin Anaesthesiol 2011 24: 676-681

(3) J Gen Intern Med 2009 25: 72-78


(6) Acad Med 2009 84: 135-139
Introduction: Medical students are required to perform direct laryngoscopy (DL). 50 attempts are needed to achieve a 90% success rate, a volume that they are unlikely to approach during their Anesthesia rotation. Video laryngoscopes GlideScope Direct® (Verathon Medical, Bothell, MA) and C-MAC® (Karl Storz Endoskope, Tuttlingen, Germany), shaped and used like conventional Macintosh laryngoscope increase the success rate of students performing DL while the instructor views the progress on the monitor. This allows real-time feedback with positive impact upon subsequent intubation of manikins and patients. The laryngoscopy can also be recorded for subsequent review. In this pilot study we are testing hypotheses that teaching DL on patients using Macintosh-style video laryngoscope (MacVL) enhances skill acquisition compared with conventional DL and that subsequent review of MacVL recordings accelerates this ever further.

Methods: Having obtained local ethics board approval, sixty consecutive 3rd year medical students are prospectively recruited prior to their two week Anesthesia rotation at two hospitals. After granting written consent they are randomized for the first TRAINING week into one of three groups to use either Macintosh laryngoscope (Control group), MacVL (either CMAC or GlideScope Direct) without (VL1 group) or with recordings (VL2 group). During the second week all students are TESTED using DL. The following outcome measures are noted: time to intubate during the TESTING week (primary outcome), number of intubating opportunities during each week, number of times each video-recording was viewed (VL2), overall success rate during TESTING week and complications. The statistical analysis is performed by Prism 5.0, GraphPad Software Inc, La Jolla, CA. ANOVA and Chi Square test is used to generate p values for intubating times and success rates, respectively, and p < 0.05 is considered statistically significant. Eligible students had no prior laryngoscopy experience with patients. During their two weeks the students were supervised by consenting staff anesthesiologists who
determined patient suitability and provided non-standardized verbal feedback.

**Results:** Preliminary results from 30 students are available for analysis. Patients’ age, BMI and gender were similar amongst groups. Average intubating attempt lasted 62.3+/-34.9 seconds in the Control group, 63.0+/-26.3 seconds in VL1 and 70.4+/-38.1 seconds in VL2 group, respectively, and differences were not statistically significant (p=0.54). Secondary outcomes are listed in Table 1. None of the observed differences between individual groups reached statistical significance. We recorded a 15% complication rate with no permanent harm.

**Discussion:** Preliminary results do not indicate significant differences between groups in any of the outcome measures. The primary outcome results are similar to those of other authors in the same subject population.2 Other authors also found around 10 intubations with approximately 50% success rate in medical students during a two week rotation4, similar to our findings. Full results after the completion of the study will inform the design of a larger trial potentially to be rolled out nation-wide.

**References:**
Introduction: Mentorship has been shown to improve career satisfaction, research productivity, and retention of academic physicians.¹ There are currently no studies that investigate factors that either promote or hinder effective mentoring relationships simultaneously through both the faculty and resident perspectives.² We planned to fill this gap by exploring mentoring relationships at one institution.

Methods: Following local research ethics board approval, mentorship experiences were examined through semi-structured interviews. Data was analyzed with a grounded theory approach using open, axial, and the constant comparative method to identify common themes effecting positive or negative mentorship outcomes.

Results: A successful mentorship program was found to hinge on three key factors, as determined from both the mentor and mentee perspectives: the anticipated goals of a mentorship relationship; characteristics of the participants; and the structure the program. When themes were compared between mentors and mentees, differences in perception of the relationship goals and structure resulted in cases of participant disillusionment and negative mentorship outcomes. A perceived lack of explicitly stated expectations and responsibilities of mentorship led to confusion as to whether the relationship was fundamentally mentor or mentee driven. This differentiation was integral to the development of the relationship and fulfillment of outcomes.

Discussion: We were able to obtain multiple stakeholder perspectives through rich narratives including proposed solutions on designing a mentorship program for postgraduate training programs. The concept of a mentorship network, which has been well described in the business literature, emerged as a possible solution to meeting the evolving needs of mentees as they progress through training.

References:

Background: Several international studies have demonstrated a lack of patient awareness regarding the roles and level of education of anesthesiologists both in and out of the operating room and limited understanding of anesthesiologists' roles in patient care. The aim of this study is to examine patients' awareness about the medical specialty of anesthesiology. To that end, we have designed a questionnaire to determine patients' knowledge, awareness and opinions of anesthesiologists based on similar national surveys.

Methods: Following REB approval, we performed a prospective single-center observational study from September 2014 – January 2015. Consenting patients completed a multiple-choice questionnaire prior to elective surgery and before meeting the anesthesiologist. Total percentage scores were calculated and data were analyzed with Fisher's Exact Test. The questionnaire included patient demographics, prior anesthesia history and whether they had received a preoperative anesthesia assessment (PAA).

Results: 247 total patients were polled - 124 males (50.8%), 120 females (48.6%) and 3 (1.2%) unspecified. 149 (60.6%) of patients had a PAA prior to their proposed surgery, and 97 (39.4%) did not. 173 (71.5%) patients recognized anesthesiologists as medical doctors. 100 (44.1%) patients responded the primary role of the anesthesiologist was to assist the surgeon. 132 (58.4%) patients thought the surgeon was responsible for their medical well being during surgical emergencies. Post-operatively patients responded nursing staff is most responsible for: their safe recovery 142 (61.5%), treating nausea and vomiting 126 (55.5%) and pain management 115 (52.3%). Patients that had undergone PAA had a statistically significant improved understanding of addition roles of anesthesiologists outside the operating room.
210 (85.4%) patients had undergone prior surgical anesthesia. 146 (81.5%) patients recalled meeting their anesthesiologist before surgery and 169(94.9%) were satisfied with their previous anesthesia. Only 90 (51.4%) patients thought their anesthesiologist prepared them for how they would feel post-operatively and 119 (69.2%) felt they had time to ask questions before going to the OR.

**Discussion:** This study demonstrates that the majority of patients undergoing elective surgery recognize anesthesiologists as medical doctors who have a similar level of training to surgeons. However, patients felt their safety was the responsibility of the surgeon and nurse in medical emergencies. This study demonstrates a need for improved communication in regards to roles of anesthesiologists in patient care.

**References:**
2. Rev Bras Anestesiol 2011 61(6), 720-7
3. Anesth & Analgesia 1996 83(6), 1314-1321
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M. Dylan Bould - Children's Hospital of Eastern Ontario

Background: In simulation-based education, debriefing has traditionally been led by an instructor, with the limitation of cost and availability. Research on peer-assisted learning suggests that involving students in peer-assessment could be effective and further develop their own competencies in learning. We hypothesized that peer-debriefing alone would improve the performance of non-technical skills (NTS) of medical students in a simulated crisis.

Methods: After institutional ethics approval, volunteer undergraduate medical students (n=61) were randomized to one of three groups: instructor debriefing (control), peer-debriefers, and peer-debriefees. All students individually managed a simulated crisis (pre-test). All subjects then underwent two successive simulation scenarios, each immediately followed by a debriefing. Subjects from the control group had an instructor debriefing while the peer debriefee group were debriefed by their peers (peer-debriefers). All subjects then managed a further simulated scenario (immediate post-test) and a retention post-test two months later. Two blinded and trained experts independently rated videos of all performances in a random order, using the Ottawa Global Rating Scale (OGRS).

Results: For the three groups, performance significantly improved from pre-test to both immediate and retention post-tests (p < 0.038). There was no significant difference between the immediate and retention post-test. There was no significant difference in performance between-subjects by group allocation (p=0.147).

Discussion/Conclusions: Peer-debriefing in simulated crisis situation effectively improved NTS performance in both the peer-debriefers and peer-debriefees, and the degree of improvement was not different from instructor debriefing. Learning with peers
through simulation debriefing was a valuable alternative to traditional instructor debriefing.
AIRWAY MANAGEMENT POSTER DISCUSSION 6
Sunday, June 21
9:45 AM - 11:30 AM
Room: Parliament Foyer

Moderators:
Dr Tim Turkstra
Western University

Dr Adriaan Van Rensburg
University of Toronto

Objective:
At the end of this session, participants will be able to:
• Discuss presented research presentations in airway management with author(s) and attendees.

78656 - BISPECTRAL INDEX AS PREDICTOR OF ACCEPTABLE NON PARALITIC INTUBATION
Presenting Author: Luiz Antonio Mondador, Cancer Center A.C. Camargo, Sao Paulo, Not applicable, Brazil
Co-Authors(s): Marcelo S. Ramos

78685 - REMIFENTANIL AS A SOLE SEDATIVE FOR AWAKE FIBEROPTIC INTUBATION
Presenting Author: Luiz Antonio Mondador, Cancer Center A.C. Camargo, Sao Paulo, Not applicable, Brazil
Co-Authors(s): Marcelo S. Ramos

82973 - OPTIMUM BRIGHTNESS OF A NEW LED LIGHTWAND DEVICE IN A CADAVERIC MODEL
Primary Author / Presenting Author: Andrew D. Milne, Dalhousie University, Halifax, Nova Scotia
Co-Authors(s): Matthew d'Entremont, Orlando Hung

83946 - ALKALINIZED LIDOCAINE INTRACUFF TO PREVENT EMERGENCE COUGHING
Presenting Author: Yannick Fréchette, Université de Sherbrooke, Sherbrooke, Quebec
Primary Author: Houssine Souissi, Université de Sherbrooke, Sherbrooke, Quebec
Co-Authors(s): Alexandre Parent, Alexandre Murza, Marie-Hélène Masse, Frédérick D'Aragon, Yanick Sansoucy

85250 - VISUAL ASSESSMENT OF MINIMUM LARYNGOSCOPE BRIGHTNESS
Presenting Author: Gaurav Arora, Dalhousie University, Halifax, Nova Scotia
Co-Authors(s): Paul Brousseau, Andrew Milne

85568 - ULTRASOUND IDENTIFICATION OF CRICOTHYROID MEMBRANE - LEARNING CURVE
Primary Author / Presenting Author: Katia Ferreira de Oliveira, Mount Sinai Hospital, Toronto, Ontario
Co-Authors(s): Cristiano Arzola, Naveed Siddiqui, Jefferson Clivatti, Eric You-Ten

85989 - SCOPES VS. BLADES: WHAT ARE ANESTHESIOLOGISTS USING?
Primary Author / Presenting Author: Meredith J.L. Briggs, Queen's School of Medicine, Kingston, Ontario
Co-Authors(s): Kim Turner, John Murdoch
Background and Goal of Study: We evaluated if BIS values could predict acceptable conditions for laryngoscopy and tracheal intubation (TI) without muscle relaxants, with the use of remifentanil plus propofol.

Methods: Local ethics board approved the study. We reviewed charts of 2 groups of patients: patients anesthetized with 1,2 mcg/Kg remifentanil+ lidocaine 1,5 mg/Kg + propofol enough to produce BIS in the range of 40 – 55; and patients who received the same induction but remifentanil 2 mcg/Kg. TI conditions were evaluated by an arbitrary method in which: Grades 0 means excellent, grade 1 acceptable and grades 2 or 3 means unacceptable TI condition; besides these, hemodynamic data were also recorded. Difficult TI, nasotracheal and double lumem tubes were excluded

Results: Among 23 cases in 1,2 mcg/Kg group, BIS 40-55 failed to predict acceptable TI conditions 5 patients(21,7%). Acceptable conditions were found in 18 patients(78,2%), score zero 9 (39,1%) and score one 9 (39,1%). Systolic, diastolic pressure and heart rate dropped more than 25% from baseline in 43,4%; 39,1% and 17,3% of cases respectively.

Among 24 patients who received 2 mcg/Kg remifentanil, BIS 40-55 failed to predict acceptable intubating conditions in 3 (12,5%). Acceptable conditions were found in 21 (87,5%), score zero in 16(66,6%) and score one in 5 (20,8%). Systolic, diastolic pressure and heart rate dropped more than 25% from baseline in 58,3%; 41,6% and 4,1% of cases respectively, but in no case the drop reached 50% of baseline values.

With both doses, the attending anesthesiologist never deemed necessary resort to muscle relaxation to perform the TI, and there were no hemodynamic difference between the patients with acceptable and non acceptable intubating conditions. With both doses acceptable TI conditions were related to Cormack grade.

Discussion: We evaluated TI conditions by a crude criteria, instead of the Stockholm criteria, for the sake of feasibility of the study done in our regular work hours. With the caveat that what we understand as acceptable TI conditions, may not be deemed so by a stricter investigator. We tried to find if BIS in the therapeutic value could predict adequacy for TI without relaxants. We speculate if a lower BIS target and/or higher opiate dose could achieve higher TI excellent conditions, and at which hemodynamic cost. Due to the small number of patients we understand that the study might be underpowered to draw definite conclusions.
Conclusion: When combined to lidocaine and propofol, increasing the dose of remifentanil from 1,2 to 2 mcg/Kg increases the reliability of BIS (87.5%) as a predictor for acceptable TI conditions, but also increases the incidence of drop in systolic and diastolic pressures beyond 25% of the baseline. No disclosures. No financial support.

References:

5 - European Journal of Anesthesiology 2009, - Volume 26 – Issue 3 p 223-8
Background and Goal of Study: Awake Fiberoptic intubation (AFOI) generates more patient discomfort than general anesthesia, but when it comes to difficult ventilation and/or intubation, comfort shall be sacrificed in favor of safety. The combination of midazolam plus fentanyl has been employed as sedative along with local anesthesia for AFOI for many years as a standard technique with good results, but the author deemed that results were improvable according to current literature.

Methods: Since no novel drugs or techniques were involved, the ethical board not only approved the study but also deemed not necessary specific written patient authorization. We compared data from 44 patients who underwent AFOI from June to November 2013, under standard sedation protocol (midazolam 100 mcg/Kg + fentanyl 2 mcg/Kg) ("GROUP M") with data collected from 41 patients who underwent AFOI from January to November 2014, but sedated with remifentanil (1 mcg/kg in 3 minutes + 0,07 mcg/Kg/min) ("GROUP R"). All the intubations were done by the author, in two hospitals, and evaluation of the response to the airway instrumentation was recorded by the nurse, blinded to the sedative technique. In both groups the same local anesthetic technique and oxygen supplementation were employed.

Results and Discussion: Among 44 GROUP M patients, 34 (77,7%) had fair to good intubation conditions with minimal cough or reaction to the "spray-as-you-go" (SAYGO) lidocaine injections and intubation, 10 patients (22,7%) reacted with strong cough and/or movement to the SAYGO lidocaine injections to the larynx and trachea, 5 patients (11,3%) demanded more than 10 minutes to perform the intubation; in 5 patients (11,3%) saturation dropped to 85% and 3 patients (6,8%) needed immediate general anesthesia after the intubation.

Only one patient in GROUP R reacted to the SAYGO injections with a weak cough, none reacted to intubation. All remained calm and comfortable after the intubation, none developed saturation below 93%, no patient demanded more than 5 minutes to complete the intubation. No GROUP R patient developed muscle rigidity. Hemodynamic values were equally stable in both groups. Nine extra patients who underwent nasal AFOI under remifentanil were not included, in spite of excellent results, because the author deemed that they could not be compared to orally intubated GROUP M patients. Respiratory rate was not recorded because respiratory drive was under anesthesiologist verbal command. Amnesia or memory of the procedure was not investigated.
Conclusion: Due to the discrepancy in the results between the two groups, the “old standard” was replaced by remifentanil as the “new standard” technique for AFOI. No conflict of interest, no financial support.

References:
82973 - OPTIMUM BRIGHTNESS OF A NEW LED LIGHTWAND DEVICE IN A CADAVERIC MODEL

Author(s)
Andrew D. Milne
Dalhousie University
Primary Author / Presenting Author

Co-Authors(s)
Matthew d'Entremont - Dalhousie University
Orlando Hung - Dalhousie University

Introduction: Lightwands still play an important role in the difficult airway situation\(^1\). However, the recent withdrawal of the Trachlight (Laerdal) from the airway market has left many anesthesia providers without a suitable replacement for this well validated airway device\(^2\). While the Trachlight was popular, it had limitations including: appreciable degradation in light output with repeated use and cleaning\(^3\), the potential risk for thermal burns from the incandescent bulb, and fixed light output (new wands brightness 2300 lux\(^3\)) which could not be adjusted for different neck thicknesses\(^4\). A new LED lightwand prototype with adjustable light intensity has recently been developed. The purpose of this pilot study was to assess the optimum range of light intensity and LED bulb color (white vs red) for transtracheal illumination with this new device.

Methods: After obtaining the approval of the REB, two freshly prepared clinical grade cadavers (1 male and 1 female cadaver with neck circumferences of 40.4 and 38.3 cm respectively) were obtained for this pilot study. A Trachlight device handle was equipped with a custom built power system and adjustable dimmer dial which powered a modified lightwand with either a red LED (brightness range 0-4500 lux) or white LED bulb (brightness range 0-8000 lux). Thirteen staff anesthesiologists familiar with lightwand intubations were recruited and consented to participate in the study. The device light output was calibrated using a validated light meter testing system\(^3\). The room was darkened to an ambient light level of < 3 lux and the order of testing scenario (cadaver/bulb color) was block randomized. The lightwands were placed at the glottic opening by the primary investigator with placement confirmed by direct laryngoscopy. Testing was done on both cadavers using both the red and white LED bulbs. For each bulb color, the staff were asked to adjust the brightness dial to the optimum transtracheal illumination from the off position up to the optimum and then from the maximum brightness down to the optimum. After completing the study, participants were asked which bulb color they preferred. Optimum brightness levels were analyzed using three way ANOVA with Holm-Sidak multiple comparisons.

Results: The optimum light intensity (mean ± sd) selected by the 13 staff for the different testing scenarios is shown in figure. There was a significant difference in the optimum light intensity for cadaver 1 versus cadaver 2 (p < 0.001) and red versus white LED bulb brightness (p < 0.001), however there was no significant difference in optimum brightness selection by direction of dial adjustment (i.e up/down, p=0.162).
There was no observable pattern of preference in bulb color.

**Discussion:** Our pilot data suggest that the optimum brightness required for transtracheal illumination was dependant on the anatomy of the cadaver tested, with a wide range of lux required for both LED bulb colors. The optimum brightness often exceeded the brightness of the old Trachlight device. The red LED appeared to require less light intensity for transtracheal illumination. These data support the design of an adjustable light intensity feature in the new lightwand device.

**References:**
1. ASA Newsletter 2012 76:30-31
Introduction: Cough upon emergence from general anesthesia (GA) is associated with adverse effects\(^1\). Evidence shows that alkalinized lidocaine (AL) in the endotracheal tube cuff (ETC) decreases cough, although these studies used nitrous oxide (N\(\text{2}O\))\(^2\). N\(\text{2}O\) diffuses into the ETC, which can lead to tracheal mucosal injury\(^3\). Therefore, we conducted a randomized controlled trial to evaluate AL’s effect on cough incidence during emergence from GA without N\(\text{2}O\). Furthermore, we sought to characterize AL’s in vitro diffusion rate for various doses.

Methods: Following Local Ethics Committee approval, 80 patients requiring elective gynaecological or urological surgery (minimum 2 hours) consented to participate in the study. Patients were blindly randomized to the AL or normal saline (NS) group and followed a standardized anesthetic protocol. After intubation, the cuff (low pressure-high volume polyvinylchloride Mallinckrodt ETC) was filled with 4 ml of 4% lidocaine (AL group) or with 4 ml of NS (NS group). A volume of 8.4% bicarbonate solution or NS was added respectively for adequate seal at a 20 cm H\(\text{2}O\) pressure. Primary outcome was the presence of cough upon emergence. Secondary outcomes included nausea and vomiting, voice hoarseness, and sore throat. Sample size was determined for 80% power, based on a 50% relative outcome reduction and a cough incidence of 70% in the NS group. A chi-square test was used for dichotomous variables, while Student’s t-test or Mann-Whitney test were used depending on continuous variables’ distribution. A \(p \leq 0.05\) was considered statistically significant.

For the in vitro study, diffusion of AL was compared to lidocaine with NS. Six endotracheal tubes (as above), 3 per group, were placed in separate physiologic mediums (37°C, pH 7.4). In each group, 4% lidocaine was injected in the ETC for doses of 40 mg, 80 mg, and 160 mg. A total volume of 12 ml was obtained in each ETC with 8.4% bicarbonate or NS. Lidocaine samples were measured hourly for 8 hours.
using high performance liquid chromatography.

**Results:** Five patients (2 AL and 3 NS) were excluded from analysis due to protocol breach. Group characteristics were similar. AL provided a statistically significant reduction in cough upon emergence by 55% (left figure). There were no differences for secondary outcomes. The *in vitro* study demonstrated that lidocaine diffusion increased more than 20 fold when alkalinized, proportionally to dose and time (right figure).

**Discussion:** We conclude that AL (160 mg) in the ETC decreased cough upon emergence from GA over 2 hours without N2O. The *in vitro* component illustrates that time is a factor in allowing sufficient amounts of AL to diffuse and block sensory cough receptors. These concepts have clinical applicability for surgery where cough can have detrimental consequences for the patient.

**References:**
3. Anesthesiology 2001 95:1120 – 4
INTRODUCTION: Repeated sterilization of laryngoscope blades progressively degrades light intensity, potentially affecting glottic visualization during intubation. A wide range of minimum or optimum laryngoscope light intensities has been reported in the literature ranging from 200 to 2000 lux. The current ISO standard specifies a minimum illuminance of 500 lux for laryngoscopes. However, it is not feasible for staff to check the light intensity of each blade with elaborate testing equipment on a case by case basis. Staff typically rely upon their own visual estimation of laryngoscope light adequacy prior to usage. No studies have compared anesthesiologists' visual assessment of light adequacy to that required at intubation or relative to the ISO standard. The purpose of this study was to quantify the minimum acceptable laryngoscope light intensity by visual inspection and manikin intubation in comparison to the ISO standard.

METHODS: This bench top study was approved by the local REB. Ten discarded reusable adult fibreoptic Macintosh laryngoscope blades (Heine) with varying light intensities (range 140-2260 Lux) were acquired for use in this study. The light intensity delivered from each blade was measured using a validated light meter testing system. Thirty-five consenting anesthesia staff and residents participated in this study. Ambient room lighting level and participant experience level were recorded for each test. Each blade was tested using a fully charged laryngoscope handle. The adequacy of light intensity (acceptable/unacceptable) from the 10 blades was initially assessed by visual inspection alone as would be done prior to usage in the operating room. In the second portion of the study, the adequacy of lighting from the same ten blades was assessed during direct laryngoscopy on an airway manikin (Laerdal). The order of blade testing was randomized for each portion of the study and participants were blinded to the blade light intensity measurements. The light intensity delivered from each blade was checked with the light meter after each test. The minimum acceptable light levels for each assessment method were compared using ANOVA.

RESULTS: The mean minimum acceptable light intensity for each individual subject was 362 +/- 203 during visual inspection and 419 +/- 211 lux during manikin laryngoscopy (p=0.25). However, the minimum light intensity that would be acceptable to all staff (100% acceptance) was 872 lux by visual inspection and 1060 lux for manikin laryngoscopy (figure).
Discussion: This study sought to compare the threshold for minimum brightness by two different assessment methods, not the optimum level for intubation. Although not statistically significant, our data suggests that anesthesiologists prefer higher laryngoscope light levels during manikin intubation than determined by visual inspection alone. Blades found to have borderline brightness by visual inspection during the pre-operative check should be rejected as they may not be adequate for laryngoscopy, especially with real life conditions such as soiled airways or difficult laryngoscopy. The minimum light threshold required by our staff appeared to be consistent with the ISO standard of 500 lux.

References:

1. Anaesth 1999 54:875-88
3. Anaesth 2008 63:65-70
6. ISO 7376-2009:Anaesthetic and respiratory equipment
Introduction: Accurate identification of the cricothyroid membrane (CTM) is crucial for successful emergency cricothyrotomy. However, the conventional finger palpation of the CTM is frequently inaccurate. The CTM can be accurately identified using ultrasound (US). We aimed to determine the amount of training an anesthesiologist would need to achieve competence in the bedside US-assisted identification of the CTM.

Methods: Six anesthesia trainees (2 fellows and 4 residents) watched an educational video and attended a 30-min lecture followed by an interactive 30-min hands-on workshop and live demonstration performed by an expert sonographer. The participants were instructed on how to perform a neck US to identify the CTM. Individual learning curves were constructed using the cumulative sum method, and competence was defined as a 90% success rate in a series of ultrasound examinations.

Results: Each trainee performed 20 ultrasound examinations (a total of 120 assessments), and 5 of the six participants achieved competence. The median number of attempts required to achieve 90% success rates by CUSUM analysis was estimated to be 17 (range: 14-20). While the overall success rate for the entire group was 88.3% (106/120), the mean success rate among the five participants who achieved competence was 92.5% (range: 80 -100%). The participant who did not achieved competence by CUSUM obtained a success rate of 75%(15/20). The time to complete the task was achieved within a mean (SD) of 36.9 (9) seconds, and a minimum /maximum of 22.5/44.25 seconds.

Discussion: With appropriate training and supervision, it is estimated that anesthesia trainees with different levels of experience will achieve competence in ultrasound identification of the cricothyroid membrane after performing 17 examinations. The trainees are currently being submitted to a skill retention assessment 3 months after the teaching sessions.

References:

Background: Video laryngoscopy is an established intubation technique in the field of anesthesia not only as an airway rescue device but a preferred intubation technique for many in routine anesthetic practice. What remains unknown is the utilization rate of video laryngoscopy versus standard laryngoscopy in elective surgery. Anesthetic records routinely indicate the type of intubation technique utilized however it is not possible to retrospectively review the reason for the use of video laryngoscopy nor whether a videoscope was brought into the room to be available in case of difficult laryngoscopy.

Methods: Following REB approval, we performed a prospective single-center observational study of all elective intubations in the operating room during a one month time period. When a videoscope was requested, information recorded by research personnel included: patient characteristics, method of intubation including whether the videoscope was used as the primary intubating device, after a direct intubation attempt, after an awake direct laryngoscopy, or remained in the OR unused. In addition the reason for use, and any delay in obtaining a videoscope including whether it was necessary to obtain a videoscope not designated for that particular operating room.

Results: The videoscope was requested for 72 (20.1%) of the 358 intubations during the study period. 67 of the 72 total cases were recorded. In 30 (44.8%) recorded cases it was used as a primary intubation device, after unsuccessful direct laryngoscopy in 7 (10.4%) cases on 1 (1.5%) occasion for awake visualization prior to direct laryngoscopy and ill defined reasons in 3 (4.5%). It was not used in 26 (38.8%) cases in which it was requested (Figure 1). The most frequent reasons cited for requesting the videoscope be present in the OR were: predicted difficult airway (65.2%), known difficult airway (13.6%), concern for dental damage (7.6%), teaching (6.1%), cervical spine immobility (4.5%) and preferred primary method of intubation (1.5%).

Anesthesiologists reported delays obtaining a videoscope in 9 of the 67 (13.4%) cases. On 10 (14.9%) occasions anesthesiologists used scopes not designated to that section of the Operating Suite.

Discussion: Anesthesiologists in our study requested a videoscope in approximately one in five surgical cases. In 10.8% of cases in which the videoscope was requested it was utilized after direct laryngoscopy, thereby underlining the importance of availability.
of this intubation method for patient safety. Delay in obtaining a videoscope as well as utilizing videoscopes not designated for that area of the operating suite raise concerns surrounding equipment availability necessary for patient safety. Results from this study, though limited to one institution over a short study period, may assist anesthesiologists in hospital resource acquisition and allocation decisions. Further research should elucidate the role of the videoscope in other areas of the hospital, as well as in other centers.

References:

CVT POSTER DISCUSSION 7
Sunday, June 21
12:30 PM - 2:15 PM
Room: Parliament Foyer

Moderator:
Dr Blaine Kent, Dalhousie University

Objective:
At the end of this session, participants will be able to:
• Discuss presented research presentations in cardiovascular and thoracic

83138 - REGRESSION OF QRS WIDENING INDUCED BY BUPIVACAINE AFTER INTRALIPID
Primary Author / Presenting Author: Matilde Zaballos, Hospital Universitario Gregorio Maraño. Universidad Complutense Madrid, Madrid, Spain
Co-Authors(s): David Callejo, Raul Sevilla, Jorge González, Mª José Anadon, Oscar Quintela, Ramiro L Menchaca, Jesús Almendral

84206 - HIGH SPINAL ANESTHESIA AND DELIRIUM INCIDENCE AFTER CARDIAC SURGERY
Primary Author / Presenting Author: Andrea Petropolis, University of Manitoba, Winnipeg, Manitoba
Co-Authors(s): Doug Maguire, Stephen Kowalski, Rakesh Arora, Trevor Lee, Hilary Grocott

84257 - RANDOMIZED COMPARISON OF ISOFLURANE & SEVOFLURANE IN CARDIAC SURGERY
Primary Author / Presenting Author: Philip M. Jones, Department of Anesthesia and Perioperative Medicine, Western University, London, Ontario
Co-Authors(s): Daniel Bainbridge, Michael Chu, Philip Fernandes, Stephanie Fox, Ivan Iglesias, Ronit Lavi, John Murkin, Bob Kiaii

84513 - INTRAOPERATIVE HYPOTENSION AND KIDNEY INJURY AFTER CARDIAC SURGERY
Primary Author / Presenting Author: Louise Sun, Department of Anesthesia, Toronto General Hospital and Division of Cardiac Anesthesiology, University of Ottawa Heart Institute, Ottawa, Ontario
Co-Authors(s): Matthew Machina, Keyvan Karkouti, Duminda Wijeysundera, W Scott Beattie, Matthew Machina, Keyvan Karkouti, Duminda Wijeysundera, W Scott Beattie
84932 - BIOMARKERS OF ANEMIA-INDUCED TISSUE HYPOXIA IN CARDIAC SURGERY
Presenting Author: Albert Tsui, St. Michael's Hospital, Markham, Ontario
Primary Author: Gregory M.T. Hare, University of Toronto, St. Michael's Hospital, Department of Anesthesia, Toronto, Ontario
Co-Authors(s): Tiffanie Kei, Yevheniy Leshchyshyn, Razak Pirani, Liam Dai, Sanjay Yagnik, Rakesh Patel, C David Mazer

85320 - NEW ANTIARRHYTHMIC IN HEART DISEASE. ECHOCARDIOGRAPHIC STUDY
Primary Author / Presenting Author: Begoña Quintana-Villamandos, Gregorio Marañón
General Hospital, Dept of Anaesthesiology & Intensive Care, Madrid, Spain, Madrid, Not applicable, Spain
Co-Authors(s): Jose Juan Gómez de Diego, Belén Basagoiti, Julia Herrero, Juan Lloret, María Jesús Delgado-Martos, David Muñoz-Valverde, Emilio Delgado-Baeza

85998 - INTRALIPID AND DISPERSION OF REPOLARIZATION INDUCED BY BUPIVACAINE
Primary Author / Presenting Author: Matilde Zaballos, Hospital Universitario Gregorio Marañón. Universidad Complutense Madrid, Madrid, Spain
Co-Authors(s): David Callejo, Raul Sevilla, Oscar Quintela, Mª José Anadon, Jorge González, Ramiro López, Jesús Almendral, Ana Mª Morales, Carlos De Diego, Carmen Marquez, Cristina Alvarez

86224 - DEXMEDETOMIDINE REDUCES DELIRIUM AFTER HIGH RISK CARDIAC SURGERY
Presenting Author: Natalie Silverton, Toronto General Hospital, Toronto, Ontario
Primary Author: George Djaiani, Toronto General Hospital, Toronto, Ontario
Co-Authors(s): Rita Katznelson, Jo Carroll, Rima Styra, Vivek Rao, Ludwik Fedorko
Background and Goal of Study: The principal mechanism of cardiac toxicity of bupivacaine relates to the blockade of myocardial sodium channels, which leads to an increase in the QRS duration. Recently, experimental studies suggest that lipid emulsion is effective in reversing bupivacaine cardiac toxicity. We aimed to evaluate the temporal evolution of the QRS widening induced by bupivacaine with the Intralipid administration.

Material and methods: Six pigs were premedicated with ketamine and anesthetized with intravenous sodium thiopental 5mg-kg. The anesthetic maintenance was performed with sevoflurane 1 CAM (2.6%). Femoral artery and vein were canalized for invasive monitoring, analytical blood gas samples and bupivacaine levels determinations. After instrumentation and motorization, a bupivacaine bolus of 4 mg.kg⁻¹ was administered in order to induce a 150% increase in QRS duration (defined as the toxic point). The Electrocardiographic parameters were recorded and blood samples were taken after bupivacaine and 1, 5 and 10 minutes after Intralipid administration (1.5 mL/kg over 1 minute followed by an infusion of 0.25 mL/kg/min) Three additional animals served as a control group, saline infusion was administered instead of Intralipid. Statistical analysis: Mann-Whitney test.

Results: The baseline QRS was 63 ± 7.4 ms in IL group, and 50 ms in control group. Bupivacaine induced similar electrocardiographic changes in both groups, the maximum QRS widening was 183 ± 39 ms and 180 ± 35 ms in IL and control group respectively. After IL administration the QRS enlargement was reversed as shown in Figure 1, (p < 0.05). At 10 min of the IL administration, the QRS interval was 84% of baseline value.

Discussion: Intralipid reversed the lengthening of QRS interval induced by the injection of bupivacaine. Time to normalization of electrocardiographic parameters can last more than 10 min. While the phenomena of cardiac toxicity persist, resuscitation measures and adequate monitoring should be continued until adequate heart conduction parameters were restored.
References:


Background: Delirium is a syndrome of acute brain dysfunction that commonly occurs in the postoperative patient. [1] The pathophysiology of delirium is poorly understood, however there is general agreement that it is multifactorial in its etiology. [1] Inflammation may play an important role in the pathogenesis of delirium, particularly in the setting of cardiac surgery, which is known to have an exaggerated inflammatory response. [1,2,3] Certain interventions, including high spinal anesthesia (HSA), may attenuate the inflammatory response to cardiac surgery. [4,5,6] The aim of this study was to determine the impact of HSA on the incidence of delirium after cardiac surgery.

Methods: Following Research Ethics Board approval, we conducted a retrospective analysis of all patients who received HSA for cardiac surgery at our institution from March 1st 2010 to March 30th 2014. Each HSA case was propensity matched to a non-HSA case from the same time period from a database which included 2300 cardiac surgery cases. Propensity matching was based on a number of pre-defined preoperative and intraoperative delirium risk factors. The primary outcome was the incidence of delirium, which was defined as any positive Confusion Assessment Method (CAM) or CAM-ICU score on postoperative days zero to seven (POD 0-7). Our secondary outcome was delirium severity, which was determined by the average number of days in hospital (POD 0-7) on which a positive CAM score was recorded.

Results: Delirium occurred in 11 (8%) of 137 patients in the HSA group, as compared to 23 (18%) of 130 in the control group (relative risk [RR] 0.45, 95% CI 0.23 to 0.89). Average (mean ± SD) number of days with delirium was not significantly different between groups (0.1 ± 0.6 vs. 0.3 ± 0.9 days in HSA vs. controls; p = 0.87)

Conclusions: Compared to a propensity-matched control group, HSA patients had a significant decrease in the incidence of post-cardiac surgical delirium. The reasons for this decrease are not known but might be related to a reduction in the inflammatory response or due to differences in anesthetic management inherent with the use of HSA.
References:


Introduction: Traditionally, much of anesthesia research has focused on testing new drugs, novel indications for older drugs, or new devices. For multiple reasons including differential benefits or harms, practical, and financial considerations, it is also important to know whether clinically important within-class differences exist for available drugs or devices. Unfortunately, within-class comparisons are rarely studied, and significant knowledge gaps exist. Comparative Effectiveness Research (CER) has emerged as a type of pragmatic research targeting ‘real world’ comparisons of the benefits and harms of commonly used interventions, including within-class comparisons.[1,2] Volatile anesthetics possess preconditioning cardioprotective properties,[3] but it is unknown if the cardioprotective effects extend equally to all members of the class. Using CER principles, we sought to determine if sevoflurane and isoflurane are comparable in their effects on clinically important outcomes in adults undergoing common cardiac surgeries. We hypothesized that sevoflurane would be non-inferior to isoflurane.

Methods: Written informed consent was obtained from all study participants and this study was approved by the local Research Ethics Board. 464 adults having cardiac surgery were randomly allocated to maintenance of anesthesia with sevoflurane (n=231) or isoflurane (n=233), administered at a dose of 0.5 to 2.0 minimum alveolar concentration (MAC) throughout the entire operation. The primary outcome was a composite of intensive care unit (ICU) length of stay ≥ 48 hours or death from any cause within 30 days of the operation. The non-inferiority margin was defined as less than 10%, based on an expected event rate of 25%. All care-givers except for the anesthesiologist and perfusionist were blinded.

Results: No losses to follow-up occurred. The primary outcome occurred in 25% of sevoflurane patients and 30% of isoflurane patients (absolute difference -5.4%, one-sided 95% CI 1.4%), thus non-inferiority was declared. Sevoflurane was not superior to isoflurane for the primary outcome or for any categorical secondary outcomes.
(prolonged ICU stay, 30-day all-cause mortality, inotrope or vasopressor usage, new-onset hemodialysis or atrial fibrillation, stroke, or readmission to the ICU, see Table). Times to tracheal extubation, ICU discharge, and hospital discharge were not different between groups.

Discussion: There are no substantive differences on any clinically important outcomes between sevoflurane and isoflurane when used for maintenance of anesthesia for cardiac surgeries. Substantial cost savings could be realized by using isoflurane, rather than sevoflurane, for cardiac anesthesia. (This trial was registered at www.clinicaltrials.gov: NCT01477151.)

References:

1. Anesthesiology 2009; 111: 1180-82
84513 - INTRAOPERATIVE HYPOTENSION AND KIDNEY INJURY AFTER CARDIAC SURGERY

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Introduction: Acute kidney injury (AKI) is a common and serious complication of cardiac surgery. Many AKI risk models have been proposed to date, but none has addressed the combined effect of intraoperative hypotension (IOH) pre-, during and post-cardiopulmonary bypass (CPB). We investigated whether varying periods of IOH, defined separately by mean arterial pressure (MAP) of < 65 mmHg pre-, during and post-CPB, were associated with postoperative AKI.

Methods: After institutional REB approval, we conducted a retrospective cohort study of 2314 consecutive patients undergoing major cardiac surgery requiring median sternotomy (November 2009 – July 2014). Exclusion criteria were preoperative MAP < 65, dialysis dependence, and lack of pre- or postoperative creatinine measurements. The primary outcome was AKI, as defined by the Acute Kidney Injury Network (AKIN) Stage I criteria (50% relative or 26 μmol/L absolute increase in creatinine over preoperative value) during the first 2 postoperative days. Secondary outcome was AKIN Stage II-III AKI (>100% relative or 44 μmol/L absolute creatinine increase). The primary exposures were the total durations of MAP < 65 pre-, during and post-CPB, in minutes. All intraoperative invasive BP measurements were recorded every minute in an electronic patient record, with any artifacts removed using an automated algorithm. The relationship between IOH and AKI was modeled using multivariable logistic regression with adjustment for a priori selected AKI risk factors. Where appropriate, covariates were tested for interactions. Measure of association was OR (95% CI). Statistical significance was defined by a 2-tailed p < 0.05. All analyses were conducted using SAS 9.1.
**Results:** AKIN Stage I AKI occurred in 400 patients (17.3%). Each 10 additional minutes of IOH with MAP < 65 during CPB was associated with a 6% increased odds of AKI (adjusted OR 1.06; 95% CI, 1.02-1.10), while each 10 additional minutes of MAP < 65 post-CPB was associated with a 11% increased odds of AKI (adjusted OR 1.11; 95% CI, 1.06-1.16). Pre-CPB IOH was not associated with AKI. Older age, male sex, history of hypertension, LVEF < 40%, preoperative renal insufficiency, anemia, aortic crossclamp > 120 min, intraoperative transfusion of ≥ 4 units of packed red cells and need to reopen postoperatively were also associated with AKI. There was no interaction between preoperative hypertension and intraoperative hypotension, or between preoperative anemia and intraoperative transfusion.

AKIN Stage II-III AKI occurred in 78 patients (3.4%) and was associated with post-CPB IOH (adjusted OR 1.18, for every 10 additional minutes of MAP < 65; 95% CI, 1.11-1.27) and low output syndrome.

**Discussion:** In this analysis, AKIN Stage I AKI is independently associated with MAP < 65 mmHg during and post-CPB while AKIN Stage II-III AKI is associated with MAP < 65 post-CPB, with evidence of a dose-response relationship with increasing total durations of hypotension. This study provides an impetus for clinical trials to determine if specific interventions that facilitate prompt treatment of IOH also help reduce the risk of AKI.
Introduction: Anemia is associated with increased risk of organ injury and mortality (1-3). During cardiac surgery with cardiopulmonary bypass (CPB), hemodilutional anemia often occurs, putting patients at risk for adverse events(2). Assessing real-time biomarkers of tissue hypoxia during cardiac surgery may allow for early detection of tissue hypoxia and the development of patient specific treatments, including personalized transfusion thresholds. Translational animal models have demonstrated several early biomarkers of anemic-tissue hypoxia including nitric oxide (NO), methemoglobin (MetHb), erythropoietin (EPO, kidney) and hepcidin (liver) (4-5). We hypothesize that anemia causes activation of hypoxic signaling pathways thereby providing evidence of anemia-induced tissue hypoxia in patients undergoing cardiac surgery.

Methods: With institutional research ethics board approval, an observational prospective study was conducted on 36 cardiac surgery patients. After informed consent was obtained, 5 arterial blood samples were taken for each patient: baseline, 15 and 45 minutes after the start of CPB, within 15 minutes following removal from CPB, and within 1 hour of intensive care unit (ICU) admission. Standard hematology, arterial blood gas, MetHb, nitrate, nitrite and plasma EPO, hepcidin, were assessed. Brain oximetry was also assessed in 9 patients. Data [mean (STDEV)] was analyzed by repeated measures one-way ANOVA.

Results: Hemoglobin (Hb) levels decreased during the onset of CPB [125 (14.5) to 101 (15.1) g/L; p < 0.05]. No correlation with MetHb, or nitrite was observed; but plasma nitrate levels decreased during CPB [p=0.002]. Plasma EPO levels increased from baseline to ICU admission [9.2 (9.8) to 14.8 (14.0) mIU/mL; p < 0.05]. Changes in Hb
correlated with changes in EPO \([R^2= 0.122, p < 0.05]\). Plasma hepcidin levels remained stable at all time points and did not correlate with Hb levels. When EPO and hepcidin were analyzed as a ratio, there was an increasing trend with decreasing Hb \([R^2=0.08, p=0.02]\). Brain oxygen saturation decreased during the onset of CPB \([71.4 \pm 7.8\) to \(65.1 \pm 7.1\) \%; \(p < 0.05\].

**Discussion:** Our findings suggest that perioperative anemia lead to an early increase in EPO from the kidney, indicative of renal hypoxia. The stable hepcidin levels may provide indirect evidence of liver hypoxia, as hypoxia suppresses hepcidin expression and levels have been shown to be elevated by surgical inflammation(6). Combination of these two measures in an index may reflect combined liver and renal hypoxia. Decreases in plasma nitrate may also reflect altered NO / nitrite oxidation reactions with Hb. Characterization of patient-specific biomarkers of anemia-induced tissue hypoxia may help provide individual patient treatment thresholds and optimize care.

**References:**
1) Anesthesiology. 2009 Mar;110(3):574-81
2) Circulation. 2008 Jan 29;117(4):478-84
Introduction: Dronedarone is a new antiarrhythmic agent (1). Dronedarone has been shown to reduce ventricle rate, however no data on regression left ventricular hypertrophy are available. This study sought to ascertain if dronedarone reduce left ventricular mass in the SHR (spontaneously hypertensive rat) model of stable compensated ventricular hypertrophy.

Methods: We examined the effect of dronedarone on left ventricular hypertrophy and cardiac function in 11-month-old male SHR (n=5). Age-matched and sex-matched SHR (n=5) and Wistar Kyoto rats (WKY) (n=5) were use as controls. After 2 weeks of treatment, left ventricular morphology and function were assessed from M-mode echocardiograms [left ventricular mass (LVM), ejection fraction (%EF)] and transmitral Doppler [early-to-atrial filling velocity ratio (E/A), E-wave deceleration time (Edec time)]. Comparisons between groups were made by Student’s t-test for independent samples. P< 0.05 was considered significant. Local Ethics Committee approval was obtained.

Results: Dronedarone lowered heart rate in treated SHR with respect to untreated SHR (P < 0.05). LVM was increased in untreated SHR when compared with the age-matched WKY group (P < 0.05). LVM was attenuated in SHR treated with dronedarone with respect to untreated SHR (P < 0.05). %EF was higher in untreated SHR than in WKY (P < 0.05). Dronedarone decreased the %EF in treated SHR (P < 0.05) compared with untreated SHR, and was similar to WKY. There were no significant changes in E/A ratio nor in Edec time among the three groups.

Discussion: Dronedarone reduced early left ventricular mass and normalized systolic function in the SHR model of stable compensated ventricular hypertrophy. These are preliminary preclinical results to show the effect of dronedarone in the regression of left ventricular hypertrophy.
Acknowledgements: This work was supported by a grant from FIS 13/01261.

References:
(1) Adv Ther 2011 28: 1059-1077
Background and Goal of Study: Bupivacaine, may induce lethal arrhythmias due to inadvertent intravascular injection. Intralipid is an effective antidote to treat bupivacaine toxicity. An increase of ventricular transmural dispersion of repolarization, a major arrhythmogenic marker, is reflected by the Tpeak-to-Tend in the ECG. The main goal is to determine the effect of bupivacaine on dispersion repolarization parameters such as QT and Tpeak-to-Tend intervals and to explore the impact of intralipid on these parameters.

Material and methods: 14 mini-pig were studied. After instrumentation a 4 mg.kg-bolus of bupivacaine was administrated followed by an infusion of 100 μg.kg⁻¹.min⁻¹). Heart rate: HR, PR, QRS, QTc: corrected by HR and Tpeak-to-Tend were determined in a sequential fashion: after bupivacaine (at 1 min, 5 min and 10 min) and after intralipid (1.5 ml.kg⁻¹ over 1 minute followed by an infusion of 0.25 ml.kg⁻¹.min⁻¹). A t-student test was used.

Results and discussions: Bupivacaine prolonged PR, QRS and QTc intervals (at 1, 5 and 10 min), and increases dispersion of repolarization (Tpeak-to-Tend). Intralipid significantly decreased PR, QRS, QTc and Tpeak-to-Tend. Table. Dispersion of repolarization was related to lethal arrhythmias (3 events, including asystole, sustained ventricular tachycardia) and repeated non-sustained ventricular arrhythmias (NSVA) (4/14, 28%). A Brugada-like ECG pattern was visualized at V1-4 leads in 5/14 pigs (35%). Intralipid significantly decreased the alterations induced by bupivacaine, with the termination of VA within 10 minutes. Intralipid administration and resuscitation maneuvers allowed for the recovery from cardiac arrest in 2 specimens.
Conclusions: Bupivacaine toxicity in this porcine model is associated with an increase of transmural dispersion of repolarization (Tpeak-to-Tend in the ECG), the occurrence of Brugada-like pattern and malignant ventricular arrhythmias. Intralipid reverses changes in dispersion of repolarization favoring the disappearance of Brugada-like pattern and ventricular arrhythmias.

References:

**Introduction:** Approximately one in five elderly patients experience postoperative delirium (POD) after cardiac surgery.\(^1\) POD is associated with higher mortality, longer hospital length of stay (LOS), and increased health care costs.\(^2\)\(^-\)\(^4\) Dexmedetomidine (DEX) is an α2-adrenergic receptor agonist that possesses sedative and analgesic properties, whilst lacking clinically significant anticholinergic effects, and respiratory depression. The current study is a prospective, randomized, controlled clinical trial comparing DEX and propofol (PROP) based postoperative sedation regimens after high-risk cardiac surgery. We hypothesized that DEX based approach would result in lower POD rates after surgery.

**Methods:** After Institutional Ethics Review Board approval, an informed consent was acquired in patients over 60 years of age undergoing elective complex cardiac surgery, and over 70 years of age undergoing either isolated coronary revascularization, or single valve repair/replacement surgery. Patients with a history of psychiatric disease, delirium, severe dementia, or undergoing emergency procedures were excluded. Anesthesia, monitoring, and surgical techniques were conducted according to routine institutional practice. Upon arrival to intensive care unit (ICU), patients received either DEX bolus of 0.4mg/kg followed by an infusion of 0.2-0.7mg/kg/h, or PROP infusion 25-50mg/kg/min. DEX infusion was continued for a maximum period of 24 hours. Assessment of delirium was performed with confusion assessment method (CAM) for ICU preoperatively (baseline) and postoperatively every 12 hours or as needed according to the patient’s condition during the first 5 postoperative days. Patients were rendered either CAM-positive (delirium present) or CAM-negative (delirium absent). Given the prevalence of delirium of 20% in patients over 60 years of age,\(^1\) to see a reduction to 6% (3% in low risk patients\(^5\)), with a = 0.05 and 1-b = 0.8, the group of 90 patients in each arm of the study is required for a total of 180 patients. Delirium rate was calculated with the \(^2\) test for differences in probabilities of a 2x2 contingency table. All
analyses were performed on an intention-to-treat basis.

**Results:** POD was present in 16 of 91 (17.5%; 95% CI, 9.7 to 25.3), and 29 of 92 (31.5%; 95% CI, 22.0 to 41.0) patients in the DEX and PROP groups respectively, p = 0.028. Median duration of delirium was 2 [1 - 4] vs 3 [1 - 5] days in DEX and PROP groups, p = 0.04. Both groups were similar with respect to demographic data, preoperative medications, co-morbidities, and surgical characteristics. In patients who had delirium, the median difference in ICU- and hospital-LOS was 8.7 hours and 2.5 days favouring the DEX group. (Table)

**Discussion:** Postoperative administration of DEX based sedation regimen in elderly patients resulted in lower POD rates after high-risk cardiac surgery.

**References:**


OBSTETRIC ANESTHESIA POSTER DISCUSSION 8

Sunday, June 21
12:30 PM - 2:15 PM

Moderators:
Dr Robert Jee, University of Ottawa
Dr Clarita Margarido, University of British Columbia
Dr Giselle Villar, University of Toronto

Objectives:
At the end of this session, participants will be able to:

• Discuss the breadth of research in obstetric anesthesia.
• Describe processes in obstetric anesthesia research.
• Determine the implications for research in obstetric anesthesia.

Track: Obstetric Anesthesia

84224 - OBSTRUCTIVE SLEEP APNEA AND HYPOXEMIA IN POSTPARTUM WOMEN
Primary Author / Presenting Author: Bill Ong, Department of Anesthesia & Perioperative Medicine, University of Manitoba, Winnipeg, Manitoba
Co-Authors(s): Christopher Parr, Fahd AlGurashi, Eleni Giannouli, Linda Girling, Margaret Morris, Eric Jacobsohn

84614 - OBSTETRIC MASSIVE TRANSFUSION PROTOCOL: QUALITY OF CARE TOOL
Primary Author / Presenting Author: Clarita Margarido, University of Toronto, Toronto, Ontario
Co-Authors(s): Stephen Halpern, Martin Chapman, Jeannie Callum, Stephen Halpern, Martin Chapman, Jeannie Callum

85816 - NEW LABOR PAIN QUESTIONNAIRE: HIGH TEST-RETEST RELIABILITY
Primary Author / Presenting Author: Pamela Angle, Sunnybrook Health Sciences Ctr, University of Toronto, University of Oxford, University of British Columbia, Toronto, Ontario
Co-Authors(s): Christine Kurtz Landy, Alex Kiss, Jasmine Djordjevic, Alanna Kibbe, Jon Barrett, Sara Farsi, Saiena Sriparamananthan, Yuna Lee, Lydia Hamata
85956 - EFFECT OF CALCIUM ON OXYTOCIN DESENSITIZED HUMAN MYOMETRIUM IN-VITRO
Primary Author / Presenting Author: Chiraag Talati, Department of Anesthesia and Pain Management, Mount Sinai Hospital, University of Toronto, Toronto, Ontario
Co-Authors(s): Nivetha Ramachandran, Jose Carvalho, John Kingdom, Mrinalini Balki

86234 - ONSET OF LABOUR EPIDURAL ANALGESIA WITH VARYING DOSES OF FENTANYL
Presenting Author: Don Nguyen, Department of Anesthesia and Perioperative Medicine, Western University, London, Ontario
Primary Author: Sudha Indu. Singh, Department of Anesthesia and Perioperative Medicine, Western University, London, Ontario
Co-Authors(s): Ramesh Sai, Philip Jones, Kristine Marmai, Fatemah Qasem, Shalini Dhir, Ramina Adam
Introduction: The prevalence of sleep-disordered breathing (SDB) and obstructive sleep apnea (OSA) in pregnant women has been estimated to range from 12% to 26.7% (1,2,3). Previous studies have evaluated SDB and/or OSA during pregnancy, but no study has specifically examined the first postpartum day. The first-day postpartum is associated with significant changes to maternal physiology and sleep conditions. We have performed a prospective observational study among women during the first postpartum night to assess the prevalence of OSA and hypoxemia.

Methods: After approval from the local Ethics Committee, we monitored fifty-five women during the first postpartum night, to identify patients with OSA and hypoxemia (oxygen saturation < 90%). Consenting women were monitored with a Remmers sleep recorder. Oxygen saturation, heart rate, nasal airflow, snoring sound, and respiratory movements were recorded continuously. The data was uploaded to a computer and summarized with the Remmers Insight software (SagaTech Inc, Calgary). A respirologist with subspecialty sleep medicine training manually interpreted the generated reports according to American Academy of Sleep Medicine criteria. A diagnosis of OSA was based on 5 or more episodes of apnea or hypopnea per hour during sleep. Oximetry data and clinical information were recorded. Continuous variables were analyzed with analysis of variance. Fischer's Exact Probability Test was used for comparison of categorical variables. The results are presented as mean ±SD. Results with a p-value less than 0.05 were considered statistically significant.

Results: Seven patients (12.7%) have OSA by polysomnography criteria. Six of the 7 OSA patients had hypoxemia overnight. Five patients had hypoxemia but did not meet the polysomnography OSA criteria. Eleven (20%) of the 55 women in this study, had severe hypoxemia (oxygen saturation < 90%) during the first postpartum night. Compared to the normal subjects, the OSA subjects and the hypoxemic subjects had significantly lower mean oxygen saturation overnight, lower minimum oxygen saturation levels, and greater weight as well as BMI (Table). There was no respiratory arrest and none of the patients required assisted ventilation or endotracheal intubation. There was no significant difference in the anesthetic techniques or the frequencies of intrathecal
opioids received by the hypoxemic and non-hypoxemic patients.

Discussion: The 12.7% prevalence of OSA in the first postpartum night is consistent with the reported prevalence of OSA in the obstetric population during pregnancy (2,3). The 20% prevalence of hypoxemia (oxygen saturation < 90%) in the first postpartum night is greater than the prevalence of OSA in our patients. This indicates that OSA is not the only disorder associated with postpartum hypoxemia. OSA is more prevalent in pregnant women than non-pregnant women of similar age, and is associated with hypoxemia during sleep in the first postpartum night. Further studies are needed to identify the women at risk for hypoxemia, to assess the clinical courses of these women and to determine the clinical implications.

References:

1. Sleep. 2013 1;36:717-721B.


Introduction: Postpartum hemorrhage (PPH) is the leading cause of maternal mortality globally implying a considerable disease burden for our society. Canadian PPH rates increased by 22% from 2003 to 2011 (from 5.1% to 6.2%). Antenatal risk factors screening is crucial to identify women at high risk of developing PPH. However, a large proportion of women who presents with PPH do not have any identifiable risk. When it occurs, timely diagnosis is critical to set off appropriate interventions. Peripartum hysterectomy can be a life-saving intervention performed in women with PPH who might otherwise exsanguinate. Frequently, women have hemorrhaged by the time they undergo the procedure and lose significantly more blood during the hysterectomy itself. Massive Transfusion Protocols (MTP) were originally developed for trauma emergencies to provide blood transfusion to unstable patients in an immediate and sustained manner. The MTP is an effort to coordinate surgical, anesthesia, laboratory and blood bank teams and to address and monitor hemorrhage emergencies. The aim of this study was to define a tool to outline the “ideal” care during a MTP activation in an obstetric environment.

Methods: A multidisciplinary team at Sunnybrook Hospital Health Science represented by a hematologist, obstetrician, anesthetist, trauma surgeon, intensivist, nurse and blood bank technician was assembled. The team was required to set up a tool that would indicate a paramount quality of care during a Massive Transfusion Protocol (MTP) activation. Parameters were selected and set for each phase: activation, initiation, maintenance, and deactivation. The performance of each item was assumed to be essential to deem that the protocol goals were achieved.

Results: Table 1.

Discussion: To our knowledge, the current level of evidence on clinical impact of MTPs in obstetric practice is low (level of evidence 4). There are only two descriptive studies published in this population: a series of 3 cases and a descriptive report on 31 consecutive cases of MTP activation in obstetric settings. Apparently, current
development and implementation of MTP in obstetrics are relying on trauma literature. Our tool was constructed comprising both face and content validity. Hopefully, the tool suggested by this study will assist institutions to: 1) implement efficient MTP in obstetrics; 2) evaluate the quality of care provided when MTP is activated in obstetrics; and 3) assess adherence to protocol.

References:
85816 - NEW LABOR PAIN QUESTIONNAIRE: HIGH TEST-RETEST RELIABILITY

Author(s)
Pamela Angle
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Co-Authors(s)
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Lydia Hamata - Sunnybrook Health Sciences Centre

Introduction: The Labor Pain Questionnaire (LPQ) is the first health-specific multidimensional psychometric instrument developed to measure women’s childbirth pain experiences. Once validated, the LPQ will allow interdisciplinary research to resolve existing controversies related to childbirth pain relief and build the scientific foundation required for evidence-based labor analgesia. We hypothesized that the LPQ would provide reliable measurement (ICC>0.7) in women in early labor without pain relief who reported minimal or no change in their pain over the course of the study. We further hypothesized that the LPQ would demonstrate sensitivity to change in women who reported clinically important changes in their pain.

Methods: Following REB approval and written informed consent, healthy ASA 1-2 laboring women with healthy term fetuses were recruited in early labor. All women were fluent in English, >18 years of age, < 6cm cervical dilatation, contracting > 3 minutes apart without pain relief. Women were randomized to answer the LPQ in Mixed versus Standard questionnaire format in two test sessions (Test 1, Test 2) separated by a 20-minute window. Versions of the LPQ differed only by the order of questions. Both test sessions were administered by the same trained interviewer. Additional questions included an 11 point numeric rating scale (NRS) for pain, verbal pain rating scale (VPRS) and Pain Mastery Scale (PMS) completed during each test session as part of validity testing. Changes in women’s pain experiences over the course of the study were rated using the Patient Global Impression of Change Score (PGICS), permitting assessment of meaning of pain scores on the LPQ associated with each level of change in pain. Analyses: An apriori sample size estimation suggested 90 women were required to examine test-retest reliability. Intraclass correlation coefficients (ICC) were used to analyse the test-retest reliability of LPQ composite scores and subscale scores between first and second administrations of the LPQ. Raw
scores were transformed to percentage scores to ensure even representation of subscale scores in composite LPQ scores.

**Results:** 104 women completed the study. Ninety-two reported *no change or minimal change* in their pain over the study based on the PGICS. Test-retest reliability for the LPQ and subscales were high (ICC, 0.84 to 0.98, p < 0.001, Table 1). Data from the 12 women who reported a clinically important change in their pain were used to assess the LPQ's sensitivity to change. Analyses demonstrated an effect size (ES) of 0.57 (moderate) and a Standardized Response Mean (SRM) of 1.29 (small). Correlations between average percentage scores for the LPQ and the NRS were strong for Test 1 and Test 2 respectively (r= 0.78 and 0.78, p< 0.001) and moderate for the PMS (Test 1 r= 0.58, Test 2 r= 0.661, p < 0.001) and VPRS (test 1, 0.58, Test 2 r=0.50 , p < 0.001).

**Discussion:** The LPQ and its subscales demonstrated high levels of reliability when used to assess women's experiences of childbirth pain during early labor without pain relief. Study findings also suggest that the instrument demonstrates sensitivity to change and convergent validity with commonly used pain tools in labor analgesia trials.

**References:**
1. Physical Therapy 2006 86: 1351-1359
Introduction: A significant risk factor for uterine atony is prolonged exposure to oxytocin during augmentation of labor, which results in the 'desensitization' phenomenon, a decrease in the response of the myometrium to further oxytocin.[1] The importance of extracellular calcium is well-established in myometrial contractility,[2] however, in the context of desensitized myometrium, its significance is unknown. We aimed to investigate the effect of low, normal and high extracellular calcium concentration on oxytocin-induced contractility, in desensitized human myometrium in-vitro.

Methods: After REB approval, and written informed consent from patients undergoing elective cesarean deliveries, this in-vitro experimental study was undertaken using myometrial tissue dissected into six strips. Each strip was mounted in a single organ bath with physiological salt solution (PSS) under homeostatic conditions and then pretreated for 2-hours with 10-5M oxytocin (a model shown to achieve myometrial desensitization [3]), or a control with 2-hours PSS pretreatment. Following pretreatment, the tissue was washed with PSS, and the calcium concentration was altered to reflect either low (1.25mM), normal (2.5mM) or high (3.75mM) levels, thereby providing 6 study groups. After equilibration in the desired calcium concentration, a dose-response to oxytocin 10-10M to 10-5M was performed. Contractile parameters were measured and compared among groups. The primary outcome was motility index (frequency x amplitude), and secondary outcomes included frequency, amplitude and area under the curve. A sample size of 32 strips per group was used (32 patients; 6 strips/experiments per patient), to detect a difference of 0.7-1.4 (0.25-0.35) g*contractions/10 min (sq root) in motility index (SE) between groups, with a 5% significance level and a power of 80%. Primary analysis will be undertaken with linear regression models adjusted for repeated measures through compound symmetry covariance structure.

Results: Results from 49 experiments (of a total of 192) have been analyzed. The control experiments show an increase in motility index of oxytocin-induced contractions from baseline when analyzed as a cumulative dose-response average, in the presence of 2.5mM calcium (538%), versus the 1.25mM (465%) and 3.75mM (341%) groups.
Similarly, the oxytocin desensitized groups showed higher motility index in the presence of 2.5mM calcium (462%), versus the 1.25mM (460%) and 3.75mM (173%) groups (Fig. 1). We plan to complete the study by April 2015 following further recruitment of 24 patients (providing 143 experiments, at a rate of 18 experiments per week).

**Discussion:** The results so far show that in both desensitized and non-desensitized myometrium, maintaining calcium levels at physiological levels (2.5mM), provides superior contractility. Hypercalcemia, in the setting of both non-desensitized and desensitized myometrium markedly attenuates contractility. Thus, after prolonged exposure to continuous oxytocin in labor augmentation, uterine atony and PPH could be attenuated by ensuring normocalcemia and preventing hypo- or hypercalcemia. Final analysis and discussion will be presented at the CAS meeting.

**References:**
2) Biol Reprod 1989; 40: 942-948;
3) Anesthesiology 2013; 119: 552-561
Introduction Dilute concentrations of local anesthetic solutions combined with opioids are commonly used to provide epidural labour analgesia as they reduce motor block without compromising analgesia [1]. However, onset of analgesia can be delayed. The addition of a fentanyl bolus at initiation of labour epidural analgesia can speed onset [2]. A dose comparison study was conducted to investigate the onset of labour analgesia using 0.08% bupivacaine with varying doses of epidural fentanyl. We hypothesized that increasing doses of fentanyl (20, 50, or 100 mcg) would hasten the onset of labour analgesia.

Methods: Institutional REB approval was obtained. Written, informed consent was obtained from all patients participating in the study. A prospective, randomized, double-blinded, clinical trial of 105 women (ASA 1-2) at term gestation with singleton fetuses in early labour requesting epidural analgesia were enrolled in the trial. Each woman was randomly assigned to receive 20, 50, or 100 mcg epidural fentanyl with 10 mL of 0.08% bupivacaine. Maternal Numeric Rating Scale (NRS) pain scores were monitored for each contraction until pain scores were 3 or less, or for 30 minutes. The onset and duration of analgesia, maternal side effects, satisfaction, type of delivery, and fetal outcomes were also recorded.

Results: Data from 105 patients were analyzed. No losses to followup occurred. There was good balance between groups at baseline. The 50 and 100 mcg doses of fentanyl were associated with a faster development of NRS ≤ 3 compared to 20 mcg fentanyl (Table). Hazard Ratios [HR] for developing NRS ≤ 3 compared to the 20 mcg group: 2.1 [95% CI 1.2 to 3.5, P = 0.007] and 2.8 [95% CI 1.7 to 4.8, P < 0.001] for the 50 and 100 mcg groups respectively. The incidence of failure to reach NRS ≤ 3 within 30 minutes was higher in the 20 mcg group compared to both other groups. There were no
differences in adverse events between groups, except for a higher incidence of fetal bradycardia in the 50 and 100 mcg groups. However, Apgar scores were not significantly different between groups.

**Discussion:** Labouring parturients wish to have a rapid decrease in pain after the institution of epidural analgesia. We found that increasing doses of epidural fentanyl hastened the onset of analgesia without increasing maternal adverse events.

**References:**
PATIENT SAFETY POSTER DISCUSSION 9
Monday, June 22
10:30 AM - 12:15 PM
Room: Parliament Foyer

Moderators:
Dr Daniel Chartrand, McGill University
Dr Claude Laflamme, Sunnybrook Health Sciences Centre

Objective:
At the end of this session, participants will be able to:
• Discuss presented research presentations in patient safety with author(s) and attendees.

76474 - DO CHECKLISTS IMPROVE INTERPROFESSIONAL TEAM PERFORMANCE?
Primary Author / Presenting Author: Pamela Morgan, Women's College Hospital, University of Toronto, Etobicoke, Ontario
Co-Authors(s): Ryan Brydges, Jordan Tarshis, Tobias Everett, Deborah Tregunno, Heather Carnahan, Lisa Cunningham, Dennise Forde, Angela Chan, Mei Lei Ling, Matt Kurrek, Lucas Murnaghan, John Semple, Susan Bell

82753 - PROBABILITY OF MODERATE-SEVERE OSA BY THE STOP-BANG QUESTIONNAIRE
Primary Author / Presenting Author: Mahesh Nagappa, Toronto Western Hospital, University Health Network, TORONTO, Ontario
Co-Authors(s): Frances Chung, Pu Liao

83559 - UNIVERSAL TXA PROTOCOL REDUCES TRANSFUSION IN HIP & KNEE ARTHROPLASTY
Presenting Author: Alexander N. White, University of Toronto, Department of Anesthesiology, Toronto, Ontario
Co-Authors(s): Razak Pirani, Gregory M.T. Hare, James Baker, Katerina Pavenski, Nick Lo, Alex Ho, Antoine Pronovost, Mark Kataoka, Rosemary Tanzini, Emil Schemitsch, Earl Bogoch, James Waddell

85813 - SITTING POSITION MAY ALLEVIATE POSITIONAL OBSTRUCTIVE SLEEP APNEA
Primary Author / Presenting Author: Mandeep Singh, University of Toronto, Toronto, Ontario
Co-Authors(s): Azadeh Yadollahi, Pu Liao, Weimin Kang, Shadman Islam, Frances Chung
85824 - POSTOPERATIVE HYPERGLYCEMIA IN NON-DIABETIC SURGICAL PATIENTS
Primary Author / Presenting Author: Michael H. Yang, Queen's University School of Medicine, Class of 2016, Toronto, Ontario
Primary Author: Janet van Vlymen, Queen's University School of Medicine, Department of Anesthesia and Perioperative Medicine, Kingston General Hospital, Kingston, Ontario
Co-Authors(s): Michael Baxter, Aditi Kane, Melanie Jaeger, Elizabeth VanDenKerkhof

85847 - URINARY RETENTION FOLLOWING LOWER LIMB ARTHROPLASTY
Primary Author / Presenting Author: Aditi Kane, Queen's University School of Medicine, Class of 2016, Ottawa, Ontario
Primary Author: Melanie Jaeger, Department of Anesthesiology and Perioperative Medicine, Queen's University, Kingston, Ontario
Co-Authors(s): Michael Baxter, Michael Yang, Janet Van Vlymen, Wilma Hopman, D. Robert Siemens

86003 - REDUCTION IN POST OPERATIVE COMPLICATIONS WITH ACTIVE PRE-WARMING.
Primary Author / Presenting Author: Neil G. Ramsay, Vancouver General Hospital, Vancouver, British Columbia
Co-Authors(s): Dan Werry, Alana Flexman, Kelly V. Mayson, Dan Werry, Alana Flexman, Kelly Mayson

86006 - POSTOPERATIVE VISION LOSS MAY COMMONLY OCCUR POST HOSPITAL DISCHARGE
Presenting Author: Cameron Goldie, Department of Anesthesia, University of Manitoba, Winnipeg, Manitoba
Primary Author: Thomas C. Mutter, University of Manitoba, Winnipeg, Manitoba
Co-Authors(s): Fangyuan Luo, Frank Stockl

86136 - BURST SUPPRESSION WITH PROPOFOL ANESTHESIA IS LESS COMMON IN CHILDREN
Primary Author: Sonia M. Brodie, University of British Columbia, Vancouver, British Columbia
Presenting Author: Richard Merchant, University of British Columbia, New Westminster, British Columbia
Co-Authors(s): Nicholas West, Klaske van Heusden, Matthias Görges, Guy Dumont, J. Mark Ansermino, Richard Merchant
76474 - DO CHECKLISTS IMPROVE INTERPROFESSIONAL TEAM PERFORMANCE?

Author(s)
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Matt Kurrek - The Scarborough Hospital
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John Semple - Women's College Hospital
Susan Bell - Women's College Hospital

Introduction: The past decade demonstrated a 300% increase in the number of surgical/diagnostic procedures performed in US ambulatory surgical centres. [1] While the incidence of major adverse events in ambulatory surgical centers appears to be low [2], the management of critical events can be complicated by the lack of resources that are usually available in a hospital. The purpose of this study was to determine the effectiveness of Critical Event Checklists (CECs) [3] in the management of 8 high-fidelity simulation scenarios designed for use in an ambulatory surgery setting.

Methods: After REB approval, 7 multidisciplinary teams (1 surgeon, 1 anesthetist and 3 RN/RPNs) from a single ambulatory facility consented to participate in a realistic high fidelity simulation in an after hour single OR setting. Each team was oriented to the study and simulation equipment. Using an ABAB design (A=no CEC, B=use of CEC), each team managed a total of 8 distinct simulation scenarios designed to include the common perioperative critical events described by Ziewacz et al.[3]. Teams completed 4 scenarios at session 1 and 4 different scenarios at session 2, 5-11 months later. Four independent raters evaluated non-technical performance using the Team Emergency Assessment Measure (TEAM) [4]. Adherence to key processes (how closely the team followed evidence based management guidelines) was evaluated live by a research team member. [3] Given the small sample size, we used a standardized approach of visual inspection of means and standard error values to evaluate the observed patterns in the two data sets.

Results: While the team’s adherence to key processes did not appear to depend on the presence or absence of the CEC in session 1, a pattern emerged in session 2 (Figure
1), suggesting an improved adherence when the CEC was present. The intraclass correlation (ICC) for TEAM scores was 0.47, indicating only moderate agreement. TEAM scores did not appear to depend on either the presence of the CEC or the session timing.

**Discussion:** This study suggests that the use of Critical Event Checklists may lead to improved adherence to evidence-based management of critical events if teams are familiar with its use. Teamwork, as measured by the TEAM score, however did not demonstrate any difference with use of checklists. A larger study with more teams and a more diverse set of scenarios would allow more robust statistics and hence more substantive recommendations.

**References:**

4. Resuscitation 2010; 81: 446-52
Introduction  Diagnosing the patients with moderate-to-severe (AHI >15) and severe (AHI >30) obstructive sleep apnea (OSA) is important because of the increased risk of perioperative complications. Polysomnography (PSG) - the gold standard for the diagnosis of OSA - is time consuming and costly. The STOP-Bang questionnaire is a validated screening tool for obstructive sleep apnea. We conducted this meta-analysis to determine the predictive probability of moderate-to-severe (AHI >15) and severe (AHI >30) OSA by the STOP-Bang questionnaire.

Methods: A search of the literature databases MEDLINE (from 2008 to April 2014), Embase (from 2008 to May 2014), Cochrane Databases of Systematic Reviews (from 2008 to March 2014) and PubMed (from 2008 to August 2014) was carried out. The search yielded 340 citations. Irrelevant papers were excluded by title, abstract and full-text review, leaving 5 manuscripts for analysis. Inclusion criteria were: 1) Studies that used STOP-Bang questionnaire as a screening tool for moderate-to-severe and severe OSA in adult subjects (>18 year); 2) The accuracy of the STOP-Bang questionnaire was validated by polysomnography - a gold standard for diagnosing OSA; 3) Availability of data on AHI or respiratory disturbance index (RDI) ≥15; 4) and probability of moderate-to-severe and severe OSA at the different STOP-Bang scores 5) Publications in the English language. Validity criteria assessing the internal and external validity were explicitly described and coded according to the Cochrane methods group on screening and diagnostic tests. The data about the probability of moderate-to-severe and severe OSA and the different STOP-Bang scores were pooled and presented as a bar graph.

Results: The meta-analysis was carried out in 5 prospective studies including a total of 2,792 patients (3 studies in the sleep clinic patients, n=1835 and 2 studies in the surgical patients, n=957). The data on the predictive probabilities for the different severities of OSA with the corresponding STOP-Bang scores were shown in Figure.

In the sleep clinic population, the probability of moderate-to-severe OSA for a score of 3 is 52%. With a stepwise increase of the STOP-Bang score to 4, 5, 6 and 7/8, the probability rises proportionally to 62%, 72%, 82% and 92% respectively (Fig 1A). Similarly, the same pattern exists for severe OSA. With a stepwise increase of the STOP-Bang score of 4, 5, 6 and 7/8, the probability of severe OSA climbs to 35%, 45%, 55% and 75% respectively (Fig 1B).
In the surgical population, the probability of moderate-to-severe OSA for a score of 3 is 40%. With a stepwise increase of the STOP-Bang score to 4, 5, 6 and 7/8, the probability soars proportionally to 48%, 60%, 68% and 80% respectively (Fig 1C). With a stepwise increase of the STOP-Bang score of 4, 5, 6 and 7/8, the probability of severe OSA escalates to 25%, 35%, 45% and 65% respectively (Fig 1D). A higher STOP-Bang score reflects a higher cumulative score of the known risk factors and the greater the probability of moderate-to-severe and severe sleep apnea.

**Conclusion:** In the sleep clinic and the surgical patients, the higher the STOP-Bang score, the greater the probability of patients suffering from moderate-to-severe and severe sleep apnea.

**References:**

Introduction: Randomized clinical trials and observational studies have demonstrated that tranexamic acid (TXA) reduces blood loss and allogeneic red blood cell (RBC) transfusion in cardiac and non-cardiac procedures (1,2). Despite this data, our institutional use of TXA for total hip and knee arthroplasty was relatively low (46%). To address this translational gap in TXA utilization, we implemented a quality of care policy to initiate a universal protocol for treating all eligible patients with TXA perioperatively. We hypothesized that successful implementation of the universal TXA policy would increase TXA utilization and reduce allogeneic RBC transfusion. Additional outcomes included postoperative hemoglobin (Hb), length of stay (LOS) and adverse events.

Methods: After institutional ethics committee approval was obtained, we implemented a quality of care policy to provide universal administration of intravenous TXA (20 mg/kg perioperatively) to all eligible patients undergoing total hip and knee arthroplasty between October 21, 2013 and April 30, 2014. We compared data from an equal number of patients before and after protocol implementation (n=422 per group). The primary outcome was RBC transfusion. Secondary outcomes included postoperative Hb and LOS. Adverse events including death, myocardial infarction, stroke, acute kidney injury, venous thromboembolism, and seizure were identified from the electronic patient records. Data were analyzed by adjusted logistic and linear regression analysis and Chi-square test with significance assessed at p < 0.05.

Results: We observed an increase in TXA utilization [45.8% vs. 95.3%, change of 49.5...
which resulted in a reduction in RBC transfusion rate [8.8% vs. 5.2%; change of 3.6 (0.1 -7.0) %, p=0.043]; and an increase in postoperative day 3 Hb from 97.1 (95.6 – 98.5) to 100.8 (99.5 – 102.2) g/L (p < 0.001). An analysis of the impact of anemia was performed by stratifying patients with preoperative Hb < 120 g/L (anemic patients) vs. those with a preoperative Hb ≥ 120 g/L (nonanemic patients). This analysis demonstrated a high incidence of RBC transfusion in anemic patients not treated with TXA (53.2%) which was reduced to 18.9% in anemic patients who received TXA therapy (p < 0.001). The RBC transfusion rate in nonanemic patients who did not receive TXA was lower than that observed in anemic patients (9.9%). TXA treatment resulted in a further reduction on RBC transfusion in these non-anemic patients (4.0%). No change in LOS was observed and there was no increase in incidence of adverse events.

**Conclusion:** In this observational quality improvement study we demonstrated that the implementation of a universal TXA policy for total hip and knee arthroplasty resulted in an increase in TXA utilization and a reduction in RBC transfusion. We also observed an increase in postoperative Hb suggesting that the reduction in transfusion rate did not result in worsened post-operative anemia. No increase in adverse events was observed suggesting that this protocol was safe. Broader application of TXA therapy for major joint arthroplasty may improve patient outcome.

**References:**

1. BMJ. 2012; 344:e3054
2. BMJ. 2014; 349:g4829
Introduction: The severity of obstructive sleep apnea (OSA) has been shown to increase postoperatively. Elevated head position has been used in the management of OSA in the general population, but not postoperatively. In this pilot trial, we hypothesized that the use of a semi-upright position versus a non-elevated position will prevent postoperative worsening of OSA in patients undergoing non-cardiac surgeries.

Methods: Following research ethics board (REB) approval, adult patients (>18 years), ASA I to IV, undergoing elective inpatient surgery, were consented to undergo a home portable sleep study. Patients with OSA (AHI >5 events/h), were randomized into a treatment group, semi-sitting position (45 degrees incline, Group S), or a control group (no head-end elevation, Group C). The bed angle was measured by using either an in-built bed-angle monitor or a goniometer, at the beginning and end of night. All patients were monitored for three postoperative nights using oximetry and underwent a PSG on the postoperative night 2 (N2) or night 3 (N3). The primary outcome measurement was postoperative AHI. Subgroup analysis was performed to examine the effects in patients with positional or supine-related OSA, defined as preoperative overall AHI > 5 events/h, and, supine AHI more than two times of the non-supine AHI. ANCOVA analysis was used to compare change of AHI as a continuous variable from baseline between two groups.

Results: Eighty-three OSA patients undergoing mainly orthopedic and general surgeries were randomized (Group S: 41 and Group C: 42). There was no difference between the two groups in baseline demographics and comorbidities. Forty-six patients (Group S: 25 and Group C: 21) completed PSG on the postoperative N2/N3. The AHI increased postoperatively within the groups (Group S: pre-op AHI vs. postop AHI: 22.0±11 vs. 22.9±27 events/hr, p=0.001; Group C: Pre-op AHI vs postop AHI: 20.2±14 vs. 25.0±26 events/hr, p < 0.001), indicating worsening of the severity of OSA. Based on the intention-to-treat analysis, no significant difference was observed in AHI on postoperative N2 and N3 between the two groups (p >0.05). Subgroup analysis showed that patients classified as “supine-related OSA” (n=12) had a significantly lower AHI postoperatively in the semi-sitting position than those who were not (n=34) (p < 0.05),
Conclusion. This pilot trial demonstrated the feasibility of the use of semi-sitting position amongst OSA patients postoperatively. Patients with supine-related OSA benefitted from the semi-sitting position and had a significantly lower AHI postoperatively. Future trials with sufficient power are needed to establish this relationship further.

References:
1. Anesthesiology 2014 120: 287-298
85824 - POSTOPERATIVE HYPERGLYCEMIA IN NON-DIABETIC SURGICAL PATIENTS

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Introduction/Objectives: Postoperative hyperglycemia increases the risk of surgical site infections, length of hospital stay, and can increase mortality. Although recent studies have shown that elevated glycosylated hemoglobin (HbA1c > 6.0%) is common among hospitalized patients, it is not known if this is predictive of postoperative hyperglycemia. The objectives of this prospective observational study were to 1) determine the incidence of postoperative hyperglycemia (blood glucose > 10 mmol/L) in elective surgical patients with no previous history of diabetes 2) assess whether preoperative elevated HbA1c is associated with postoperative hyperglycemia and 3) identify other factors that may predict postoperative hyperglycemia. Thus, future interventional studies could target this group with strategies to prevent postoperative hyperglycemia and its associated adverse effects.

Methods: Following local ethics committee approval, 275 patients consented to participate in the study. Patients > 18 years of age having elective surgery requiring hospital admission postoperatively were eligible to participate. Patients with planned ICU admission and patients taking oral hypoglycemic agents or insulin were excluded. Preoperatively, participants had capillary blood glucose (CBG) and HbA1c measured and they completed the CANRISK diabetes-screening questionnaire. Standard demographic and perioperative data were collected. CBG was ordered on arrival to PACU, before meals and at 22:00h for 2 days or until discharge. Postoperatively, if CBG>10 mmol/L on two or more occasions, the surgical service was notified and they determined the most appropriate management. The incidence of postoperative hyperglycemia was calculated as the percent of participants with CBG>10 mmol/L on at least one occasion. The chi square test was used to assess for potential risk factors for postoperative hyperglycemia including elevated HbA1c, CANRISK score, and fasting blood glucose on the first morning postoperatively (FBG-POD1).
Results: Thirty-four participants were excluded because they were discharged home from PACU. Of participants admitted to hospital, 14.5% (35/241) had at least one episode of postoperative hyperglycemia. HbA1c was elevated in 18.4% (44/239) of all participants and 6.7% (16/239) had a value that was consistent with a provisional diagnosis of diabetes (HbA1c ≥ 6.5%). Postoperative hyperglycemia was common (68.8%) in participants with HbA1c ≥6.5%. However, 11% of participants with a normal HbA1c also had at least one episode of hyperglycemia. Those participants with the combination of an elevated HbA1c and FBG-POD1 had the highest incidence of postoperative hyperglycemia (91.7%, 11/12). (See table for details of potential risk factors).

Discussion/Conclusions: A significant number (14.5%) of elective surgical patients with no previous diabetic history experienced postoperative hyperglycemia. Approximately two thirds of those with postoperative hyperglycemia had a provisional diagnosis of diabetes based on their HbA1c value. The best predictor of postoperative hyperglycemia was the combination of elevated HbA1c and elevated fasting blood glucose on POD1.

References:

Arch Surg 145.9 (2010): 858-864
Can J Anesth 61.5 (2014): 393-7
Introduction: Post-operative urinary retention (POUR) after lower limb total joint arthroplasty (TJA) is a common cause of morbidity. The incidence of POUR is highly variable, but is commonly reported as 30-50% (1,2). More recently, peri-operative care has been streamlined toward a multi-modal, fast-track approach, which may have affected the incidence. Our primary objective was to assess the incidence of POUR, as defined by need for a catheter, following lower limb TJA. Our secondary objectives were to identify risk factors associated with the onset of POUR, and describe the association between POUR and postoperative length of stay (LOS).

Methods: This prospective, observational study was conducted after institutional research ethics board approval and informed consent. All consecutive patients undergoing lower limb TJA from June to September 2014 were included. Pre-operatively, subjects completed an International Prostate Symptom Score (IPSS) questionnaire and a post-void residual (PVR) bladder scan was completed. Peri-operative management was consistent with the current standard of care. In our institution, patients are not routinely catheterized unless they are unable to void within 6-8 hours and a PVR is >500ml, at which time an intermittent catheterization (IC) is performed and consideration is given to an indwelling catheter if >1 IC is needed. Standard demographic and peri-operative data were collected in addition to bladder volume prior to discharge from the Post-Anesthetic Care Unit and LOS. Chi-square tests, t-tests and nonparametric (Mann-Whitney) tests were used to determine the association between postoperative urinary retention and baseline parameters. Regression analysis was performed to determine the contribution of individual factors to POUR.

Results: Of 128 patients, the incidence of POUR was 37.5%. For male participants, the incidence was 50.7% (38/75). In univariate analysis, factors associated with any need for catheterization included gender, age, IPSS and pre-operative PVR. Contrary to
previous reports, POUR was not associated with type of anesthetic, use of intrathecal opioids, postoperative opioid use, or ASA classification. In multivariate analysis, the only factors independently associated with POUR were age (OR: 1.59, 95% CI: 1.05-2.40, p=0.028 for every 10 years of age) and male gender (4.78, 2.02-11.30, p < 0.001).

While pre-operative IPSS fell just short of significance (1.06, 0.99-1.13, p=0.056) in the whole cohort, it was significant for male participants (1.08, 1.002-1.170, p=0.045). In multivariate analysis, POUR was independently associated with increased LOS (p=0.002), as was age (p < 0.001), blood loss (p=0.025), and opioid requirements on postoperative day #1 (p = 0.007). Indeed, presence of POUR appeared to increase LOS by almost one full day.

**Discussion:** A significant number of patients still suffer from POUR following TJA even with contemporary peri-operative management, and this complication is highly associated with increased LOS. Older men, particularly those with higher IPSS scores, are at highest risk of POUR. Further investigation and intervention should target this group.

**References:**

Introduction: It has been shown that perioperative hypothermia can cause adverse outcomes in surgical patients [1,2,3,4]. Recent research has shown that pre-warming patients can reduce peri-operative complications [5,6]. Our primary objective was to determine if active pre-warming reduced the incidence of intra- and postoperative hypothermia in non-cardiac surgery. Our secondary objectives were to determine if active pre-warming reduced the incidence of PACU complications and rates of transfusion and surgical site infection.

Methods: After ethics approval from our local ethics committee we carried out a retrospective cohort study. We included patients undergoing non-cardiac surgery scheduled for greater than 90 minutes duration from the American College of Surgeons National Surgical Quality Improvement Program (NSQIP) database. We compared patients from our baseline cohort (October 2011 to May 2012 (N=323) to a similar cohort after we introduced an active pre-warming program (May to Aug 2013 (N=191)). Patients were warmed with Bair Paws forced air gowns. Temperature was recorded pre-operatively, intra-operatively and on arrival to the recovery room. We compared the rates of hypothermia and PACU complications in each group as well as transfusion and surgical site infection rates. All statistical analysis was performed with Graphpad Prism 5.0, using t-tests or Fisher’s exact tests where appropriate.

Results: The average period of pre-warming was 60 + 40 minutes (SD). Active pre-warming resulted in a significant decrease in the incidence of patients arriving in PACU hypothermic, 33% pre intervention versus 5.4% pre-warmed, p < 0.01. The percentage of time intraoperatively below 36° decreased from 27.3% to 21%, p=0.03. PACU complications including desaturation and excessive pain were significantly decreased in the pre-warmed group, 13.6% vs 3.2%, p < 0.01 and 27.6% vs 12.7%, p < 0.01 respectively. We were unable to demonstrate a statistical difference in transfusion or SSI rates between the groups.
**Discussion:** Implementation of an active pre-operative warming program was associated significant reductions in intraoperative hypothermia, hypothermia on arrival to PACU, desaturation and excessive pain in PACU. We hypothesize that reductions in pain and desaturations were secondary to reduced hypothermia following pre-warming, since shivering can contribute to thermal pain and increase oxygen requirements. A limitation of this study is that there was more use of thoracic epidurals in the pre-warmed population, which may have contributed to a reduction in PACU pain scores. In addition, the study was underpowered to detect any reduction in transfusion and surgical site infection rates for specific procedures.

**References:**
4. Anaesthesiology 1997 87: 1318-1323
5. Lancet 2001 358: 876-880
6. Anaesthesia 2012 67: 612-617
Introduction: Postoperative visual loss (POVL) is usually a rare, devastating and immediate complication of nonocular surgery[1]. However, less severe cases may not be immediately recognized and some POVL subtypes become symptomatic only several days after surgery[2]. Previous POVL epidemiology studies have been restricted to clinical case series or analyses of hospital discharge abstracts databases (HDA)[1]; they may have unintentionally excluded late and less dramatic presentations. We employed a relatively unique longitudinal, provincial administrative database repository to determine the frequency with which POVL may present after hospital discharge.

Methods: With local ethics committee approval, surgeries considered to be high-risk for POVL[1,3,4] were identified in HDA between 1987 and 2013. These included cardiac, vascular, lung, lower extremity joint replacement, spine, head and neck, major pelvic, shoulder and trauma surgery. In addition, low-risk surgeries performed on similar populations but not associated with POVL (percutaneous coronary intervention and ambulatory orthopedic, gynecologic and general surgeries) were identified to provide a comparison estimate of the baseline incidence of acute vision loss. We only included surgeries where the patient had been continuously registered in the repository for at least 5 years prior to the date of surgery, in order to have sufficient data to identify exclusion criteria (see below). Cases of POVL were identified by the occurrence of relevant International classification of diseases version 9 (ICD-9) diagnoses in the HDA, and within 14 days of discharge in the medical service (MS) databases, which includes physician and optometry visits. We excluded patients with pre-existing diagnoses consistent with vision loss and, as the MS database is only coded to 3 digits, we also excluded patients with comorbidities that could confound the outcome of POVL (i.e. diabetics were excluded because ICD-9 code 362 includes both diabetic retinopathy and retinal vascular occlusion). Chi-squared and Fisher Exact tests were used for this preliminary analysis, with cell sizes of < 6 suppressed as a privacy requirement.

Results: Of 242 POVL cases in 184,263 high-risk surgeries and 236 cases in 402,509
low-risk surgeries, 35.6% were diagnosed after discharge. The incidence of POVL overall and after hospital discharge varied substantially by surgical subtype (Table 1). Some high-risk surgeries had rates comparable to low-risk surgeries. The risk of POVL was lower after 2008 compared to before in high-risk \((p = 0.05)\), but not low-risk surgery \((p=0.68)\). The proportion of post discharge diagnoses increased significantly \((p = 0.01)\) after 2008 compared to before.

**Discussion:** Previous studies likely missed a significant number of cases of POVL that presented after hospital discharge, particularly in cardiac surgery patients. The number of these late presentations is increasing, even as overall rates of POVL decrease. More detailed analyses and ultimately clinical studies, will be required to better characterize these outpatient presentations.

**References:**


Introduction: Burst suppression (BS) is a feature of the electroencephalogram (EEG), in which electrical bursts alternate with isoelectric periods. It can be identified with clinical monitors that use a processed EEG to measure depth of hypnosis. Deep anesthesia is a predictor of postoperative mortality [1], especially in combination with low blood pressure and low anesthetic concentrations [2]. BS is associated with deep anesthesia [3] and one recent report found that BS was a significant predictor of postoperative mortality when it was coincident with low blood pressure during anesthesia [4]. However, the incidence, mechanism, and consequences of BS are poorly understood [5]. One recognized predictor of BS in adults is advanced age [5], but its incidence in children requires further study. The aim of this analysis is to evaluate EEG data we have collected during two recent studies of closed-loop controlled anesthesia to identify BS in children and adults undergoing propofol anesthesia.

Methods: Two investigational trials were conducted with Health Canada authorization, ethical approval and written informed consent. The cohort of study 1 comprised 102 children aged 6-17 years, ASA I-II, undergoing gastrointestinal endoscopy. Study 2 involved 82 adults aged 22-82 years, ASA I-III, undergoing elective surgery. In both studies, induction and maintenance of anesthesia was closed-loop controlled with propofol administered according to a EEG feedback measure (WAV_CNS) obtained from the NeuroSENSE monitor (Neurowave, Cleveland, OH), which calculates a Burst Suppression Ratio (BSR) based on the proportion of EEG epochs with BS over the previous minute.

Results: Median [IQR] of the overall lowest WAV_CNS observed during anesthesia was 36.4 [32.5, 39.1] in study 1, and 21.8 [14.9, 32.2] in study 2 (Figure 1). Only 2/102 (2%) children had BSR>0 (maximum BSR 5% for ≤2.5% of case duration). Both were 15 year
old, ASA I males. In contrast, 60/82 (73%) of adults had BSR shortly after induction of anesthesia and 39/82 (48%) had BSR at some point during maintenance of anesthesia. In the adult sample, a positive correlation between age and percent of case with BSR>10 ($r_s = 0.425$, $p < 001$) was observed.

Discussion: Differences in protocols and procedure types prevent direct comparison of these datasets: in study 1, stimulation began immediately after induction of anesthesia, which may decrease BSR [6]; in study 2, intubation was followed by a period of unstimulating surgical preparation. Nonetheless, very little BS was detected in our pediatric sample, despite low WAV$_{CNS}$ values. Our adult sample was much more prone to BS, and our data agree with the observation that age is a significant risk factor for BS during anesthesia [5], suggesting that BS is not simply a byproduct of deep hypnosis. The large variability in individual BS levels suggest further studies are required to elucidate the causes and effects of BS during anesthesia.

References:

HEALTH MANAGEMENT POSTER DISCUSSION 10
Monday, June 22
10:30 AM - 12:15 PM
Room: Parliament Foyer

Moderators:
Dr Dale Engen, Queen’s University
Dr Peter Moliner, University of Sherbrooke

Objective:
At the end of this session, participants will be able to:
• Discuss presented research presentations in health management with author(s) and attendees.

82175 - PERFORMANCE ASSESSMENT IN ANESTHESIA: A POST-IMPLEMENTATION SURVEY
Presenting Author: Kathryn Wheeler, University of Ottawa, Ottawa, Ontario
Primary Author: Gregory L. Bryson, University of Ottawa, Ottawa, Ontario
Co-Authors(s): Alan Baxter, Sylvain Boet, Chris Pysyk

83350 - THE POPULATION-LEVEL IMPACT OF FRAILTY ON POSTOPERATIVE OUTCOMES
Primary Author / Presenting Author: Daniel I. McIsaac, University of Ottawa, The Ottawa Hospital, Ottawa Hospital Research Institute, Institute for Clinical Evaluative Sciences, Ottawa, Ontario
Co-Authors(s): Gregory Bryson, Bernice Duan, Carl van Walraven

84646 - MULTIMODAL PREHABILITATION IN CANCER PATIENTS. WHO BENEFITS?
Primary Author / Presenting Author: Celena Scheede-Bergdahl, McGill University, Montreal, Afghanistan
Co-Authors(s): Rashami Awasthi, Julia Munden, Sarah-Eve Loiselle, Francesco Carli, Celena Scheede-Bergdahl, Francesco Carli

84652 - PRESURGICAL MODIFICATION OF PHYSICAL FITNESS IN COLORECTAL CANCER
Primary Author / Presenting Author: Celena Scheede-Bergdahl, McGill University, Montreal, Afghanistan
Co-Authors(s): Rashami Awasthi, Brian P Chen, Andreas Bergdahl, Francesco Carli, Celena Scheede-Bergdahl, Rashami Awasthi, Brian P Chen, Andreas Bergdahl, Francesco Carli

85907 - BLOOD PRODUCT TRANSFUSION AND RISK OF POSTOPERATIVE DELIRIUM.
Primary Author / Presenting Author: Joseph E. DeCaria, University of Toronto, Faculty of Medicine, Etobicoke, Ontario
Co-Authors(s): Gordon Tait, Jo Carroll, Keyvan Karkouti, George Djaiani

85977 - ANALYSIS OF A CALL DISTRIBUTION SYSTEM IN A SHARED PRACTICE MODEL
Primary Author / Presenting Author: Mark Broussenko, Queen's University School of Medicine, Kingston, Ontario
Co-Authors(s): Rob Tanzola, Michael McMullen, Dale Engen

86005 - POHM: POSTOP HOME MONITORING AFTER ARTHROPLASTY EARLY DISCHARGE
Presenting Author: Homer Yang, University of Ottawa, Ottawa, Ontario
Co-Authors(s): Geoff Dervin, Susan Madden, Sylvain Gagné, Ashraf Fayad, Monica Taljaard, geoff dervin, Paul Beaulé, Susan Madden, Sylvain Gagné, Ashraf Fayad, Monica Taljaard, Mary Lou Crossan
Introduction: The use of electronic medical records in the perioperative setting has provided a wealth of clinical data, however the optimal method of packaging such data into formal performance feedback is ill-defined (1). In 2013, our centre provided its anesthesiologists with a table of individualized performance data extracted from the local electronic medical record system. Performance measures reported were a convenience sample of data mined for research purposes. A post-implementation survey was administered to determine user-acceptability of current measures and to highlight areas of potential improvement for future assessments.

Methods:
Following Research Ethics Board approval an electronic survey was administered to all recipients of a performance assessment. Research participants were identified by departmental email contact list. Questionnaire items were generated by investigator review of quality indicators in anesthesiology and data elements in the electronic medical record. Respondents graded their replies on a five-point Likert scale with higher scores indicating increased acceptability or interest. The survey was pilot tested by five clinical anesthesia fellow volunteers using the Burns Clinical Sensibility tool (2). Eligible participants were sent an email describing the purpose of the study. A copy of the participant’s individual performance assessment followed in one week with a link to the electronic survey. Three email reminders and a paper version were offered to increase response.

Results:
Fifty-eight of 76 (76%) eligible participants responded with 53 complete questionnaires for a completed response rate of 70%. Responses are summarized in Figure 1. Respondents indicated a reasonable level of user acceptability, with the majority agreeing that this type of feedback is respectful of physician autonomy and influential to practice and professional development. Variables which the user group most consistently felt should be included in future assessments trended towards practice
outcome measures such as patient temperature on arrival to PACU, frequency of resident case involvement, and frequency of adverse events such as unplanned re-intubation, cardiovascular events, etc. Areas for improvement trended towards exclusion of specific practice and process of care descriptors - such as patient age and gender data and frequency of ketorolac and ketamine use, however 70% of respondents felt that all existing data should remain in future assessments.

**Discussion:**
The high survey completion rate suggests that physician performance assessment is an area of significant interest to anesthesiologists at our centre. Preliminary review of the survey results indicates reasonable user-acceptability of the current performance assessment tool and has identified several areas for future improvement. Through annual repetition of this process we aim to establish of a sensitive, specific, and clinically relevant performance assessment that can support professional revalidation and self-reflection for anesthesiologists at our centre.

**References:**
2. Burns KE. CMAJ 2008;179(3):245-52
83350 - THE POPULATION-LEVEL IMPACT OF FRAILITY ON POSTOPERATIVE OUTCOMES

Author(s)
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Introduction: Frailty is a phenomenon that describes a multidimensional loss of reserve and is differentiated from related concepts, such as multi-morbidity, by focussing not on a count of medical conditions, but on factors that denote physiologic vulnerability to stressors. In the general population frailty is strongly correlated with early mortality and vulnerability to adverse health outcomes. Recent single center studies demonstrate that frailty independently predicts postoperative mortality, morbidity, increased length of stay (LOS), and institutional discharge; the impact of perioperative frailty on population-level mortality and health resource use has not been documented, but is of significant importance to clinicians, patients and health system planners.

Methods: This study was conducted under institutional review board oversight specific to the use of anonymized health administrative data. All community-dwelling Ontarians aged > 65 years at the time of elective, major noncardiac surgery were identified from 2002-2012. Frailty status for each patient was established using the Johns Hopkins ACG® frailty indicator. Our primary objective was not to calculate the independent impact of frailty on resource use, but to estimate the percent of postoperative mortality and resource use attributable to frail patients in general; therefore, our primary analyses were adjusted only for procedure. We compared hospital LOS, institutional discharge, ICU admission, 30-day hospital readmission, 30-day total physician billing, and 30-day ED visits between frail and non-frail patients using appropriate statistical tests. We then calculated the attributable percent of mortality and resource use by frail patients for each outcome (prevalence x ([risk ratio-1]/risk ratio)), and the number of frail patients who would need to have surgery to contribute once excess adverse event (number needed to treat to harm). As a secondary analysis we used multivariable regression to calculate the independent impact of frailty on mortality and resource use.

Results: We identified 202 811 patients, of whom 6 289 (3.1%) were frail. Frail patients were older, more likely to be female, and carried a higher comorbidity burden than non-frail patients. Mortality and all measures of resource utilization were significantly higher in frail patients (Table 1). Adjusting for multi-morbidity and patient demographics, frailty remained an independent predictor of LOS, ICU admission, MD billing, and institutional
Discussion: Although the prevalence of frailty is relatively low in community-dwelling elderly elective surgical patients, frail individuals experience a much higher absolute and relative increase in their risk of adverse postoperative events. Frail patients represent an important target for quality improvement efforts aimed at enhancing the value, efficiency and outcomes of perioperative care.

References:
J Am Col Surg 2010 201: 901-908
Aging in Ontario-2010 ICES: Toronto
84646 - MULTIMODAL PREHABILITATION IN CANCER PATIENTS. WHO BENEFITS?

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Introduction: Recent publications on the impact of a multimodal prehabilitation program for patients undergoing surgical resection for colorectal cancer on functional walking capacity have shown a significant increase of this outcome during a 4-week program. However, not every patient improved to the same extent. The purpose of this subanalysis is to determine which patients would benefit from the multimodal prehabilitation.

Methods: This study involved a reanalysis of data arising from a pilot (1) and a randomized trial (2) with the addition of a new randomized controlled study. All three investigations received ethics approval. The primary outcome measure was functional walking capacity measured by the validated Six-Minute Walk Test (6MWT), which was assessed at baseline when patients were admitted to the study and after an average of 4 weeks of multimodal prehabilitation. The program included a 4-week, home-based unsupervised intervention of moderate aerobic and resistance exercises, nutritional counseling with whey protein supplementation (Immunocal), and relaxation exercises. The patients were divided in two groups: group A included those patients whose baseline 6MWT was below 60% of the predicted value, and group B included patients whose predicted value was above 60%. The change in 6MWT during the prehabilitation period was compared between the two groups.

Results: Data from 106 patients were analyzed. There were 40 patients in group A and 66 in group B. Gender distribution among the two groups and BMI were similar. The average age of group A was 72 ± 16 years compared to group B 66 ± 20 years (p < 0.01). There were more patients with ASA 3 and 4 in group A(p < 0.05). The increase in 6 MWT during the prehabilitation period in group A was 46 ± 50 m while in group B was 22 ± 43 m (p < 0.01). The proportion of patients whose 6MWT improved over 20 m was significantly greater in group A (70%) compared with group B (43%) (p < 0.05).

Discussion: These preliminary data indicated that patients whose predicted 6MWT is below 60% at baseline, tend to be older and with ASA of 3 and 4. When these patients
were enrolled in a multimodal prehabilitation program their functional walking capacity increased by an average 45 m.

References:

1) Surg Endosc 2013 27:1072–82

2) Anesthesiology 2014 121:937-47
Introduction: Poor physical function is associated with an increased risk of post-surgical complications. Not only are many patients sedentary with poor physical function at time of diagnosis but high complication rates following colorectal resection render many patients with poor post-surgical functional capacity and quality of life (1). Prehabilitation is the process of improving physical function prior to a physiological stressor, such as surgery. This study aims to assess if a prehabilitation program (exercise and nutritional supplementation), implemented in the 4 weeks from diagnosis to surgery, is sufficient to modify physical activity levels and functional capacity in elderly colorectal cancer patients.

Methods: Patients were assigned to either a prehabilitation (PREHAB; n=50; age 68.2±11.3 years) or a matched time control group (CON; n=49; age 67.2±9.5 years). Patients in PREHAB were prescribed an individualized 4 week home training program and received dietary supplementation with whey protein to ensure adequate protein intake. CON received the same program but only after surgery, as per present hospital protocols. In both PREHAB and CON, the Community Healthy Activities Model Program for Seniors (CHAMPS) questionnaire was used to measure physical activity levels, while the six-minute walk test (6MWT) was used for assessment of functional exercise capacity.

Results: Measurements were collected at the initial visit and on day prior to surgery. Change in total physical activity during the pre-operative period was significantly greater in PREHAB versus CON (+17.97 vs. -4.26 kcal/kg/week, p=0.01). The shift in levels of moderate and vigorous intensity exercise was significantly greater in PREHAB than CON (+17.52 vs. -3.09 kcal/kg/week, p < 0.01). Compared to CON, patients in PREHAB experienced a significantly greater change in 6MWT during the pre-operative period (+27.7 vs. -1.33 meters, p < 0.01), thus indicating improved functional capacity.
Discussion: These results show that a 4 week prehabilitation program is sufficient to improve both physical activity levels and functional capacity in elderly patients with colorectal cancer. These improvements are critical for post-surgical wellbeing, subsequent treatment strategies and overall quality of life in this surgical population.

References:
1) Anesthesiology 2014 121:937-47
Introduction: The development of postoperative delirium (POD) may be related to an exaggerated inflammatory reaction caused by an aberrant stress response during surgical trauma (1). The use of intraoperative blood product transfusion can compound this inflammatory response (2), resulting in increased morbidity and mortality. The purpose of this study was to identify an association between different blood product transfusion and the risk of POD after non-cardiac surgery.

Methods: After Research Ethics Board approval, a retrospective review was conducted of all patients who underwent non-cardiac surgery at a large tertiary care hospital from 2003-2013. Delirium codes from the ICD10 were matched with all inpatients undergoing non-cardiac surgery during the same time period. Patients were excluded if they had a history of delirium, dementia, or underwent transplant surgery or neurosurgery. Unadjusted odds ratios (OR), 95% confidence intervals (CI), and p-values were calculated for selected risk factors. P value < 0.05 was considered statistically significant.

Results: The dataset consisted of 100,437 patients. There were 945 (0.94%) patients with ICD10 codes that were consistent with POD. The univariate risk factors for POD included age ≥ 70, male gender, ASA class 3 or 4, emergent/urgent surgery, preoperative anemia, 3 or more Charlson co-morbidities, and transfusion ≥ 1 unit of packed red cells, ≥ 5 units of platelets, and ≥ 1 unit of fresh frozen plasma. (Table)

Discussion: The results from this study have identified several significant risk factors associated with POD, including intraoperative blood transfusion. The multivariate analysis will identify whether blood product transfusion is an independent risk factor associated with POD after non-cardiac surgery. This data will be presented at the conference venue.

References:
Introduction: The distribution of call in a shared practice model poses a significant challenge in terms of logistics and human resource planning. A shared practice setting typically uncouples remuneration provided for a call shift from the amount billed on that shift. Given that switching call is a real and necessary component of any call schedule, this leads to an underlying barter economy, with formal or informal systems of valuing call creating a currency of expected hours worked on a given shift [1, 2]. This study retrospectively reviewed the accuracy of an internal call value system in order to analyze its efficacy at equalizing, and appropriately distributing, workload.

Methods: Local research ethics board approval was obtained. Additionally, all staff members of the department of anesthesia whose billing and cases would be reviewed expressly consented to the study. A complete list of all billings by the department of anesthesia for the fiscal years of 2012-13 and 2013-14 was obtained. This was supplemented by a record of direct billings for patients not covered by a provincial plan. These lists were crosschecked against OR bookings in order to ensure an appropriate capture rate (>95% concordance) [3]. The following data was collected from each case, with all additional information being discarded: attending staff, time in/out, patient age, day and date, service code(s) billed and amount billed. The primary outcome was a measure of total hours worked compared against the maximum possible time worked on that shift. A secondary measure was the number of ‘spill-overs’; cases that started during the day and continued into call shifts. Total amount billed, in-house work and home call work and institutional status of the staff (i.e. academic appointment, full/part-time status) were also evaluated.

Results: When compared with an optimal system of assigning call – i.e. 1 hour assigned carries a consistent expected amount of work associated – the current system was very inefficient, with significant opportunities for improvement. Expected work varied significantly (46% +/- 15%) between shifts assigned during the week and on the weekend. A review of secondary measures revealed a high number of spillover cases (n= 2934) accounting for 48% of total work done during call hours. Using strategies from similar size centers, [4,5] a predictive model of call system distribution with time horizon = 1 year, showed a potential 14% increase in efficiency and a 17% decrease in time on call spent not providing patient care, with no decrease in available call coverage. The
model also showed a marked (59% +/- 7.5%) reduction in handover of daytime cases carrying into on-call hours, with no commensurate increase in individual staff workload.

**Conclusion:** A fair valuation of call shifts is necessary for institutional efficiency and staff morale. Perceived inequalities in the distribution of call can be efficiently evaluated and addressed using retrospective analysis and effectively addressed with dynamic business processes [6]. Solutions from similar industries with complete coverage (i.e. shipping, software support, public utilities) can also be effective at addressing staffing issues in healthcare.

**References:**

6. BMC Health Ser Res 11(1): 26
With surgical and pain management advances, early discharge (EDc) after hip or knee replacement (HA or KA) is now possible. However, after HA or KA, 3.1% experience DVT, or other complications. Postoperative myocardial infarctions (45.8%) often occur after post-operative day (POD) 2. With EDc, therefore, complications may occur as outpatients. Also, more medication errors occur at transition points; i.e. hospital discharge. We hypothesize that home monitoring allows better transition of care and earlier intervention of post-operative complications at home. This is a preliminary report on home monitoring with wireless connectivity on pain scores and VS (non-invasive blood pressure, heart rate, and pulse oximetry).

**Primary Outcome:** ≥ 90% of patients with successful transmission of pain assessments and VS, once on evening of surgery (DOSx) and four times a day for 4 days of home monitoring

**Method:** After REB approval of this prospective observational study, patient consent was obtained prior to surgery. Inclusion Criteria were (a) Patients undergoing elective HA or KA; (b) expected LOS ≤ 1 day; (c) Age 18 – 80 years; (d) Revised Cardiac Risk Index (RCRI) ≤ Class 2; (e) available and able care-takers at home to assist the patient upon discharge during the early postoperative recovery phase. Exclusion Criteria: (a) ASA IV; (b) COPD with FEV₁ ≤ 1; (c) OSA; (d) patient or family reluctance to participate in early discharge; (e) new undiagnosed or unstable medical condition at the time of discharge; (f) previous participation in the study. Management protocols for pain and VS were created for these patients. Sample size was 54.
Results: To-date, 55 patients were eligible, 33 enrolled, and 1 withdrawal. Twenty-seven of the 32 patients completed the 30-day follow-up (Table 1): 4 total hips; 2 unipolar hips; 13 total knees; 8 hemi-knees; 23 under spinal anesthesia and 4 under GA. All were discharged on the DOSx. Transmission rates were 100%, 96%, 96%, 85%, 85% on DOSx, POD1, 2, 3, 4 respectively. Overall, 74% (95% CI 57.5 to 90.6%) completed every transmission. On average, 1.34 phone calls were made per patient over 4 days. Twenty-three patients strongly agree or agree to recommend this. At 30-day follow-up, all were at home; no mortality; 1 visited the ED on POD 15 for pain and no re-admissions.

Discussion: Although the “all completed” transmission rate was 74%, pain scores and VS were received for all patients every day until POD4 when 2 patients felt the monitoring no longer necessary. Data interaction with all patients every day supports the feasibility of postop home monitoring. Completion of 54 patients is expected by May 2014.

References:


RESIDENTS COMPETITION
Monday, June 22
8:30 AM - 10:15 AM

86165 - PRE-OXYGENATION OF OBESE: EFFECT OF POSITION AND VENTILATION
Primary Author / Presenting Author: Etienne J. Couture, Departement of Anesthesiology and Critical Care, Université Laval, Quebec, Quebec
Co-Authors(s): Jean Bussières, Steeve Provencher, François Lellouche, Mathieu Simon, Éric Nadreau, Jacques Somma, Nathalie Gagné, Simon Marceau

83149 - PREDICTION OF BLOOD PRESSURE RESPONSE IN SURGICAL PATIENTS
Primary Author / Presenting Author: Caleb Zelenietz, University of Manitoba Department of Anesthesia, Winnipeg, Manitoba
Co-Authors(s): Duane Funk, Duane Funk

86017 - NEUROPATHIC PAIN PATHWAYS IN THE HUMAN SPINAL CORD AND BRAINSTEM
Primary Author / Presenting Author: Jordan K. Leitch, Department of Anesthesia & Perioperative Medicine, Schulich School of Medicine & Dentistry, Western University, London, Afghanistan
Co-Authors(s): Catherine M. Cahill, Patrick W. Stroman

86197 - A MIXED COHORT STUDY COMPARING PERSISTENT PAIN POST THORACIC SURGERY
Primary Author / Presenting Author: Dina Aboutouk, McMaster University, Hamilton, Ontario
Presenting Author: Eugenia Poon, McMaster University, Hamilton, Ontario
Co-Authors(s): Harsha Shanthanna, Christian Finley, Ji Cheng, Toni Tidy, James Paul, Turlough O'Hare, Lehana Thabane

82726 - PERCEPTIONS AND PRACTICE OF INTRAOPERATIVE HANDOVERS: A SURVEY
Primary Author / Presenting Author: Farah Manji, London Health Sciences Centre, Western University, London, Ontario
Co-Authors(s): Andreas Antoniou, Richard Cherry

86023 - PERIARTICULAR KETOROLAC INJECTION AND ESTIMATED BLOOD LOSS
Introduction: Intraoperative anesthesia handovers can be unstructured and of variable quality (1). Verbal, ad hoc handovers are prone to communication failure, information loss, and inaccuracy, all of which can compromise patient safety (2). The purpose of this study was to provide data regarding current intraoperative handover practices at a tertiary-care academic institution, as well as the perceptions of their quality, from anesthesia providers. Presently, there is no intraoperative handover protocol at this institution. The data gathered will inform a future study which will endeavour to develop a standardized institutional protocol for use among anesthesia providers who transfer the care of patients intraoperatively, with an aim to improve the quality of handovers.

Methods: With local REB approval, an online survey was created and distributed using Survey Monkey (Palo Alto, CA). An invitation to participate in the survey was e-mailed to 75 OR anesthesia consultants and 45 anesthesia residents on December 1, 2014. After two weeks, weekly reminder e-mails were sent to non-respondents until a 75% response rate was achieved. There were ten multiple-choice questions and one free text question. Only two questions, which collected demographic information, were mandatory. Responses could not be linked to individual respondents.

Results: 59 consultants and 34 residents responded, yielding a response rate of 77.5%. Responses to selected questions are depicted in stacked diverging bar charts (Fig 1). 67.7% (63/93) of respondents do not have a standardized way of handing over a patient to an anesthesia colleague in the OR, and 81.7% (76/93) do not have a standardized way of receiving such a handover (Fig 1a). When asked to rate the quality of handovers given and received in the last three months, most respondents rated them as “good” or “acceptable” (Fig 1b). Most providers state that they “rarely” experience major or minor intraoperative complications due to poor quality handovers. 9.7% (9/91) of respondents “frequently” feel “uncertain” after receiving a handover and the original provider has left and 46.2% (43/91) “sometimes” do (Fig 1c). There was no association between having a standardized method of either giving or receiving a handover and the frequency of perceived intraoperative complications or feeling uncertain.

Discussion: Standardized communication tools and transition of care practices improve information transfer and reduce errors (3,4). At this institution, most anesthesia providers do not have a standardized way of giving or receiving intraoperative handovers. While intraoperative complications are only rarely attributed to poor quality
handovers, almost 56% of providers routinely feel uncertain about the information received during handovers. The lack of association between reporting a standardized handover practice and perceived complications due to poor handovers or feelings of uncertainty may indicate that individual standardization practices are not effective. The results of this survey suggest that this institution may benefit from a structured handover protocol. This study will be used to begin creating that protocol.

References:
1. Int Anesthesiol Clin 2013 51: 31-42
2. Anesthesiology 2014 121: 695-706
83149 - PREDICTION OF BLOOD PRESSURE RESPONSE IN SURGICAL PATIENTS

Author(s)
Caleb Zelenietz
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Primary Author / Presenting Author

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Duane Funk, MD FRCP(C) - University of Manitoba
Duane Funk - University of Manitoba

Introduction Pulse pressure variation (PPV) and stroke volume variation (SVV) are excellent predictors of cardiac output response to intravenous fluid bolus administration (1-3). Dynamic arterial elastance (EaDyn), the ratio of PPV/SVV, has been shown to predict mean arterial blood pressure (MAP) increase to intravenous fluid bolus administration in patients with sepsis (4). This study aims to generalize this result to patients undergoing major elective vascular surgery, in order to guide fluid therapy to maximize therapeutic effect and patient safety.

Methods: Ethics approval was obtained from the local research ethics review board. A post hoc analysis was conducted of forty patients undergoing combined general and thoracic epidural anesthesia for open repair of infrarenal abdominal aortic aneurysm in a tertiary care center. Continuous hemodynamic monitoring with a minimally invasive cardiac output monitor was employed for all patients. A 15% increase in MAP with fluid boluses was considered a priori as being clinically significant. Five-minute averages of hemodynamic variable were compared pre and post fluid bolus administration. Receiver operating characteristic curves were then generated to show the sensitivity and specificity of EaDyn for the prediction of mean arterial pressure increase to fluid bolus administration.

Results: Patients with a 15% increase in MAP with fluid bolus demonstrated a significant decrease in pre vs. post EaDyn from 1.0 ± 0.3 pre fluid bolus to 0.63 ± 0.29 post fluid bolus (P=0.0021). In those patients who did not have a 15% increase in MAP with fluid administration, EaDyn remained unchanged (0.75 ±0.35 vs. 0.73 ± 0.31 pre vs. post fluid, p=NS). There was no change in central venous pressure in MAP responders [9.5 ± 5.1 vs. 11.2 ± 6.2 mmHg, P=0.3713] or MAP non-responders [9.6 ± 3.3 vs. 10.1 ± 3.2 mmHg, P=0.4765] with fluid bolus. Stroke volume index did not differ significantly pre and post IV fluid bolus between MAP responders [40.7 ± 5.4 vs. 45.5 ± 9.6 ml/M², P=0.0342] or non-responders [40.4 ± 8.7 vs. 40.0 ± 8.2 ml/M², P=0.7824]. An EaDyn cutoff value of < 1.1 gives a sensitivity of 87.5% and specificity of 48% for predicting a 15% increase in MAP. Figure 1 shows the receiver operating characteristic curve for EaDyn, arterial stiffness (Pulse Pressure/Stroke Volume) and systemic vascular resistance.

Discussion: EaDyn successfully predicts MAP response to IV fluid bolus
administration in adult patients undergoing open AAA repair. PPV, as shown previously, predicts cardiac output response to IV fluid bolus administration, and may predict MAP response in some patients. Traditional predictors of fluid responsiveness such as CVP are ineffective. Dynamic arterial elastance is a promising new tool for predicting which surgical patients will benefit from IV fluid bolus, potentially avoiding excessive volume administration and complications.

References:


2) Crit Care Med. 2013 Jul;41(7):1774-81

3) Crit Care Med. 2009 Sep;37(9):2642-7

Introduction: Neuropathic pain is a subtype of chronic pain that affects 3-8% of the population, and presents a major clinical challenge because it is often refractory to conventional and unconventional treatments (1). Investigations of the neural signature of pain in humans have focused primarily on cortical regions, and studies that have included the spinal cord and brainstem have employed experimental models of pain (2, 3, 4). The objective of this study is to further this research by comparing the neural responses to noxious stimuli in healthy participants to those in a patient population diagnosed with peripheral neuropathic pain.

Methods: In this study, high-resolution functional magnetic resonance imaging (fMRI) was used to detect neural activity in the brainstem and cervical spinal cord of thirteen healthy participants and nine carpal tunnel syndrome (CTS) patients while noxious mechanical pressure was applied to the volar forearm overlying the median nerve. CTS results in peripheral neuropathic pain secondary to median nerve damage as it traverses the carpal tunnel. Participants in both groups indicated the pressure to produce a pain rating of 2, 4, and 6 out of 10 on an 11-point pain scale, and fMRI data were acquired with pain applied at each level during noxious stimulation. Standardized pain ratings were used (as opposed to standardized mechanical stimuli) because the pain response is subjective, and varies widely between individuals (5). This study was approved by the appropriate local research ethics board governing human studies.

Results: Revealing similarities and differences in fMRI signal change trends were observed between the groups. Both healthy participants and neuropathic pain patients exhibited a trend of overall positive signal change at a pain rating of 2 to negative signal change at a pain rating of 6 in the midbrain and rostral medulla of the brainstem. However, consistent differences were observed between the two groups in the ipsilateral dorsal horn of the spinal cord, rostral ventromedial medulla, periaqueductal gray matter, regions known to play an important role in nociceptive pain processing as well as the endogenous descending modulation of pain. Please see the attached figure for group results demonstrating regions of the brainstem and spinal cord that responded to stimulation of the right wrist in the area overlying the median nerve at all 3 pressures.
The far right panel shows the contrast between neural activity in CTS patient and control groups.

**Discussion:** This study is one of the first to identify variation in the neural activity associated with pain processing between control and neuropathic pain patient groups. The demonstration of the difference in signal activity between patient and control groups, in particular in regions critical to endogenous analgesia, is a key first step in elucidating the pathophysiology that underlies chronic neuropathic pain syndromes. This work could contribute to future studies investigating endogenous analgesia and pain processing in patient groups, which may facilitate the optimization of pain management and ultimately improve quality of life for patients suffering from chronic neuropathic pain.

**References:**
**86023 - PERIARTICULAR KETOROLAC INJECTION AND ESTIMATED BLOOD LOSS**

Author(s)
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**Introduction:** Total knee arthroplasty (TKA) is associated with significant blood loss. There is large variation in the reported blood loss and transfusion rates, and a number of factors are reported to influence it\(^1,^2\). Periarticular multimodal injection, including Ketorolac, is a common mode of analgesia for patients undergoing TKA\(^3-^5\). Ketorolac has a known anti-platelet effect and its intravenous use has been reported to be associated with increased blood loss\(^6-^9\). The effect of periarticular Ketorolac on blood loss following TKA has not been studied.

The primary purpose of this study is to determine whether periarticular Ketorolac injection is associated with increased estimated blood loss following TKA. The secondary purposes are to determine if blood transfusion is more common and if postoperative analgesia is better following periarticular Ketorolac injection.

**Methods:** All patients in this study had provided consent to access their files, and ethical approval for this study was received from our institutional Research Ethics Board. This was a single centre retrospective cohort study of patients who have undergone a primary total knee arthroplasty under spinal anesthetic. The study group is patients who have received periarticular Ketorolac (n=57) and the control group is patients who did not receive Ketorolac (n=33). Patients with chronic diseases that would increase the risk of blood loss or transfusion, perioperative anticoagulant or NSAID use, or perioperative tranexamic acid use were excluded. The primary outcome is estimated blood loss following surgery, which was calculated using established formulas\(^10,^11\); secondary outcome measures include postoperative blood transfusion requirements, pain scores and opioid consumption, hospital length of stay, and intraoperative and postoperative fluid administration and balance.

**Results:** There was no difference in estimated total blood loss between the two groups (1.24 ± 0.38 L in control vs. 1.41 ± 0.44 L in Ketorolac, p=0.07). One patient in each group required postoperative blood transfusion. There was less pain at rest on postoperative day 1 (POD1) in the Ketorolac group (3.6 ± 1.6 vs. 2.8 ± 1.7 numeric rating scale (NRS), p=0.02), but this difference was not seen on POD2, and there was no difference in opioid consumption between the two groups (p=0.18). There was no difference in hospital length of stay between the two groups.
**Discussion:** Periarticular Ketorolac does not seem to be associated with an increased blood loss in patients who are at relatively low risk for blood loss undergoing primary TKA. The reduction in NRS pain score at rest on POD1 is not clinically significant and does not result in reduced opioid consumption, and is not seen past the first postoperative day. Given that patients at high risk for blood loss were excluded from this study, it is still unknown how these patients respond to a multimodal periarticular injection with Ketorolac. Going forward, periarticular Ketorolac for analgesia following arthroplasty should be assessed for increased blood loss in higher risk patients, and the benefits of its use should be carefully weighed against potential risks on a patient-by-patient basis.

**References:**
1. HSS J 2013 9(2): 123-128
2. Int Ortho 2007 31: 39-44
11. Anaesthesiology 1974 41: 609-612
Introduction: Morbidly obese patients are at high risk of hypoxemia following induction of general anesthesia. Patient’s position and ventilation strategy used during pre-oxygenation influence the safe non-hypoxic apnea length by their effect on functional residual capacity (FRC). Head-elevated positions including beach-chair position (ramp position) are currently recommended and used to provide a better laryngoscopic view during tracheal intubation. A positive pressure ventilation strategy during pre-oxygenation might benefit FRC, but is not used systematically. We hypothesized that FRC will be better after pre-oxygenation simulation in head-elevated positions (beach-chair and reverse Trendelenburg position) than supine position and after spontaneous ventilation with positive pressure versus spontaneous ventilation at zero inspiratory pressure.

Methods: Using a prospective crossover randomized trial design, we compared the FRC (helium dilution method in a physiology lab) following simulation of pre-oxygenation period according to different positions and ventilation strategies. After approbation of the local REB and written consent obtained, subjects underwent, in a randomized order, 6 simulations of pre-oxygenation strategy during 5 minutes. Pre-oxygenation strategies included a combination of one of three positions: supine (S), beach-chair (BC; 25° back inclination), reverse Trendelenburg (RT; 25° table inclination) and one of two ventilation strategies: spontaneous ventilation at zero inspiratory pressure (ZEEP-SV) or spontaneous ventilation with positive pressure provided by a mechanical ventilator (PP-SV) set to an inspiratory pressure of 8 cm H₂O, PEEP of 8 cm H₂O and FiO₂ of 0.21. A mouthpiece and a nose clip were used in PP-SV and for FRC measurement to minimize leak. Pre-oxygenation simulations were separated by 20-minutes intervals in sitting position to minimize a potential alveolar recruitment from the previous intervention.

Results: Seventeen obese patients (BMI = 50 ± 8 kg/m²) were included. Mean FRC
was significantly higher in RT compared to BC position (2483 ± 521 versus 2338 ± 469 mL, p=0.009), while there was no difference between S and BC (2359 ±519 mL versus 2338 ± 469 mL, p=0.894). Mean FRC in the three positions (S, BC, RT) was also significantly higher using PP-SV compared to ZEEP-SV (2571 ± 477 versus 2215±481 mL, p < 0.001). The pre-oxygenation strategy using PP-SV in RT position was associated with a 465 mL (21%) increase in FRC compared to ZEEP-SV in BC position (2684±473 versus 2219 ± 477 mL; p < 0.001).

**Conclusion** Compared to supine, the beach-chair position did not increase FRC. Significant increases in FRC are observed when the patient is moved from beach-chair to reverse Trendelenburg position. Significant increases in FRC are observed when the spontaneous ventilation at zero inspiratory pressure is switched to positive pressure spontaneous ventilation. Finally, the strategy using the reverse Trendelenburg position combined with spontaneous positive pressure ventilation is superior to beach-chair position associated with spontaneous ventilation at zero inspiratory pressure.
Introduction: Persistent Post Thoracotomy Pain (PPTP) is a recognized complication following thoracic surgery, with an incidence between 44%-67% (1). Its etiology is considered to be multifactorial, with both surgical and patient factors involved (2). It is uncertain whether the pathophysiological process involved is predominantly inflammatory, neuropathic, or mixed(2). The burden of PPTP after Video Assisted Thoracoscopic Surgery (VATS) is considered to be less, although previous studies have shown conflicting results (3). Since the use of Epidural Analgesia (EA) is less with VATS, it is unclear if this influences the chances of PPTP (4). Our primary objectives were: 1) assessing the incidence of PPTP at 6 months after surgery, as compared to Open Thoracic Surgery (OTS) and VATS; and 2) identifying the type of pain if present (neuropathic versus non-neuropathic). The secondary objectives were to: 1) analyze the effect of EA on PPTP between the 2 groups; and 2) analyze other predictive factors of PPTP development.

Methods: Approval from REB was obtained for a mixed cohort (retrospective and prospective) study of thoracic surgery patients aged 18 or greater, performed at our center. Patients were contacted by a mailed questionnaire regarding the presence or absence of pain, its type and other pertinent factors. Non-responders were reminded by a phone call. Demographical, surgical, and postoperative analgesia details were collected from health records, acute pain database, and the thoracic surgery database. The patients were divided into 2 groups (OTS or VATS). Sample size of 90/group, was calculated using the primary outcome of difference in proportions; P1: 25%, P2: 45%, (Alpha: 0.05 and Power: 80%). The data was analyzed using a multivariable logistic regression analysis, with adjusted odds ratio for primary and secondary outcomes.
Results: Out of 353 patients initially approached, 130 patients responded; 5 patients were excluded due to selection criteria, and 18 responses could not be appropriately analyzed. Final analysis involved a total of 106 patients. A logistic regression model, with surgeons treated as clusters, indicated a significantly lower incidence of PPTP in the VATS group; adjusted OR: 0.33(0.13, 0.86). In the reduced model with important predictors included, diagnosis of cancer, and history of previous chronic pain were observed to be significantly predictive of PPTP development (table 1).

Conclusion: Our study indicates that persistent pain at 6 months has an incidence of 35% with VATS, compared to 54% with OTS. The persistent pain has a higher chance of being neuropathic with OTS, compared to VATS. The results support the finding that a diagnosis of cancer, and history of previous pain are highly predictive; however, the actual procedure, gender, and the use of epidural do not affect the development of PPTP. A prospective randomized study of appropriate sample size is necessary to confirm the above findings.

References:

3) Anesthesiology. 2006; 104(3): 594—600.
RICHARD KNILL COMPETITION
Monday, June 22
10:30 AM - 12:15 PM

82053 - DEXMЕDEТОMIDINE VS REMIFENTANIL FOR EBUS-TBNA
Presenting Author: Patrick St-Pierre, Université de Montréal, Hôpital Pierre-Boucher, Longueuil, Quebec
Co-Authors(s): Louis-Phillipe Fortier, Oliver Verdonck, Christian Loubert, Pierre Drolet, Issam Tanoubi

85146 - COGNITIVE AIDS WITH ROLES DEFINED (CARD): CRISIS MANAGEMENT IN THE OR
Presenting Author: Alexandra C. Bunting, University of Ottawa, Ottawa, Ontario
Primary Author: Simone Crooks, The Ottawa Hospital, Ottawa, Ontario
Co-Authors(s): Tania Di Renna, M. DYLAN BOULD, Amy Fraser, Sylvain Boet

86222 - A NEW MOUSE MODEL OF CONCUSSION TO STUDY MEMORY AND SYNAPTIC PLASTICITY
Primary Author / Presenting Author: Sinziana Avramescu, University of Toronto, Toronto, Ontario
Co-Authors(s): Irene Lecker, Tom Chang, Charissa Poon, Paul Whissell, Andrew Baker, Beverley Orser

85870 - AGREEMENT OF RISK DISCLOSURE FROM 5 ANESTHESIOLOGY ASSOCIATIONS
Primary Author / Presenting Author: Alexander J. Villafranca, University of Manitoba, Winnipeg, Manitoba
Co-Authors(s): Divya Parveen, Eric Jacobsohn, Raja Rajamohan

86254 - POINT-OF-CARE SYRINGE LABELING PROCESS PREVENTS MEDICATION ERRORS
Presenting Author: Ludwik Fedorko, Toronto General Hospital, Toronto, Ontario
Co-Authors(s): Joseph Fisher, Esther Fung, W Scott. Beattie, Rita Katznelson

86258 - EFFECT OF A REGIONAL GUIDELINE ON UNNECESSARY PREOPERATIVE LAB TESTS
Primary Author / Presenting Author: Thomas C. Mutter, University of Manitoba, Winnipeg, Manitoba
Introduction: Dexmedetomidine hydrochloride (Precedex, Hospira®), is a $\alpha_2$-adrenoreceptor agonist that produces sedation and analgesia with minimal respiratory depression. It exhibits a unique profile compared to commonly used hypnotics as its action is not mediated by the $\gamma$-aminobutyric acid (GABA) pathway. Dexmedetomidine has been used in patients requiring monitored anesthesia care (MAC) for awake intubation and surgical or diagnostic procedures. We hypothesize that, compared to remifentanil, the use of dexmedetomidine for MAC during endobronchial ultrasound-guided transbronchial needle aspiration (EBUS-TBNA) in spontaneously breathing non intubated patients would result in a lower incidence of major respiratory and hemodynamic adverse events while providing equally satisfying operative conditions.

Methods:
After obtaining patient consent in accordance with local institutional guidelines, sixty (ASA I-III) patients scheduled to undergo EBUS-TBNA under MAC without intubation were randomized to receive either remifentanil: 0.5 $\mu$g/kg IV bolus in 2 minutes, followed by 0.05-0.2 $\mu$g/kg/min, or dexmedetomidine: 0.4 $\mu$g/kg IV bolus in 10 minutes, followed by 1.0 $\mu$g/kg/h. Primary outcome was number of major adverse events (Bradypnea, Apnea, Hypoxia, Hypotension, Hypertension, Bradycardia, Tachycardia) while secondary outcomes included differences in operative conditions, observer’s Assessment of Alertness/Sedation Scale (OAA/S) scores, pain, recall, discharge criteria (Aldrete score), total dose of endotracheal lidocaine administered and nausea and vomiting incidence. Unpaired t test with Sodak-Bonferroni correction for multiple comparison and Mann Whitney test were used.

Results:
The median number of apnea (0[0-0] vs 0[0-0.5] p=0.010) and desaturation episodes was higher in the remifentanil group (0[0-0.5] vs 1[0-4] p=0.01). Remifentanil was associated with a decrease in mean respiratory rate (Figure). Otherwise, dexmedetomidine use resulted in longer post EBUS-TBNA discharge time (24.80±28.78min vs 4.50±3.10min p < 0.0001) and greater need for intra-tracheal lidocaine during the procedure (201.50±7.53mg vs 175±5.97mg p=0.0091). Dexmedetomidine was also associated with more hypotensive events (0[0-0] vs 0[0-0.5] p=0.0015). Sedation depth (OAA / S), operative conditions and other secondary
outcomes (operator satisfaction, patient satisfaction, pain, cough, vocal cord mobility and recall) were similar in both groups.

**Conclusion:**
Although dexmedetomidine resulted in a safer respiratory profile compared to remifentanil for MAC during EBUS-TBNA, its use was associated with more hypotension, delayed postoperative discharge and need for more local anesthetics during the procedure.

**References:**

Ann Pharmacother 2009 43:2064-74

Am J Ther 2010 17:586-95

Curr Opin Anaesthesiol 2008 21:457-61

Anesth Analg 2010 110:47-56

Chest 2009 136:229-36
Introduction: Patient survival after intraoperative cardiac arrest highly depends upon rapid and coordinated delivery of life-saving actions, reliant upon a multi-disciplinary team. Uncoordinated teamwork due to overcrowding, lack of role definition and task overload is the most important barrier to the efficient management of cardiac arrest. This study assesses the value of C.A.R.D. (Cognitive Aids with Roles Defined), which is a cognitive aid delineating roles and tasks designed to facilitate crisis resource management.

Methods: The local Hospital Research Ethics Board approved this study. Twelve multidisciplinary teams, each consisting of anesthesiologists, surgeons, nurses, a respiratory therapist, and operating room attendants, underwent three successive simulated intraoperative cardiac arrest scenarios each followed by a debriefing, and then a final focus group. The first scenario ran as per current practice without C.A.R.D.; the second scenario used C.A.R.D. without previous instruction; the third scenario used CARD after specific teaching. A retention test was performed six months later on eight teams (4 with and 4 without C.A.R.D.). The transcripts of the focus groups discussing C.A.R.D. for crisis management underwent a thematic analysis using an inductive methodology. Each scenario was videotaped and later rated by two blinded experts for technical and non-technical skills of teams (time to start CPR, hands-on time, global rating scale, and TEAM scale). The TEAM (Team Emergency Assessment Measure) scale is a validated and reliable teamwork assessment tool for emergency resuscitation team performance. A repeated measures ANOVA was used to capture change in TEAM score rating across the three initial scenarios.

Results: Qualitative data revealed thematic dimensions including role definition in crisis management, logistical issues, and real-life applicability. C.A.R.D. clarified roles, enhanced efficacy, and improved team focus and coordination during crises. Participants felt more comfortable and confident on a personal level, and empowered to
carry out their assigned tasks. Participants felt that C.A.R.D. requires initial training. Exploratory quantitative analysis did not show any change in team performance when using C.A.R.D at the retention test (Table).

**Discussion:** The C.A.R.D. protocol was well received by participants. C.A.R.D. may facilitate crisis resource management for intraoperative cardiac arrest, but requires some teaching. C.A.R.D. is relevant and easily exportable to other types of crises. The concept of a well-organizing team with defined roles may be infinitely valuable for patient safety. Since this study, the C.A.R.D protocol has been implemented in ORs with positive feedback.

**References:**
2. Resuscitation 2004 60: 51-56
5. Resuscitation 2010 81: 446-52
Introduction: 72% of people in the US searched online for health information in the past year (1). National anesthesiology associations are a source of credible online information regarding anesthesia, and they produce patient education materials (PEMs). The risks of general anesthesia (GA) and neuraxial blockade disclosed in PEMs should be similar in developed countries. This would ensure that the PEMs have the same potential to facilitate informed consent and that a consistent message is sent to patients seeking information from multiple associations. Yet, agreeability has not been investigated previously. Therefore, our primary aim was to quantify the overall agreement in risk disclosure between 5 national anesthesiology associations.

Methodology: REB approval was not required as only public domain documents were used. Included associations were from English speaking countries with high UN human development index scores and similar WHO health system rankings: American Society of Anesthesiologists (ASA); Australian Society of Anaesthetists (ASA_AU); Association of Anaesthetists of Great Britain and Ireland (AAGBI); Canadian Anesthesiologists' Society (CAS); New Zealand Society of Anaesthetists (NZSA). Disclosed risks were extracted from online PEMs. Agreement network analysis was performed (2). Each network represented agreement regarding one risk and a sum composite network was calculated. Descriptive statistics included overall network density (agreement between all associations), and node degree (agreeability of a given association relative to the other four) (2-3). Agreement was examined at 2 levels: 1) disclosure of a risk and 2) specification of risk (GA, neuraxial blockade, both, undifferentiated). A permutation test determined if the level of agreement seen for disclosure was due to chance (4). Data was analyzed using Ucinet social network analysis software (version 6, MA), and Excel 2013.

Results: 59 unique risk were identified across all PEMs (range 11-42 for individual associations, figure 1). Overall agreement was: 1) 54.2% for disclosure, 2) 42.2% for specification. Agreement in risk disclosure was not greater than what would be seen by chance (z=0.57, p=0.21). Agreeability and the number of risks disclosed by the individual associations are shown in figure 1. Only 4/59 risks were disclosed by all five associations (death, awareness, respiratory complications, and allergic reaction). The five associations did not agree on specification of any risk.
**Conclusions:** There was poor agreement in anesthesia risk disclosures in PEMs between the 5 associations studied, and the number of risks disclosed varied widely. This may cause confusion in patients seeking risk information from online PEMs. It would be ideal if associations could collaborate in creating a standardized set of risks to disclose in their PEMs.

**References:**

Background: Each year, approximately 1.7 million North Americans suffer from traumatic brain injury (TBI) (1). Deficits in memory and executive function are common after TBI, and are powerful predictors of poor long-term functional recovery (2). The mechanisms underlying these memory deficits remain elusive and there are no effective treatment strategies. A barrier to the development of therapies is the lack of animal models that accurately mimic the pathology of mild concussion in humans. Current models require surgery and prolonged anesthesia and are not easily adopted for studies of mice. Our goal is to develop a novel, high-throughput mouse model that can be used to study memory deficits and treatment strategies after mild TBI. We will use this model to study a variety of memory-related behaviors and synaptic plasticity in the hippocampus after TBI.

Methods: Local Ethics Committee approval was obtained for all experiments. A modification of the free weight drop method (3) was developed to cause mild TBI in mice. The new model: 1) was performed under a brief anesthesia (isoflurane 1.3% for 20 min); 2) did not require stereotaxic head restraint or scalp surgery; 3) allowed for rapid acceleration of the free-moving head and torso, an essential characteristic of concussive injury in humans; 4) allowed repetitive injuries. Memory performance was tested in TBI and sham (anesthesia only) mice using three behavioural assays: Novel Object Recognition (NOR), Object Place Recognition (OPR) and Fear Conditioning (FC). In addition, long-term potentiation (LTP) in the hippocampus, a cellular correlate of memory was recorded. Statistical analyses were conducted using Graphpad Prism 5.0. Student t-test or standard One-Way or Two-Way ANOVA was used when appropriate. All values are expressed as mean ± SEM, and p < 0.05 was considered statistically significant.

Results: Following a single concussive injury, mice spontaneously recovered their righting reflex and showed no evidence of seizures, skull fractures, paralysis or overt impaired behavior. One week after TBI mice had impaired performance in the OPR (Sham: 53% ± 3%; TBI: 32% ± 4%, p < 0.01) and cued fear memory assays (Sham:
34% ± 4%; TBI: 24% ± 3%, p < 0.05), but not the NOR or contextual fear memory assays. LTP in CA1 region of the hippocampus was reduced in slices from TBI compared to Sham animals (Sham: 146% ± 9%, TBI: 121% ± 3%, p < 0.05).

Conclusions: We developed a novel, high-throughput animal model that mimics human concussive injury and does not require surgery or prolonged general anesthesia. We show for the first time that this model leads to impaired memory performance and synaptic plasticity in the hippocampus. Importantly, not all forms of memory are impaired after TBI. This model will aid in the development of biomarkers and treatments for cognitive impairment following concussive brain injury.

References:

Introduction: Anesthesia medication errors are rare but predictable events. The unintended ampoule swap and label swap type of errors are not recoverable and often lead to erroneous administration. An average anesthesiologist administers approximately 10,000 drug doses a year. Error rates reported in literature range from 0.1% to 0.85%

The preprinted color-coded syringe labeling systems, consisting of multiple rolls of (up to 30) on anesthesia carts are common today in most of ORs. This approach may reduce syringe swap errors. However, a label swap error is more likely than ever as a result of this solution. Labels for rarely used medications are still hand written, or are omitted.

We have devised developed and introduced to clinical practice a barcode reader aided point-of-care labeling process, which prevents an unintentional label and ampoule swap, and forces a "second look" at the ampoule by the anesthesiologist during medication preparation. Some of the preliminary results were previously reported in an abstract form.

Methods After local REB approval, we have studied effectiveness of this process for preventing this type of error in a large scale prospective evaluation. In 19 operating rooms over a period of three years, we have introduced apoint-of-care process to scan barcodes on all anesthesia injectables and to produce corresponding syringe labels. The use of this process was voluntary and traditional label rolls were also present on anesthesia cart at all times. Once the ampoule was scanned the user had an option to print the label or cancel printing by choosing one of the 4 menu options: Near Miss(drug error)/ Error in Preparation/ Testing / Practice-Training. At the end of 5 months period we have conducted a retrospective, anonymous survey of anesthesia providers asking them if and how many times the use of the system potentially intercepted their drug error. At the end of 3 year period printer logs were analyzed again for incidence of drug errors intercepted by the barcode scanning.
**Results:** During the first 5 months 58,644 ampoules were scanned by anesthesiologists in all ORs. 41 anesthesiologists (76%) participated in the retrospective survey indicated that "wrong drug" error has been intercepted on 29 occasions according to the participants (0.049%). At the end of three years 306,928 ampoules were scanned and 184 intercepted near-miss errors were prospectively logged (0.059%). Most common "near-miss" drugs were: cefazolin (15), midazolam (13), ephedrine (13), epinephrine (11), fentanyl (9), succinylcholine (7)

**Conclusions:** The barcode aided point-of-care syringe label generating process is effective in intercepting impending medication errors. Estimated lowest limit for the ampoule/label swap during drug preparation is 0.06%. This is lower than previously published data, possibly because the process itself requires a "second look" to position ampoules under the scanner.
Introduction: Preoperative laboratory testing (PLT) is intended to assist in perioperative care. However, its value has been questioned for some time[1] and it is widely accepted that many preoperative tests are unnecessary health system expenses resulting in patient inconvenience, and perhaps even harm[2,3]. The development of a consensus between caregivers regarding expected testing and subsequent education strategies to raise awareness of new guidelines have resulted in short term success at reducing unnecessary PLT in the literature[4,5,6]. However, these single centre studies are not reflective of contemporary perioperative care where primary care providers, anesthesiologists and surgeons share responsibility for patients across a wide range of settings and locations.

In 2010, a multidisciplinary team created a consensus based provincial guideline for PLT to reduce unnecessary testing. The document received approval from local standards committees and senior health administration and was widely distributed through a dedicated implementation strategy. We report on this guideline’s transient effect in reducing unnecessary testing in a large health region, 2 years after implementation.

Methods: Ethics approval was obtained to re-analyze 3 quality assurance audits. These retrospective chart review audits examined PLT prior to (November 2010), 6 months after (September 2011) and 2 years after (May 2013) guideline implementation. Each audit reviewed a random sample of adult patients having surgery across 8 facilities within the largest provincial health region during a typical 5 day week. Each sample was stratified by surgical specialty and facility, and included 150-250 patients, reflecting 15-20% of the total number of surgeries. The PLT ordered for the patient was noted with the specialty of the physician who ordered the test (primary care, surgery, anesthesia). Tests were considered unnecessary if they were ordered but were not recommended by the guideline, based on the patient’s age, comorbidities, functional status, medications and the nature of the proposed surgery, as documented in the chart.

Results: Unnecessary tests were ordered 31.6% of the time at baseline, 27.0% of the time 6 months after implementation (p < 0.005), and 31.3% of the time 2 years after implementation (p=0.86). Overall and individual test results were consistent except there was a trend (p=0.06) to a sustained reduction in unnecessary chest x-rays from 44.9% at baseline to 25.6% at two years post-implementation. Primary care providers and surgeons ordered over 95% of unnecessary tests.
Discussion: Implementation of a new PLT guideline did not result in important or sustained reductions in unnecessary testing in a large health region. The short-term success documented in previous single centre studies may not translate to long-term results in multicentre, multidisciplinary models of care. More research is required to understand the determinants of unnecessary PLT in contemporary practice, and to develop knowledge translation strategies to improve guideline adoption by caregivers.

References: