

Queen's University 32nd Annual Anesthesiology Research Day

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Institutional support:
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Providence Care

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Held at Donald Gordon Centre, Kingston, Ontario, CANADA, April 8, 2011.

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Queen's University 32nd Annual Anesthesiology Research Day

SCIENTIFIC PROGRAMME

0800 – 0810 Opening Remarks

– **Dr. Joel Parlow**

0810 – 0830 Research Day Introduction

– **Dr. Ian Gilron**

0830 – 0930 Oral presentations (see list below)

0930 – 1000 Poster presentations (see list below) **and nutrition break**

1000 – 1130 Oral presentations (see list below)

1130 – 1200 Dr. Joel Parlow (moderator): ***Emeritus Alumni presentations***

1200 – 1300 * LUNCH (provided) *

1300 – 1330 Dr. Joel Parlow (moderator): ***Emeritus Alumni presentations***

1330 – 1430 Oral presentations (see list below)

1430 – 1500 Poster presentations (see list below) **and nutrition break**

1500 – 1545 Oral presentations (see list below)

EACH 10-MINUTE ORAL PRESENTATION WILL BE FOLLOWED BY A 5-MINUTE QUESTION PERIOD

The Judges will be:

Dr. Philip Peng, Associate Professor, Department of Anesthesia, University of Toronto

Dr. Cara Reimer, Assistant Professor, Queen's Department of Anesthesiology & Perioperative Medicine

Dr. John Murdoch, Assistant Professor, Queen's Department of Anesthesiology & Perioperative Medicine

1545 Dr. Philip Peng, Associate Professor, Department of Anesthesia, University of Toronto, Speaker of the Royal College of Physicians & Surgeons of Canada, Region 3 Advisory Committee

***"From RCTs to clinical practice – why it doesn't always work:
Lessons learned from acute pain"***

Wine & Cheese to follow with *** Awards Presentation *** (Donald Gordon Center)

Oral Presentations

JD CYR, PGY4

"The Impact of Anesthesia Assistants on Anesthesiology in Canada" (data presentation)

Yasser HAYAT, PGY2

"The economics of drug wastage" (proposal)

Gita RAGHAVAN, MD Candidate, Queen's University School of Medicine

"Impact of the preoperative anaesthesia clinic meeting on patient's preference for spinal versus general anaesthesia for lower limb joint arthroplasty." (data presentation)

Luis Enrique CHAPARRO-GOMEZ, Research Fellow

"Analgesic effectiveness of Dipyron (Metamizol) for postoperative pain after herniorrhaphy" (data presentation)

Tricia DOYLE, PGY2

"A Survey of Health Professional Education in Patient Safety at Queen's University" (proposal)

Laura KATZ, MSc Candidate, Queen's Psychology

"Evaluating a Psychosocial Model of Disability Using Structural Equation Modeling (SEM) in Women Suffering from Chronic Pelvic Pain" (data presentation)

Ali IGLESIAS, PGY2

"The introduction and validation of a "pause" button in medical simulation." (proposal)

Matthew LANGDON, PGY3

"Does Pre and Post operative Dextromethorphan Reduce Post Tonsillectomy Pain in Children?" (update)

Ryan MAHAFFEY, PGY3

"Combined topical and intravenous tranexamic acid may be superior to intravenous alone, in reducing blood loss following coronary bypass surgery: An observational study" (data presentation)

Karen WONG, PGY2

"Do Antidepressants reduce post-operative pain? A systematic review." (proposal)

Serena SHUM, MD Candidate, Queen's University School of Medicine

"Predicting Enhanced Care Unit Use In Elective Surgery" (data presentation)

Rebecca GERLACH, PGY3

"Efficacy of a Preoperative Smoking Cessation Intervention by Surgeon vs. Pre-Surgical Screening Clinic" (update)

Brian GRANT, PGY3

"Impact of spontaneous versus evoked neuropathic pain on daily function" (update)

Drew McLAREN, PGY4

"Canadian Anesthesia Workforce Assessment 2010" (data presentation)

Oral Presentations (continued)

Lawrence LEUNG, PhD Candidate, Queen's Center for Neuroscience Studies
"Needling the pain--is there science in it?" (research update)

Thomas R. CAWTHORN, MS, MD Candidate, Queen's University School of Medicine
"Perioperative Ketorolac is Associated with Increased Bleeding after Reduction Mammoplasty" (data presentation)

Poster Presentations

Julian DEBACKER, MSc Candidate, Queen's Center for Neuroscience Studies
"Resilient NR2B-containing NMDA receptors accompany dysfunctional synaptic plasticity associated with drug abuse" (poster presentation)

Ryan MAHAFFEY, PGY-3
"Congenital Myasthenia Patient For Strabismus Repair"
(poster presentation)

Michelle REITSMA, RN, MSc, Research Associate, Queen's Anesthesiology
"Incidence and sociodemographic predictors of chronic pain in Canadians: A gender-based perspective."

Sarah WALKER, RN, MSc, Research Coordinator, Queen's Anesthesiology
"The association between physical and psychological symptoms and healthcare utilization in women waiting for gynaecological surgery."

Critical Appraisal Essays

Gini LEE, MD, PGY-1, Queen's Anesthesiology
"Lung function after total intravenous anaesthesia or balanced anaesthesia with sevoflurane"
Br J Anaesth. 2011 Feb;106(2):272-6.

Judith MAROIS, MD, PGY-1, Queen's Anesthesiology
"Hemidiaphragmatic Paresis Can Be Avoided in Ultrasound-Guided Supraclavicular Brachial Plexus Block"
Regional Anesthesia & Pain Medicine 2009 Nov-Dec;34(6):595-9.

Erika NGUYEN, MD, PGY-1, Queen's Anesthesiology
"High-fidelity simulation demonstrates the influence of anesthesiologists' age and years from residency on emergency cricothyroidotomy skills"
Anesthesia & Analgesia. 111(4):955-60, 2010 Oct.

The Impact of Anesthesia Assistants on Anesthesiology in Canada

Jason Denis Cyr, Drew McLaren, Rob Tanzola, Rick Chisholm, Elizabeth G. VanDenKerkhof, Dale Engen

Introduction: Nationally, there is wide variability in the availability and the utilization of Anesthesia Assistants (AAs) by departments of anesthesiology. The purpose of this study was to assess the current number of AAs, their utilization, and their impact on the specialty of Anesthesiology in Canada.

Methods: An email list for Canadian Department Heads of Anesthesiology and funding was obtained from the Canadian Anesthesia Society. After ethics approval, two iterations of an online survey were sent in December 2010. Frequencies and percents were calculated. Statistical significance was assessed with the chi square statistic. Level of significance was set at $p < .05$.

Results: A total of 274 surveys were sent. This analysis is based on respondents (31%) representing departments providing care at 115 different sites. Forty-three percent of departments routinely use AAs. There were significantly more AAs (78%, $p < .01$) in Quebec than the rest of Canada. AAs were utilized almost equally between academic (53%) and community (47%) departments. All institutions that employed AAs were in an urban setting (population > 10,000). Fifty-nine percent of departments have employed AAs for over 10 years. In all institutions, AAs assist with technical support. Seventy-eight percent of the departments allow AAs to monitor patients under General Anesthesia (GA). This is all performed under a 1:1 ratio of staff anesthesiologist to AA. Of those that permit it, 80% have medical directives for the AAs. Seventy-two percent of departments allow AAs to monitor patients under Regional Anesthesia (RA). A few departments permit a ratio of 2:1 between anesthesiologist and AA. Eighty-seven percent of institutions allowing AAs to monitor RAs have a medical directive. Fifty-nine percent of departments allow AAs to monitor patients under Monitored Anesthetic Care. Most have a ratio of 1:1 while one department reports a ratio of 3:1. Ninety percent of departments allowing AAs to monitor patients under MAC have medical directives. Over 93% of respondents agree that AAs improve efficiency, productivity, patient safety and job satisfaction. All respondents agree that AAs are an important part of the workplace team. In Ontario, few departments reported a reduction ($n = 6$ Full Time Equivalents) in requirements for Anesthesiologists with the introduction of AAs.

Discussion: This was the first national study to describe the role of AAs on departments of anesthesiology. The results indicate that Quebec utilizes the most AAs. Interestingly, AAs are more likely to monitor patients under GA followed by RA and then MAC. Overall, respondents agreed that AAs improved the work environment for anesthesiologists. The introduction of AAs has led to a small reduction in Anesthesiologist requirements in Ontario.

The Economics of Anesthesia Drug Wastage

Yasser Hayat

Principal investigator: D. Engen; Co Investigators: R. Tanzola & R. Rooney

Background: Soaring health care costs have led to an increasing proportion of the federal and provincial budget being utilized to provide health care services. Both federal and provincial governments have been forcing reductions in health care expenditures. This has led to hospitals and medical departments, including Anesthesiology, being pressured to bring down their costs and justify expenditures. Anesthetic drugs are a major variable cost for the department and the hospital. Over the past 11 months, the total OR anesthetic drug expenditure at KGH was approximately ½ million dollars. Gillerman et. al., using a mathematical model, estimated the cost of anesthetic drug wastage to be 26% of an Anesthesiology department's total drug expenditure. At KGH, this wastage could be approximately \$125,000. Weinger calculated drug wastage cost per case of US \$ 13.51 and estimated potential aggregate annual savings of US \$250-\$350 million based on the potential cost savings of \$10-\$15 per surgical case in the USA. Wagner et. al. used regularly drawn drugs including epinephrine, ephedrine, lidocaine, atropine and succinylcholine in their study and estimated total savings of \$ 66,000 per year in a tertiary care hospital. However, no study has directly quantified the amount of total drug wastage. Therefore, the purpose of this study is to quantify total drug wastage and to calculate the magnitude of the financial cost.

Hypothesis: At least twenty five percent of the Anesthetic drugs are wasted on a given day

Objectives: To quantify the magnitude of the Anesthetic drugs wastage and to determine the five most commonly wasted drugs.

Proposed study Design: KGH and Queen's Research ethics committee's approvals have been obtained. We will have all unused and incompletely used syringes of anesthetic drugs collected from operating rooms of KGH. All anesthetic drugs will be collected in clearly marked container with compartments labeled as "used" & "unused". Unused/partially used drug vials will also be collected. It will be a "Prospective quality assurance study". Researchers will be blinded in terms of origin of the drugs.

Study timeline: We will collect syringes and drug vials for a four week period. It will take additional eight weeks to collate and analyze the data.

Potential benefits: This study will help us understand the magnitude of Anesthetic drug wastage and will allow us to consider strategies to minimize the wastage.

Acknowledgement & references:

Thanks to Ron Koob, OR pharmacist for supplying data on Anesthetic agents

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3. Driver R P, Snyder I S, North F P, Fife T J., Sterility of anesthetic and resuscitation drug syringes used in the obstetric operating room. *Anesth Analg* 1998; 86: 994-997
4. Wagner D S, Naughton N N, Pierson C, Michel T, Potency and sterility of anesthetic drugs in obstetric anesthesia. *International Journal of Obstetric Anesthesia* (2002) 11, 252-254

Impact of the preoperative anaesthesia clinic meeting on patient's preference for spinal versus general anaesthesia for lower limb joint arthroplasty.

**Raghavan G., Murdoch J.A.C., Phelan R., Shyam V.
Queen's University, Department of Anesthesiology, Kingston, Canada**

Background and Goal of Study: Patients can have preconceived opinions or fears regarding spinal anaesthesia. (1) The presurgical meeting with an anesthesiologist offers a chance to provide information for an informed anaesthetic choice and to allay anxieties. We hypothesized that meeting with the anesthesiologist would alter patients' anaesthesia preference in favour of spinal anaesthesia and reduce anxiety levels.

Materials and Methods: Following Research Ethics Board approval and informed consent, 62 patients undergoing elective hip or knee arthroplasty were recruited from the preoperative assessment clinic. In this prospective study, a questionnaire was administered before and immediately after the meeting with an anaesthesiologist, who had no knowledge of the study questions. The primary outcome was preference for general versus spinal anaesthesia while the secondary outcome was anxiety, measured using a modified Amsterdam Preoperative Anxiety and Information Scale (APAIS). Other secondary outcomes included reasons for change of anaesthetic preference and concerns for side effects. Chi square test and Fisher's exact test were used to analyze changes in anaesthetic preference and concerns for side effects; paired t tests were used to compare anxiety levels ($p < 0.05$).

Results and Discussion: 62 patients, (35 female, 27 male, mean age 67+/- SD 10) were recruited over a six-week period. We observed a significant decrease in patients preferring general (48% to 18%, $p < 0.01$) and a significant increase in patients preferring spinal (39% to 74%, $p < 0.01$) anaesthesia before versus following the meeting with the anaesthesiologist. The most frequent reason quoted for this change was "being more knowledgeable" with "safety" ranked second. Of those reporting the greatest concern for having spinal anaesthesia, the commonest reason (72%) was that of "hearing intraoperative sound". Regarding side effects, the most frequent concerns were "nerve damage" and "paralysis". All concerns regarding side effects and all anxiety measures were significantly reduced post meeting except anxiety directly associated with the anaesthetic. This was likely attributable to patient's anxiety scores for the anaesthetic already being low prior to the meeting.

Conclusions The anaesthetic preoperative interview significantly influences patients' choice in favour of spinal anaesthesia for major lower limb arthroplasty and reduces anxiety.

References: Sosis et al. J Clin Anesth 7(5):389-94, 1995.

Analgesic effectiveness of Dipyron (Metamizol) for postoperative pain after herniorrhaphy: a randomized, double blind, dose response study

Luis Enrique Chaparro, MD^{1,2}, Wilson Lezcano, MD¹, Hernan Alvarez, MD¹, and William Joaqui, M.D.²

¹ Department of Anesthesiology, University of Antioquia. IPS Universitaria Ambulatory Surgical Unit. Medellin Colombia.

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Background: The efficacy of non-narcotic analgesics is mostly supported by randomized, placebo-controlled trials with no comparison with ordinary practice. Additionally, systematic reviews of these placebo-controlled trials have failed to determine clinically meaningful dose response effect.

Methods: In this double-blind, randomized trial, patients undergoing elective inguinal, umbilical or epigastric herniorrhaphy under general anesthesia were assigned to receive 15 mg/kg (D15 group) versus 40 mg/kg (D40 group) of dipyron intravenously during surgery. The primary outcome was the incidence of moderate to severe pain with movement during the recovery room phase. The secondary outcomes were morphine consumption, incidence of vomiting and Ramsay score (sedation scale).

Results: 162 patients were enrolled and analysed for the primary and secondary outcomes. Relative to the D15 group, the D40 group showed a lower incidence of moderate to severe pain in the first 30 minutes (61% and 40%; p value < 0.05); lower cumulative morphine consumption during the recovery period (3.85 versus 2.55 mg, p value < 0.006) as well as a lower incidence of vomiting (15.8% versus 2.5%, p value < 0.005). In addition, more cases of sedation were recorded in the D15 group than in the D40 group (17 versus 10 cases). There were no serious adverse effects attributed to dipyron in either group.

Conclusion: This trial shows a dose response effect of 40 mg/kg over 15 mg/kg of intravenous dipyron based on better movement-induced pain control, lower morphine consumption and fewer opioid-related side effects.

References

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Accepted for publication in *Pain Practice* Journal on March 10/2011.

A Survey of Health Professional Education in Patient Safety at Queen's University

Patricia Doyle, David Goldstein, Elizabeth VanDenKerkhof, Dana Edge

Background

Safety is central and critical to quality healthcare. With the current efforts to optimize safe, quality care, more attention has been brought to the integration of patient safety into health education curricula. Much of this effort in Canada is underpinned by the Canadian Patient Safety Institute's Safety Competencies Framework. The result of the Institute's study revealed that the integration of patient safety concepts into training has been poor, and launched an initiative which developed a framework composed of six competencies to make patient safety easy to understand and apply at all levels of education. An understanding of current student perspectives on these concepts is necessary in order to integrate these safety concepts and monitor the effectiveness of any changes made. Currently, there is little evidence garnering student perspectives in this domain, particularly amongst undergraduate medical students and residents. The purpose of this study is to understand the quality and content of patient safety education in the medical programs at Queen's University, and subsequently for trainees across Canada.

Research Questions:

1. How do medical trainees describe the patient safety curriculum in the classroom and clinical settings?
2. Is there a relationship between the patient safety curriculum in the classroom and clinical settings?
3. Are there differences in trainee perspectives of the patient safety curriculum across years and between different residency programs?

Proposed Study Design and Methodology:

The proposed study design is a cross-sectional web-based study. We will approach all students in the Medicine (n ~400), medical residency (n~404) programs at Queen's University to participate. If the response rate is similar to that of nursing students surveyed in Nov. 2010, we anticipate a response rate of 70% (n~560). The trainees will be invited to complete the online Modified Health Professional Education in Patient Safety Survey; a questionnaire designed to assess students' exposure to the six health safety competencies, students' perceptions on how broader patient safety issues are addressed in their education, and basic demographic information. Data gathered will remain confidential. Demographic data will be described using descriptive statistics (mean and standard deviation). For research question #1, frequencies and percentages will be used to summarize findings; for question #2, Spearman rank coefficient will be used, and for question #3, Kruskal-Wallis one-way analysis of variance will be used. Data collection will occur in Oct-Dec 2011, followed by analysis, interpretation and manuscript preparation by June 2012.

Implications

Results from this study will guide future health safety curriculum development for medical education programs at Queen's University and will serve as a baseline to track students' perspectives about patient safety over time.

Evaluating a Psychosocial Model of Disability Using Structural Equation Modeling (SEM) in Women Suffering from Chronic Pelvic Pain

Laura Katz, Dean A. Tripp, Jess Ginting, J. Curtis Nickel

Introduction: Interstitial Cystitis / Painful Bladder Syndrome (IC/PBS) is a persistent and refractory medical condition that is characterized by chronic pelvic pain along with abnormal urinary frequency and urgency (Rosamilla, 2005). Currently, there is no widely accepted etiology for IC/PBS and medical research has been unable to provide a cure. As such, treatment often relies on symptom management (Clemens, Joyce, Wise & Payne, 2007). Women suffering from IC/PBS report poorer mental health and strong functional disability (Nickel et al., 2010), and disability is a complex process that is as much related to psychosocial factors as it is to functional limitations (Phillips & Stuifbergen, 2010). The literature has found that factors such as depression, catastrophizing and social support are robust predictors of disability in chronic medical samples (Adams, Thibault, Davidson, Simmonds, Velly & Sullivan, 2008; Sullivan, Stanish, Waite, Sullivan & Tripp, 1998; Okifuki, 2008). However, no research has directly examined disability in IC/PBS using a biopsychosocial approach.

Objective: The primary objective of this analysis is evaluate psychosocial factors as mediators within the “Disablement Process Model” (Verbrugge & Jette, 1994) in a sample of women affected by IC/PBS.

Results: Structural Equation Modeling (SEM) was used to examine model fit and how psychosocial factors (negative affect, catastrophizing and social support) mediate the relationship between impairments and functional limitations. The measurement model showed reasonably good fit to the data, $\chi^2(196, N = 253) = 371.621, p < .001, CFI = .93,$ and $RMSEA = .07$ (90% confidence interval [CI]: .06, .08). While social support and catastrophizing provided value to the model, negative affect was the key mediator between impairments and functional limitations.

Conclusions: Negative affect (i.e., depression and mental-health quality of life) significantly impacts the relationship between impairments and functional limitations and is thus a key variable of interest. This research can provide specific insights into targets of clinical intervention to decrease IC/PBS pain-related disability.

Debriefing on Demand: The introduction and validation of a “pause” button in medical simulation.

By: Ali Iglesias

Research Supervisors: Dr. McMullen and Dr. Burjorjee

The use of simulation in medical education is rapidly increasing. It has been shown to be an effective tool leading to improvements in medical knowledge, procedural skills, teamwork and communication (1). Specifically to the novice learner, simulation provides the opportunity for exposure to acute clinical scenarios without the risk of patient harm (2).

Debriefing has consistently been found to be the most important aspect of simulation (3-5). Despite this, little is known on the best practice of debriefing, relating specifically to time and context. Debriefing traditionally occurs at the end of the scenario, focusing on *reflection on action* (6), with high level debriefing being largely participant driven.

The novice learner brings unique challenges to simulation. They are typically unfamiliar with simulation, and may view it as a stressful environment due to a perceived lack of clinical knowledge and fear of judgment by peers and educators (7). For these same reasons, traditional debriefing is challenging with the novice learner, and results in largely didactic sessions.

Given the benefit of simulation with the novice learner, we believe it necessary to explore the development of an alternative debriefing strategy to decrease their perceived barriers to participation, optimize the debriefing process and hence the simulation experience. We anticipate that the introduction of the pause button to facilitate debriefing throughout the scenario, and hence focusing on *reflection in action*, will achieve these goals. Debriefing on demand will allow participants time to establish where the problem fits into learned schema, understand the elements and implications present in their chosen approach to the clinical problem at hand, and think about alternative management options. This time can also be used to reflect upon teamwork and resource management.

We intend to pilot our study among the junior anesthesia residents at an established simulation based education session. Participants will experience scenarios with the pause button to facilitate on demand debriefing. Feedback from the participants will be sought through both a formalized survey and open-ended inquiry statements. Information gathered will focus on the impact of the pause button in relation to participant stress/learning environment, team dynamics and integration of clinical theory and practice in crisis resource management.

Ideally this novel debriefing strategy will decrease the barriers to active participation of the student in both the simulation scenario and reflective debriefing process. We anticipate that the implementation of on demand debriefing will optimize the debriefing process and further facilitate the application of crisis resource management principles by learners.

References:

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Does Pre and Post operative Dextromethorphan Reduce Post Tonsillectomy Pain in Children?

Langdon M, Rooney R

Background: Tonsillectomy is a common pediatric surgical procedure which is associated with moderate to severe postoperative pain. Attempts at providing safe and adequate analgesia have been unsuccessful. Treatment with opioid and non-steroidal anti-inflammatory agents, although widespread, has been controversial due to potential central nervous system effects and increased risk of postoperative bleeding. The N-methyl-D-aspartate (NMDA) antagonist, dextromethorphan (DM), has been shown to modulate pain processes and reduce post-surgical pain and opioid consumption with few side effects. This drug may prove to be an effective and safe alternative for the treatment of post-tonsillectomy pain in children.

Knowledge Gap: The perioperative use of NMDA antagonists as pain adjuncts is increasing, but few studies address the specific use of many of these agents in pediatric surgery. Previous studies on the preoperative use of oral DM provide limited data and confounding results. Single-dose administration, variable use of intraoperative opioid, insufficient postoperative follow up, and smaller sample sizes may add limitations to these studies. New research addressing some of these concerns may lead to a better understanding of the perioperative use of DM in pain management for a common pediatric surgery.

Hypothesis: We predict that dextromethorphan will improve pain control which will be apparent through an integrated assessment of pain scores and reduced consumption of opioid pain medications.

Primary Outcome: Combined pain severity and opioid use score

Secondary Outcomes: Postoperative nausea and vomiting, respiratory depression, bleeding

Study Design: After obtaining parental consent we plan to recruit 74 patients, ASA class I and II (ages 3-12 years old) who are having tonsillectomy and/or adenotonsillectomy, into a prospective, blinded, randomized control trial. Patients will receive either study drug (DM) or placebo preoperatively, followed by a standardized anesthetic protocol including the use of inhaled gases, opioid and steroids. A second dose of study drug or placebo will be administered early in the recovery period, along with rescue opioid and anti-nausea medications if needed. Patients will be assessed, by post anesthetic care nurses at determined intervals, for pain and opioid consumption, nausea and vomiting, respiratory depression, bleeding. A follow up phone call after 24 hours to assess similar outcomes at home will also be performed. Based on previous assessments of pain using similar measurement tools we will consider a 20% decrease in pain severity as clinically significant.

Status Update: Over the past year we have submitted an Ethics Review Board application and had a peer review performed by the Department of Pediatrics. We are presently working towards Health Canada approval prior to proceeding with patient recruitment, hopefully in the Fall of 2011. We have been fine-tuning the specifics of the parental consent form and study protocol, including determination of appropriate sample size and statistical methodology in consultation with the Department of Biostatistics at KGH. Issues with the timing and means of drug administration perioperatively, as well as a recent Health Canada advisory on 'cold medication' administration to children have presented some challenges. We expect data collection and analysis to be complete by the Spring of 2012.

Acknowledgements: Rachel Phelan, Elizabeth VanDenKerkof, Andrew Day, Sarah Jones

Combined topical and intravenous tranexamic acid may be superior to intravenous alone, in reducing blood loss following coronary bypass surgery: An observational study

Authors: Ryan Mahaffey, Louie Wang, Ramiro Arellano

Introduction:

Blood loss during cardiac surgery remains a significant problem despite recent advances in surgical technique and postoperative (postop) care. Within Canadian medical centers, 24-54% of patients undergoing cardiac surgery receive blood products with a median transfusion of 2-3 units of packed red blood cells (PRBCs).¹ Both intravenous and topical tranexamic acid (TEA) decrease postop blood loss following cardiac surgery; however, there are no published studies examining combined IV and topical administration.²⁻⁵ The purpose of this study was to examine the efficacy and safety of combined IV and topical TEA in reducing blood loss after coronary artery bypass grafting (CABG).

Methods:

Following Ethics approval, we conducted a chart review of 160 patients undergoing elective, primary CABG. The first eighty eligible patients starting March 1st 2010 received combined IV and topical (2g in 100 ml normal saline poured into the pericardial cavity at the end of surgery) TEA (Top+IV) whereas the first eighty eligible patients starting January 1st 2009 only received intravenous TEA (IV). Demographics, chest tube blood loss, transfusion requirements, and adverse outcomes were evaluated. The primary outcome was 12-hour chest tube blood loss.

Results:

The two groups did not differ with respect to demographics, cardiac risk factors or intraoperative variables. Chest tube blood loss was lower in the Top+IV group at 3h (164.8 ± 102.2 vs. 242.7 ± 148.9 ml, $P < 0.001$), 6h (265.6 ± 163.7 vs. 358.8 ± 247.2 ml, $P = 0.006$) and 12h (374.3 ± 217.1 vs. 498.5 ± 336.6 ml, $P = 0.006$) postop. Chest tube blood loss was non-significantly reduced at 24 hours (583.8 ± 321.4 vs. 707.7 ± 521.1 ml, $P = .072$). The Top+IV group had a non-significant decrease in transfused PRBC (0.35 ± 0.93 vs. 0.56 ± 1.24 units, $P = .222$) and fresh frozen plasma (0.38 ± 1.11 vs. 0.61 ± 1.49 units, $P = .254$) over the first 24 hours. The IV group had one death compared to none in the Top+IV group, and one patient from each group required re-operation.

Discussion:

The addition of topical TEA to IV, significantly reduces post-CABG blood loss. There was a non-significant decrease in blood products and no difference in adverse outcomes. An appropriately powered, prospective study is warranted to further investigate the benefits and safety of topical TEA in cardiac surgery.

References:

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5. Cochrane Database Syst Rev2007(4):001886.

Do Antidepressants reduce post-operative pain? A systematic review.

Karen Wong, PGY-2
Supervisor: Ian Gilron

A multimodal approach to postoperative pain has long been advocated to balance the therapeutic and unwanted side effects of analgesic medications, particularly for opioids. Additionally, the concept of preemptive analgesia, with the aim to prevent central sensitization due to surgical trauma by administering pre-operative medications such as gabapentin have also been advocated¹. However, despite these efforts, post-operative pain continues to be a challenge to clinicians.

In the field of chronic pain, antidepressants have emerged as first-line agents for neuropathic pain, and are efficacious in other pain syndromes such as fibromyalgia, chronic headaches, and even osteoarthritis². It is not entirely clear how antidepressants function as analgesics, as they have multiple sites of action. What is known is that the antidepressants affect the pain pathway both centrally and peripherally. In animal models, antidepressants, primarily amitriptyline, has been shown to be an effective sodium channel blocker, in fact, more potent than bupivacaine³. Furthermore, in both in vivo and in vitro models, antidepressants have demonstrated anti-inflammatory properties. Centrally, their mechanisms of action become even more complex. Antidepressants are known inhibitors of monoamine reuptake, where noradrenaline and 5-HT appear to be particularly important in the pain modulation pathway. Furthermore, the NMDA and opioid receptors are also sites of actions for antidepressants, which further support their antinociceptive action. Finally, they also affect the reuptake of adenosine, an endogenous antinociceptive molecule, as well as adrenergic receptors, which are also known to be important in the pain pathway⁴.

The primary objective of this review is to elucidate the efficacy of antidepressants in postoperative pain and the secondary objective is to consider the incidence of side effects related to these medications used in this clinical setting. Only RCTs in adult patients are considered. The antidepressant may be given at any time in the perioperative period, of any dose and duration. Outcome measures considered are patient or observer-reported pain scores, reduction of opioid consumption, side effects and proportion of drop outs related to these ill effects. The electronic databases EMBASE, Medline, CINAHL, Cochrane library, and the registry Clinicaltrials.gov., will be evaluated for published literature. Additionally, unpublished trials or those that were not published in the mainstream channels will also be evaluated via the resource links from the Queens University library website for 'grey literature'. All studies will be examined systematically using the Cochrane Collaboration Risk of Assessment tool.

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Predicting Enhanced Care Unit Use In Elective Surgery

Serena Shum, Rob Tanzola, Dale Engen, Mike McMullen

Introduction Enhanced care units (ECU) were developed to provide care for patients whose requirements fall in between that provided by intensive care units and the general ward. ECUs are a scarce resource and surgeries are often cancelled due to their unavailability. Elective surgical patients are often admitted to the ECU for monitoring and to facilitate interventions to minimize perioperative morbidity. This chart review evaluated ECU use by elective surgical patients at a tertiary care center over a 6 month period.

Methods After ethics approval, a retrospective cohort study of patients who had elective surgeries with an ECU room booked pre-operatively was carried out. Patient characteristics, the number of interventions necessitating an ECU bed, and the predictors of need for post-operative ECU stay were examined. Two previously validated morbidity and mortality scores, the Surgical Risk Score (SRS)¹ and the Surgical Apgar Score (SAS),² were also evaluated. Patient data were extracted from the hospital's electronic record system and nursing progress notes.

Results 133 patients were scheduled for admission to the ECU following elective surgery. Sixty (45.1%) of these patients were actually admitted to the ECU; 73 patients (54.9%) were admitted directly to the surgical ward or were discharged. The most frequent surgery types admitted were general (27.8%), thoracic (15.8%), and orthopedic (14.3%). Of the ECU patients, 48.3% received an intervention during their stay. Uncontrolled pain (11.1%), administration of blood products (8.9%), desaturation (8.9%), tachycardia/arrhythmia (7.4%), hypotension (7.4%), and decreased level of consciousness (6.7%) were the most frequent events. 75.0% (n=12) of referrals by anesthesia required an intervention while only 40.4% (n=19) of the referrals by surgery did (p=0.050). Patients who went to ECU were more likely to have ART (p<0.001) and CVP (p=0.001) lines. The SRS was a significant predictor (p<0.001) of patients that went to the ECU; the SAS was a significant predictor (p=0.027) of patients requiring an intervention while in ECU.

Discussion The results of this study demonstrate the difficulty in predicting the need for ECU admission based only on pre-operative factors. Less than half of patients identified were actually admitted to the ECU postoperatively; of those, less than half required an intervention. The high frequency of uneventful ECU stays and the relatively common nature of interventions occurring in this study may be the result of ECU routine care which prevented patients from deteriorating and requiring major interventions. Alternatively, these patients potentially could have been sufficiently cared for on a ward. The SRS, which is a score based solely on pre-operative factors, predicted admission to ECU and can be used as a means to identify a patient's need ECU admission during the preoperative assessment. Subsequently, the SAS, which is based on both pre- and intra-operatively factors, predicted the need for an ECU intervention. Consideration should be given to the development of a predictive score that emphasizes intraoperative factors and early post-op factors to optimize allocation of this scarce ECU resource.

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Efficacy of a Preoperative Smoking Cessation Intervention by Surgeon versus Pre-Surgical Screening Clinic

Resident Presenter: Rebecca Gerlach, PGY-3

Supervisor: Janet van Vlymen

Introduction:

Patients who smoke are at increased risk of peri-operative complications, specifically wound infection, poor bone and incision healing, respiratory complications and cardiovascular complications. Recently, several randomized controlled trials have studied smoking cessation interventions implemented as late as 3 weeks prior to surgery, resulting in a significant reduction in post-operative complications. To date, no study has compared the efficacy of such an intervention delivered by the surgeon versus the presurgical screening program versus no intervention, as we propose. The purpose of the current investigation is to deliver information on these complications and provide extra information to patients regarding the hazards of smoking peri-operatively and to observe for alterations in patient behaviour based on who delivers the intervention.

Protocol:

Consent for this study was obtained from the Queen's University Research Ethics Board. Patients are identified at the time they are booked for surgery as being daily cigarette smokers. Exclusion criteria include age <18 years, surgery date <1 week away, or only local or topical anesthetic required. A research assistant obtains written informed consent for participation in the study while the patient is still in clinic. They are randomized to one of three groups by means of a sealed envelope: Surgeon intervention (SI), Pre-Surgical Screening intervention (PI), No intervention (NI). All patients complete a questionnaire to identify their smoking habits and smoking history.

The intervention consists of three parts:

- **Targeted Advice:** The provider (i.e., surgeon or pre-surgical screening staff) provides advice to quit or reduce smoking before surgery and a brief summary of the major benefits of smoking cessation preoperatively.
- **Information and referral:** Emailed or mailed document details benefits of smoking cessation with referral to the Smoker's Helpline for counseling and resources.
- **Weekly reminder emails or mailings:** Provides further advice and encouragement to continue with smoking cessation attempts.

Results of the intervention will be followed up by questionnaire and exhaled CO measurement on the day of surgery, as well as a 30-day follow-up phone call.

Impact of Spontaneous Versus Evoked Neuropathic Pain on Pain-Related Quality of Life

Grant B, Gilron I, Orr E.

Background: A substantial percentage (18-42%) of patients with diabetes suffer from disabling pain due to neuropathic pain. Neuropathic pain is known to have a significant impact on quality of life and activities of daily living. Given that current pain therapies are inadequate for 40-60% of affected patients, much effort is being invested into the identification of new targets of pain modulation. Research into novel drug therapies for pain is largely based upon animal pain models of stimulus-evoked pain since very few animal models of spontaneous pain exist. Patients with neuropathic pain describe an array of sensory abnormalities. These can be pains of a spontaneous nature (those that arise without detectable stimulation) and evoked pains (abnormal responses to stimuli). Spontaneous pain can be continuous, steady and ongoing, or it can be paroxysmal, episodic and intermittent. It is not known what impact spontaneous pain versus evoked pain has on quality of life and activities of daily living. There have been very few reports on the ability of patients to differentiate between these two types of pain and their relative impact on pain-related quality of life.

Study Questions:

1) Can we distinguish between spontaneous pain and stimulus-evoked pain in patients with neuropathic pain and do they differentially impact upon pain-related quality of life? 2) Can we develop an inventory of questions to be used in further investigations, which quantify the functional impact of spontaneous versus evoked pain?

Study Design: This is a prospective observational study involving patients with neuropathic pain. 50 adult patients will be recruited who experience daily moderate pain for at least 3 months. Patients will be contacted by phone or mail and informed consent will be obtained. They will then complete questionnaires relating to pain intensity, a neuropathic pain questionnaire, and a questionnaire looking at the functional impact of neuropathic evoked and spontaneous pain. These questionnaires will be completed on two separate occasions approximately 3 months apart. The proposed timeline will be 1 year.

Impact: The proposed study is innovative in that it closely examines patients' experience of pain (specifically, spontaneous versus evoked pain) and how it impacts their activities of daily living. Given our focus on humans suffering from neuropathic pain, results from this study will more appropriately guide future research strategies and may emphasize more clearly that additional experimental models of spontaneous pain are needed.

Canadian Anesthesia Workforce Assessment 2010

Drew McLaren, Jason Denis Cyr, Rob Tanzola, Rick Chisholm, Elizabeth VanDenKerkhof and Dale Engen.

Introduction: In the early part of the past decade there were a number of studies that identified a shortage of anesthesia providers in Canada with predictions that this shortage would worsen significantly with time. In the interim there have been a number of interventions, such as increasing training positions, introduction of Anesthesia Assistants, and other policy changes that may have affected the shortage. The purpose of this study was to re-assess the current and near future need for Anesthesiologists in Canada.

Methods: An email list for Canadian Department Heads of Anesthesiology and funding was obtained from the Canadian Anesthesia Society. After ethics approval, two iterations of an online survey were sent in December 2010. Results were compared to a similar survey from 2002. Percent change in vacancy rates was assessed using chi square analysis. Statistical significance was set at $p < .05$.

Results: A total of 274 surveys were sent. This analysis is based on respondents (31%) representing departments providing care at 115 different sites. Twenty-five percent of respondents were in academic health science centers and 75% were in community centers. The breakdown of anesthesia providers was 92% specialist and 8% family doctor anesthesiologists in these departments. Nationally, the respondents reported an immediate need for anesthesiologists ($n = 40.5$) with a vacancy rate of 4.42%. Larger urban centers (population > 250,000) reported significantly more vacancies (OR 2.9, CI 1.1 – 8.0). Overall, there was a significantly lower vacancy rate in 2010 (4.42%) versus 2002 (9.6%) ($p < 0.001$). Regionally, vacancy rates improved between 2002 and 2010 in Ontario (38% vs. 28%) and Quebec (30% vs. 22%), but worsened significantly in British Columbia (10% vs. 25%, $p < 0.001$). Half of the departments reported members working past their planned retirement. Reasons included personal or financial (73%) followed by staffing issues (23%). Sixty percent of departments reported annual holidays for members of 5 to 8 weeks and 30% reported greater than 9 weeks. In addition, departments were more likely to report having to give extra holiday time due to over staffing versus asking members to give up holidays due to staffing shortages. When asked to estimate FTE anesthesiologists needs five years in the future, 40% expected no change, 3% estimated needing fewer and 57% projected needing additional FTE anesthesiologists.

Discussion: Our findings reveal an immediate need for more anesthesiologists in Canada. However, it appears that the national vacancy rate has improved while the deficit in British Columbia has worsened since 2002. Ongoing assessments are needed to measure the impact of increased training positions, number of holidays, and retirements on the available workforce.

Spinal cord functional MRI (fMRI) studies of osteoarthritic knee pain and the effects of acupuncture- a pilot study

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Background: Osteoarthritis(OA) of the knee is a degenerative disease leading to chronic pain and disability in primary care. Acupuncture is a recognized effective treatment for OA knee pain. Functional MRI (fMRI) is a useful neuroimaging tool in studying pain perception. The objective of our study is to characterize the lumbar cord fMRI activity of OA knee pain both at baseline and after standard acupuncture therapy and, to correlate such activity with reported levels of pain. We investigate the activity at the lumbar cord to circumvent the cognitive and emotional modulations in the higher centres which are often inseparable in the process of nociception.

Methods: This pilot study was conducted at the Primary Care Research Centre and MRI facility at Queen's University, Kingston, Ontario. Five subjects aged 50-75 with a confirmed diagnosis of OA knee are recruited. Pain levels were assessed at the baseline using the standardized visual analogue scale (VAS) and the Western Ontario and McMaster Universities (WOMAC) osteoarthritis index pain score questionnaires. They then proceeded to fMRI scanning of the spinal cord as they performed resisted knee movements to achieve a standardized level of pain during the scanning. Immediately after the scanning, acupuncture was administered at 5 standard points. 100% copper 0.25mmx25mm acupuncture needles were inserted at a depth of 20mm for 20 minutes with manual stimulation every 5 minutes. Upon the completion of acupuncture treatment, all subjects immediately received a second fMRI scan by repeating the same resisted knee movements and VAS pain scores were obtained. In the following 3 weeks, 6 additional outpatient acupuncture treatments were given at intervals of every three days. fMRI scans with resisted knee movements were performed and pain scores were obtained after the 3rd, the 6th outpatient treatments and 1 month after.

Results: Data showed changes in fMRI activity at the L3/L4 lumbar spinal cord level after immediate treatment and were maintained at follow-up scans.

Conclusion: Our data suggested that the analgesic effect of acupuncture on OA knee can be reflected by spinal cord fMRI which may be used as a translational tool in quantitative study of pain. A sham-controlled study with larger sample size is warranted to confirm our findings.

Perioperative Ketorolac is Associated with Increased Postoperative Bleeding in Reduction Mammoplasty.

Thomas R. Cawthorn, Rachel Phelan, John S. Davidson, Kim E. Turner

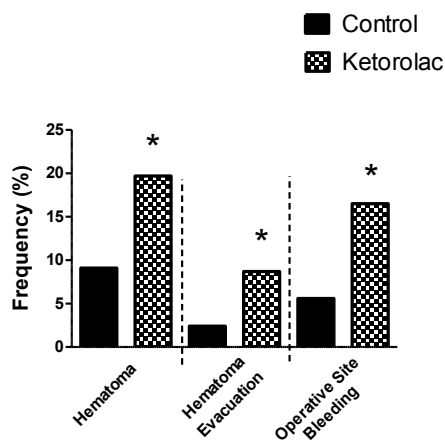
Purpose: This study was conducted to determine whether intravenous ketorolac administration increased the likelihood of surgical bleeding when used perioperatively for pain management in reduction mammoplasty procedures.

Methods: With Ethics approval, a retrospective chart review was conducted for patients who underwent reduction mammoplasty at our institution between 2004 & 2007. Data pertinent to demographics, ketorolac administration and bleeding-related outcome measures were recorded for each patient. A total of 379 patient charts were reviewed. Of these, 127 received a single dose of intravenous ketorolac (15 or 30 mg) either intraoperatively or in the post-anesthesia care unit (treatment group). The remaining 202 patients were not given ketorolac and served as the control group.

Results: Results for the bleeding-related outcome measures are summarized in Figure 1. Patients who received ketorolac had a significant increase in the incidence of operative site bleeding (RR = 3.0, CI=1.6-5.7), documented hematoma formation (RR = 2.2, CI=1.3-3.6), and requirement for emergency surgical hematoma evacuation (RR = 3.6, CI=1.4-9.6) compared to the control group. In summary, perioperative ketorolac was associated with a 3-fold increase in the likelihood of excessive bleeding and a greater than 3 fold increase in the likelihood of urgent or emergent reoperation.

Conclusions: Our data suggest that it may be prudent to avoid the use of ketorolac in reduction mammoplasty, reserving it for those cases in which its potential benefit may outweigh the serious risk of postoperative bleeding. Given the frequency of this procedure (88,337 cases in the U.S and 10,696 in Canada during 2008), this study has substantial clinical practice guideline implications.

Figure 1.



*significant (two-tailed Student's T-test $p < 0.05$) for control versus ketorolac group

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Critical Appraisal Essay

By: **Gini Lee, MD, PGY-1, Queen's Anesthesiology**

Title of the Publication: ***“Lung function after total intravenous anaesthesia or balanced anaesthesia with sevoflurane”***

Authors: ***W. Tiefenthaler, D. Pehboeck, E. Hammerle, P. Kavakebi and A. Benzer.***

Br J Anaesth. 2011 Feb;106(2):272-6.

INTRODUCTION

Total intravenous anesthesia (TIVA) is becoming widely used in anesthesia for its various advantages in terms of faster recovery, less postoperative nausea and vomiting, less pollution or avoidance of using volatile agents, ease of use and drug titration, portability, and favorable use in pediatric procedures and ambulatory surgeries; its use has become increasingly popular in the past 2 decades. However, several barriers such as expense of TIVA drugs and equipment, increased awareness and delayed clinical responses of the patient, understanding pharmacokinetics, drug interactions and using technologically advanced equipment requires the experience and expertise of the anesthetist. Despite these disadvantages, TIVA will continue to be applied in many areas in medicine and so research into how it affects patients in terms of safety, postoperative recovery, pharmacology and physiology is important.

This study addresses how lung function is affected after general anesthetic with TIVA vs. balanced anesthesia (BAL) with sevoflurane. The results were published in the British Journal of Anesthesia, Nov 2010 and was conducted by Tiefenthaler, Pehboeck, Hammerle, Karakebi and Benzer.

Comparisons between BAL and TIVA are made to see whether the known negative effects that general anesthesia has on lung function affects all parameters to the same extent or if they are affected differently. It is an experimental study, which compares two groups; thus, needs to address research questions that involve making comparisons, and should specify at least one hypothesis, in this case, whether TIVA or BAL, which group would have a greater effect on lung function. However, there was no definite hypothesis stated at the outset and the result was stated as a post hoc hypothesis of change in FVC volume as the only difference between the two groups, but what its implications are is left up to the reader.

METHODOLOGY

The study is a prospective, double-blind, randomized control study in which two groups of patients both undergoing the same treatment, elective lumbar disc surgery in the prone position, either received TIVA or BAL, and data is collected on the outcome, lung function. It is an experimental study where patients were randomly allocated according to a randomization list to their groups for comparison of the effect of TIVA vs. BAL on postoperative lung function. The assessors that administered pre and postoperative spirometry were also blinded in regards to the randomization group. The controls were set, by using the preoperative lung function tests, determined by spirometry, to assess for the changes in lung function as result of being administered the treatment.

The study was ethically sound, being approved by the institutional ethics committee, before patients were enrolled in the study. They appropriately included only people with normal preoperative function for both groups so that the control values could be determined. They appropriately excluded patients who could not perform spirometry completely or had conditions such as morbid obesity, obstructive sleep apnea, significant cardiopulmonary disease and those with compromised liver and kidney dysfunction in order to eliminate confounders and strengthen the likelihood that any changes in lung parameters are due to the effect of the treatment or intervention, TIVA or BAL in this case, and not to differences in patient characteristics.

The sample size was determined prospectively, taking into account the effect size and variability, using preliminary data on pre and post operative FEV1. They selected adequate sample sizes for both groups which would give 80% power to detect a statistically significant difference, a beta value of 0.20 which is within the conventional range and also appropriately set alpha at 0.05, using a two group t-test with a 0.05 two sided significance level. They took into account effect variability by using continuous variables (spirometry values) to measure lung function and used paired measurements and applied a

paired t-test to compare differences in pre and post-op spirometry, which removes the variability between subjects with respect to the outcome variables.

They ensured that all other predictor variables were similar between both groups and they tried to get rid of all other possible causes that would affect spirometry values at all phases of the experiment. To eliminate patient sedation or pain response as a contributing factor, no preoperative medication was given to subjects, post op pain was adequately controlled with non sedating medication using paracetamol and diclofenac, and if not controlled adequately, then given an equal and small dose of morphine bolus, adequate analgesia was rated using visual analog scale (VAS) score and spirometry was only performed when patient was alert and fully cooperative. Spirometry testing was done after a thorough demonstration of the correct usage and at each assessment; spirometry was performed 3 times to meet the criteria of the European Respiratory Society (ERS). They only studied patients undergoing lumbar disc surgery in the prone position, a peripheral surgical procedure, which would least influence changes in lung function.

RESULTS

In both groups, only 2-3 subjects were excluded due to inability to completely perform pre/postoperative pulmonary function tests, and this data was excluded from the analysis. Both groups had comparable results both within and between groups. From previous studies, it is already an established fact that lung function declines in patients emerging from general anesthesia and both show a restrictive pattern¹. As expected, both groups had a decrease in all respiratory parameters, FEV₁, FVC, MEF 25-75; however, there was a significant between-group change in FVC only, while all other parameters decreased by the same degree. The spirometry results are shown as mean and standard deviation and are normally distributed. Most values have a standard deviation approximating 1.0 and are similar both between and within groups in all parameters, which show that the values have small variations around the mean, and are statistically appropriate.

DISCUSSION

Based on the results, there was no clinically significant finding. The fact that one value, FVC, was decreased more in TIVA patients than BAL patients had no effect clinically in terms of their recovery post operatively. However, this study was done on normal patients with previously good lung function. It may be that the larger decrease in FVC that occurs in TIVA may have an adverse effect in patients with lung disease or patients undergoing thoracic or abdominal procedures. The study goes into speculation about why the better value was

seen in BAL, but does not specifically correlate these ideas with the pertinent result, namely the FVC, it doesn't say why or how the FVC itself becomes affected by the different techniques and how it is clinically relevant.

The authors provide interpretations that could potentially explain the smaller decrease in FVC in the BAL group although they do not go into any detail in regards to the physiologic reasoning for the findings. They quote previous studies that are contradictory; they say that one study showed that sevoflurane had a negative effect on diaphragmatic contractility² and another found that it did not have any affect.³ But then another study showed that a single bolus of propofol produced a decline in diaphragmatic function⁴, so this could potentially be the cause of greater decrease in FVC postoperatively seen in TIVA.

The authors provide an alternative interpretation that could account for the better FVC shown in BAL than TIVA. A study was done by the same authors to investigate the frequency of coughing during emergence following general anesthesia with TIVA or BAL. They found that with TIVA, there was significantly less coughing when compared to BAL⁵, which in the context of that study was a favorable clinical outcome. Increased coughing in BAL is a potential confounding factor. Based on the results of this study then, they could do another follow up study which would match both groups and eliminate this confounding factor by increasing FVC maneuvers in TIVA patients to see if the effect on decreased FVC became smaller. This would show that there was no significant difference in lung function with general anesthetic using TIVA vs. BAL.

Another potential confounder is the fact that the number of smokers was almost twice as high in the BAL group than the TIVA group. However, this had no effect on preoperative lung function, which is why they were included in the study as normal subjects. But, under general anesthesia this may not hold true. Maybe smokers cough more, allowing more coughing and increased vital capacity maneuvers, and with the absence of detectable lung disease in this group, accounted for the better FVC parameter seen in the BAL group.

Then what could account for the greater decrease in FVC seen in TIVA? Although an ideal combination of agents, propofol and remifentanyl, was used for the TIVA technique, perhaps the sedative effects of the agents, or other pharmacological factors while using TIVA, may be the cause for a greater decline in FVC. Pharmacodynamic synergism has been shown between propofol and opioids, such that the higher the opioid plasma concentration, the lower the plasma

propofol concentration required for the same effect. It is also known that the optimal propofol concentration is dependent on the opioid chosen and the length of infusion duration. Thus, the longer the context sensitive half life of the opioid, the more the opioid delays recovery. In addition, remifentanyl has a more rapid onset offset, making it ideal for infusions; remifentanyl and propofol is an optimal choice for TIVA technique because of its better "recovery" profile⁶. Therefore, it seems as though the authors may have initially set out to hypothesize that TIVA may have a favorable outcome which would result in better postoperative lung function recovery, including other parameters such as hemodynamic response and coughing, but the spirometry results are contrary to this and the finding of only FVC being in fact more decreased was stated as a post hoc hypothesis. In addition, they allude to the fact that the negative effect on FVC was demonstrated within the first postoperative hour in the conclusion section of the paper but they do not tell us whether they went beyond that to extend the postoperative recovery times for lung function. Perhaps in the next several hours the propofol/remifentanyl effect had worn off and there was a rapid recovery of lung function and FVC to the same values as in BAL? So, we cannot conclude that TIVA as a general rule has a more negative effect on FVC.

In order to make these results clinically useful, further studies should be performed to see if the FVC decline is reproducible in TIVA vs. BAL and then test the effect FVC decrease in TIVA has on patients with abnormal lung function or respiratory disease. Based on these findings, it may be useful for the anesthetist in regards to when they make decisions on which method to use based on the type of surgery, patients' previous lung function, comorbid conditions; for example, in thoracoabdominal procedures TIVA may be more desirable in order to reduce the coughing and pain response associated with it.

But in certain respiratory disease states it may be more beneficial to use BAL because of the more favorable decline in FVC or because of the bronchodilating properties of volatile anesthetics such as in asthma or interstitial lung disease. In addition, more studies using different agents and techniques in TIVA should be explored in order to ascertain the effect profiles on lung function and post-operative recovery.

In conclusion, although the hypothesis was not clearly stated, the methods used were sound and the resulting findings, which were not clinically important in normal subjects, have important implications for future research and application of TIVA techniques in a variety of clinical situations.

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Critical Appraisal Essay

By: **Judith Marois, MD, PGY-1, Queen's Anesthesiology**

Title of the Publication: ***“Hemidiaphragmatic Paresis Can Be Avoided in Ultrasound-Guided Supraclavicular Brachial Plexus Block”***

Authors: ***Renes SH, Spoormans HH, Gielen MJ, Rettig HC, van Geffen GJ.***

Regional Anesthesia & Pain Medicine 2009 Nov-Dec;34(6):595-9.

General

Regional anesthesia may be preferable to general anesthesia in certain cases because it avoids the risks associated with general anesthesia. Yet regional anesthesia is not without risk. For example, certain approaches to the brachial plexus nerve block carry the risk of pneumothorax or hemidiaphragmatic paresis. This study looked at the side effect of hemidiaphragmatic paresis in supraclavicular brachial plexus block, evaluating ultrasound-guided technique for a decreased incidence of hemidiaphragmatic paresis. This paper comes from the Netherlands, where the study took place at Radboud University Nijmegen Medical Centre and Bernhoven Hospital Oss.

Introduction

This study addresses the issue of hemidiaphragmatic paresis occurring with the supraclavicular approach to brachial plexus block. Hemidiaphragmatic paresis is problematic for patients with impaired respiratory function and can be a limiting factor in selecting patients for regional anesthesia for upper limb surgeries. The nerve-stimulation single injection supraclavicular approach has an incidence of hemidiaphragmatic paresis of 50-67% (1-3). This is thought to be due to local anesthetic spreading directly to the phrenic nerve or toward nerve roots C3-C5 (8-9). The authors of this study hypothesized that injecting local anesthetic (LA) caudal and posterolateral to the brachial plexus avoiding LA spread and direct phrenic nerve block can minimize the incidence of hemidiaphragmatic paresis. Testing this hypothesis addresses the problem of this side effect and if correct may provide a safer regional anesthesia technique.

Methodology

This is an observer-blinded, randomized, prospective clinical trial using human subjects. The anatomy of the human brachial plexus and phrenic nerve are significant components of the techniques being tested. The control group is experimental because it is a standard treatment rather than a placebo. Preliminary clinical findings were used to calculate the sample size assuming 90% power

and a 5% level of significance, resulting in 29 patients required per group. The population is similar to my own patients who present for upper limb surgeries: men and women aged 18-75 years and ASA class 1 and 2. This multi-centre study took place at two locations.

Clinical equipoise was met because at the time of the study uncertainty existed as to which technique, ultrasound (US) or nerve-stimulation (NS), had a lower incidence of hemidiaphragmatic paresis. Treatments met the standard of care for both the groups because, as they are described in the article, both approaches to supraclavicular brachial plexus block conformed to practice standards and have been previously validated (5-7). Both institutions involved in the study gave ethics approval after review board assessment. Patients provided appropriate written informed consent.

Exclusions occurred for several reasons. Any patients who refused to undergo a supraclavicular brachial plexus block or from whom informed consent could not be obtained were excluded on ethical basis. Pregnant patients were excluded. Contraindications to regional anesthesia excluded patients with: pulmonary and cardiac disorders/conditions, neuropathy, coagulopathy, allergy to local anesthetic, and preexisting hemidiaphragmatic dysfunction. Patients with BMI of 35 kg/m² or greater were excluded, possibly because of the technical difficulty in performing the block and the potential for respiratory complications.

The experimental protocol in this study is designed to test the hypothesis. For supraclavicular brachial plexus nerve block the control group used single injection nerve-stimulation technique and the test group used ultrasound to identify anatomical structures and then to guide local anesthetic injection in 2 sites. Comparing the incidence of hemidiaphragmatic paresis in the two groups to see if it is lower in the US group tests the hypothesis. This study could be reproduced, with its validated methodology, because it describes in sufficient detail the regional anesthesia techniques, drugs and equipment

used. A sequence of random numbers generated by computer and distributed in sealed envelopes randomized the study participants to their groups.

The incidence of hemidiaphragmatic paresis was the primary endpoint. It was assessed thirty minutes after the block and compared between the two groups. Power was sufficient to justify secondary endpoints of ventilatory function (FVC, FEV1, and PEF). This study protocol is clinically relevant because it uses standard techniques of regional anesthesia and could be used by a center to evaluate their rate of hemidiaphragmatic paresis.

Due to the type of intervention being tested, blinding the patient or the clinician is impossible; the patient would know if they underwent nerve stimulation and the clinician clearly knows which regional anesthesia technique was used. To address this it was important to use objective measures and independent blinded observers for data collection. Measurements were taken before the block and at 5, 10, 15, 30, 180, and 360 minutes post-block, producing three sets of data. Each measurement was taken 3 times and the values averaged. An independent observer assessed hemidiaphragmatic paresis by measuring post-block diaphragm movement with ultrasound. Hemidiaphragmatic paresis was also evaluated by an independent observer using a bedside spirometer to measure lung function. Block success was determined by a blinded observer assessing sensory spread of the block using a 3 point scale and pinprick testing in dermatomes C4 and C5 and the sensory distributions of the musculocutaneous, median, radial, and ulnar nerves. Analysis was done using SPSS Version 16.0 statistical software and GraphPad Prism version 5.01 for Windows. Data was analyzed with the appropriate statistical tests as described in the article.

Results

The two groups are comparable as listed in Table 1, having similar characteristics of age, weight, and height. Similar prognosis between the groups exists as there is a mix of ASA class 1 and 2 in each group. No subjects or data were eliminated from the analysis which maintained the principle of intention to treat. No patients failed to complete the study or switched treatment group. This study presents details of results in text, table, and graphic form. None of the 30 patients in the US group experienced hemidiaphragmatic paresis, while 16/30 patients in the NS group had partial/complete paresis. In the NS group lung function at 30 minutes (peak expiratory flow, forced vital capacity, and forced expiratory volume at 1 second) decreased by at least 20% in patients with total hemidiaphragmatic paresis (Figures 3 and 4). Two patients in the NS group experienced block failure, which was defined as decreased instead of absent sensation. The rate of block success was not statistically significant between the groups. There were

similar postoperative pain scores between the groups.

Discussion

The authors conclude that there is no association between hemidiaphragmatic paresis and supraclavicular brachial plexus block done by US guidance using 2 injections. The results appear to support this conclusion; however, these results do not explicitly address the question of hemidiaphragmatic paresis being due to direct phrenic nerve block. When comparing the incidence of hemidiaphragmatic paresis, the assumption is that with nerve-stimulation there is greater possibility of spread of local anesthetic to the phrenic nerve because of the needle location. According to the authors of this study, ultrasound-guided block with 2 injections and a different needle path from the nerve-stimulation technique, avoids direct phrenic nerve block and thus hemidiaphragmatic paresis. Although this seems a reasonable conclusion, we cannot be certain that this is the case because direct observation of the brachial plexus to assess spread of local anesthetic after the block did not occur.

Alternative explanations may be that slight anatomical variations influence the spread of LA in the brachial plexus, which is difficult to detect (4). Or, there may be an unknown factor contributing to the mechanism of hemidiaphragmatic paresis. Possible differences in patients' sensitivity to local anesthetics and any of the factors that varied between the nerve block techniques: different patient positioning in the two groups, 2 injections versus one; are all possible explanations for the data.

Results for the incidence of hemidiaphragmatic paresis are statistically significant in the NS group compared to the US group (US 0%, 95% CI 0.00-0.14; NS 53%, 16/30 P<0.0001). There was a significant decrease in diaphragmatic movement in the NS group (P<0.001; Figure 2). FEV1, FVC, and PEF (P<0.01) were significantly reduced and decreased at least 20% in patients with total hemidiaphragmatic paresis measured 30 minutes after block (Figure 3, 4). Results are also clinically significant because a lower incidence of hemidiaphragmatic paresis changes the risk associated with this approach to brachial plexus block. More patients might be eligible for this type of block if ultrasound were used, even if they have a mild to moderate degree of decreased lung function. Any opportunity for safer practice is clinically relevant and merits consideration.

The incidence of hemidiaphragmatic paresis in the NS group (53%) is consistent with previous studies which have shown an incidence of 50-67% (1-3). The results of this study add to the existing literature by comparing two frequently

employed techniques for supraclavicular brachial plexus block and giving results that point to a better side effect profile for the US technique. This also adds to the information available for trainees and anesthesiologists wishing to perfect their knowledge and skills in techniques of upper extremity regional anesthesia.

This study contains several limitations. The authors note that although power was insufficient for determining the true incidence of hemidiaphragmatic paresis in ultrasound-guided block the aim of the study was to test for a lower or minimized incidence rather than the true incidence. Another limitation is that the results of this study only apply to the local anesthetic in the quantity used (20mL of 0.75% Ropivacaine). A limitation of analysis is that this study does not answer the question of causation because it did not directly test the mechanism of hemidiaphragmatic paresis. The regional anesthesia techniques being compared differ in several ways: needle position, the number of injections, and the patient position (supine for NS and semi-sitting for US); creating the potential for confounding. Another limitation is the small sample size which gives a less precise confidence interval. Significant factors sometimes come to light only when a much larger sample size is used. As well, the patients who refused to participate may represent a significant variable missed by their absence from the study.

Several unanswered questions for future work arise: is it possible to maintain block success while decreasing the volume of LA injected under ultrasound guidance? What is the incidence of hemidiaphragmatic paresis in a population that includes patients with BMI greater than 35 kg/m² or ASA class 3? What is the precise mechanism or the true incidence of hemidiaphragmatic paresis?

Applicability

From reading this paper I have learned about hemidiaphragmatic paresis as an important side effect of supraclavicular brachial plexus block. Although this is a small study with some limitations, the results demonstrate to me that ultrasound is an important technique in development for regional anesthesia. This study's results will affect my clinical practice by encouraging the use of ultrasound for supraclavicular brachial plexus nerve block. However, applying this

study to my practice is limited by the fact that it was done in a different country and there were no ASA class 3 patients. Before abandoning the nerve-stimulation technique of regional anesthesia, more studies are needed in this area to address the limitations of this study and increase knowledge about ultrasound-guidance for this type of nerve block. In the meantime while research continues, developing one's skills with ultrasound would be beneficial as we aim for safer regional anesthesia practices.

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Critical Appraisal Essay

By: Erika Nguyen, MD, PGY-1, Queen's Anesthesiology

Title of the Publication: *"High-fidelity simulation demonstrates the influence of anesthesiologists' age and years from residency on emergency cricothyroidotomy skills"*

Authors: *Siu LW. Boet S. Borges BC. Bruppacher HR. LeBlanc V. Naik VN. Riem N. Chandra DB. Joo HS.*

Anesthesia & Analgesia. 111(4):955-60, 2010 Oct.

Does Age matter?

According to the Canadian Institute for Health Information (CIHI), physicians represent one of the oldest workforces of the health care system. Indeed, their average age of 49.7 years old is the highest one of all health practitioners groups. In a 2009 report¹, the CIHI states that about two thirds of physicians between the age of 70-74 and about three fifth of those between 75-79 years old were still practicing. Of note, according to American statistics, anesthesiologists tend to retire younger compared to physicians from other specialties.

The concern of deteriorating cognitive functions and motor skills affecting older physicians' practices has been addressed in numerous articles. Along with this, the ever expanding simulation technologies, which were not as accessible in the past, are more and more integrated especially in residency training programs and has demonstrated a significant impact in procedural skills acquisition. Few studies have looked into the relationship between age and specific skills using simulation and even less have studied the anesthesiologists' population and we do know that their work requires a high degree of knowledge and skills. The importance of further research on this subject might be of importance in evaluating the role of continuing medical education for procedural techniques.

I ran into this article as I was researching recently published studies addressing simulation in anesthesiology training.

Methodology

This is a single-centered, prospective, controlled, single-blinded study whose goal is to investigate the association between age and learning and performance of simulated

cannot intubate/cannot ventilate emergency percutaneous cricothyroidotomy in a high fidelity simulated setting.

The population studied consisted of the 39 anesthesiologists, 3 of which declined participation, from University of Toronto's affiliated St-Michael's hospital. The participants were separated into two groups. The first group comprised participants aged younger than 45 and the second participants over 45 years old. The hypothesis was that the younger group would have significant shorter procedural times. It was calculated that 17 participants per group were needed to obtain a one standard deviation of difference in procedural time which would be considered of clinical importance.

After a 1-hour introduction to the simulation center, all participants were presented with a scenario of cannot ventilate cannot intubate situation that only ended with successful cricothyroidotomy. This was immediately followed by a standardization process consisting of a practical and video-assisted teaching session on percutaneous cricothyroidotomy. Then, all participants were put through another scenario of cannot ventilate cannot intubate.

All scenarios were video-taped and performance was scored by two evaluators blinded to the study outcome and whether the performance was pre or post standardization. Along with procedural time, other primary outcomes included a performance score that was given following a task-specific checklist as well as a global rating scale score.

In their data analysis, the authors attempted to correlate age, years from residency, clinical practice hours per week, previous simulation experience and previous cricothyroidotomy experience (simulated or not) to the 3 primary outcomes.

Results

Demographic analysis of the two study groups demonstrated that there was a statistically significant difference in previous simulation experience, previous simulated cricothyroidotomy on mannequin or pig and number of clinical practice per week in favor of the younger group. However, there was no difference in the number of previous percutaneous cricothyroidotomy on patient.

Their study showed that age and years from residency both correlated independently with all three outcomes before and after standardization. Also, performance was significantly improved after teaching for both groups.

In their discussion, the authors suggest that training effectively improves ability to perform complex tasks such as emergent cricothyroidotomy. They also points out that older anesthesiologist tend to have longer procedural time and overall performance score even after standardization for this technique which supports the theory of age-related declining psychomotor abilities. However, they do benefit more from skill training.

Discussion

The primary hypothesis of the study is that older anesthesiologist will have longer percutaneous cricothyroidotomy procedural times than younger ones which the results do show. It is difficult to argue against the methodology through which the research was conducted.

The population studied is likely representative of the anesthesiologist population in most Canadian teaching hospital and no one was excluded. Although no details were given as to why 3 subjects declined participation, it is unlikely that this would have significantly affected the results. The authors' protocol and equipment used is thoroughly detailed in a way that it could be fairly uncomplicated to reproduce it in another institution provided that it is equipped with a high fidelity airway simulation laboratory.

One might say that, in the older group, previous simulation experience was significantly less and this has been correlated with poorer performance. However, the authors attempted to overcome this potential confounder, with standardization. In fact, post standardization, previous simulation experience was not correlated to performance which was still poorer in the older group.

Considering the evaluators who graded the participants' performance could not be blinded for age and could have made assumptions, we could identify this as a differential information bias that could negatively affect the older group performance. Still, if there was such a bias, it would only affect the global rating scale score and the checklist score. Measured procedural times would be minimally affected as it was clearly defined as the time from the subject grasping any equipment from the cricothyroidotomy kit to the time of successful cricothyroidotomy as defined by positive capnography.

As said, this study was conducted on a methodologically sound manner and very few flaws can be pointed out. However, it is not irrelevant to question the purpose of the study. As the authors mention in their discussion, their goal was to simply show that age may affect performance and learning of complex tasks such as emergent cricothyroidotomy and not to determine if there's a cutoff age beyond which an anesthesiologist should retire or consider additional training (even though the study shows that the benefit of training is greater for older anesthesiologists). In other words, the authors don't state specific recommendations as to how these results can be used or can affect practice and only suggest that further research should explore the benefit of continuing medical education to physicians further away from residency.

The authors have the merit of being among the first to study the relationship between age and a particular anesthetic procedure. That being said, the conclusions drawn from this study are far from surprising. On a biological point of view, there are multiple explanations to account for poorer performance. Decreasing cognitive functions, decreasing sensorimotor functions such as eyesight, hearing, fine motor functions and fine touch are only a few to mention among an endless list. In their 2007 study, Zackary Boom-Saad Ph.D. and al.3 explored the relationship between age and psychomotor and visual-spatial abilities among surgeons. They concluded that there is a decline in reaction time, rapid visual information processing, and visual-spatial learning capabilities that occurs with advancing age of surgeons of just as it does in the general population. They do not comment on the impact of these findings on procedural learning capacity and suggest further research involving simulation. Although experience can often compensate for age-related deterioration, in general, no one expects a 60 year old to perform as well as a 30 year old on a task when complex decisions, changing conditions, manual dexterity in a stressful environment are involved.

Moreover, the study centered on a very specific anesthetic skill, percutaneous emergent cricothyroidotomy, that is very seldom performed in day-to-day practice. In fact, their results show that the older group of anesthesiologists, which has on average 24 years more of practice experience, does not have more experience with previous cricothyroidotomy on humans than the younger group. Unless another tertiary health care center has significantly different statistics as for the number of cricothyroidotomies performed by anesthesiologist (data unavailable), the clinical importance of the findings of this study on this particular procedure is likely minimal. We should also point out that the data analysis was made on the presumption that one standard deviation in procedural time between the groups would be of clinical significance. This represents an average of 52 seconds of difference pre standardization and of 12 seconds post standardization. The clinical importance of this difference is subject to discussion.

In conclusion, this very well conducted study questions important matters of today's medical practice such as age-related deterioration among physicians and the role of simulation in continuing medical education. However, the clinical significance of these results and how applicable they are in everyday practice is unclear at this point and may need further research.

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- Tripp DA**, Nickel JC, Fitzgerald MP, Mayer R, Stechyson N, Hsieh A. Sexual Identification of Patients at Risk for functioning, catastrophizing, depression, and pain, as predictors of quality of life in women with interstitial cystitis/painful bladder syndrome. *Urology*. 2009 May;73(5):987-92.
- Tripp DA**, Nickel JC, Ross S, Mullins C, Stechyson N. Prevalence, symptom impact and predictors of chronic prostatitis-like symptoms in Canadian males aged 16-19 years. *BJU Int*. 2009 Apr;103(8):1080-4. Epub 2008 Oct 24.
- Turner KE**. Book Review: From Craft to Specialty - A Medical and Social History of Anesthesia and Its Changing Role in Health Care: David Shephard in association with Alan Sessler, Francis Whalen and Tuhin Roy. Thunder Bay, Ontario: York Point Publishing, 2009. *Can J Anaesth* 2010 57(5):523.
- Vandenkerkhof EG**, Hall S, Wilson R, Gay A, Duhn L. Evaluation of an innovative communication technology in an acute care setting. *Comput Inform Nurs*. 2009 Jul-Aug;27(4):254-62.
- VanDenKerkhof EG.**, Friedberg E., Harrison MB. Prevalence and risk of Pressure Ulcers in Acute Care Following Implementation of Practice Guidelines: Annual Pressure Ulcer Prevalence Census 1994-2008. *J Healthc Qual*, in press, 2011.
- VanDenKerkhof EG**, Macdonald HM, Jones GT, Power C, Macfarlane GJ. Are persons who have diet and lifestyle risk factors for cancer and cardiovascular disease at increased risk of chronic widespread pain? Results from the 1958 British Birth Cohort Study. *Pain Research and Management*, in press, June 2010.
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- Zamora JE**, Luyt N. Pandemic preparedness and protective clothing: priorities of health care workers in a Canadian teaching hospital. *Can J Anaesth*. 2009 Sep;56(9):707-8.
- Zamora JE**, Nolan RL, **Sharan S**, Day AG. Evaluation of the Bullard, GlideScope, Viewmax, and Macintosh laryngoscopes using a cadaver model to simulate the difficult airway. *J Clin Anesth*. 2011 Feb;23(1):27-34.
- Zamora JE**. Dispatch from the medical front: Khandahar arrival. *Canadian Medical Association Journal*. 2009 Mar 31;180(7): E8.
- Zamora JE**. Homeward bound. *Canadian Medical Association Journal*. 2009 May 12;180(10): E38.
- Zamora JE**. The best care anywhere. *Canadian Medical Association Journal*. 2009 Apr 14;180(8): E16-7.