Can J Anesth/J Can Anesth (2021) 68:S91–S226
https://doi.org/10.1007/s12630-021-02074-3

# 2021 CAS VIRTUAL ANNUAL MEETING
# Abstracts and Case Report/Series

**Materials are arranged by category as follows:**

# AIRWAY MANAGEMENT

## ACE Inhibitor-Mediated Angioedema Triggered by LMA Placement

Amy Jiang[1], Anthony M.-H. Ho[1], Emily Cook[1], Joanna Dion[1], Greg Klar[1], Glenio B. Mizubuti[1]

1 Department of Anesthesiology and Perioperative Medicine, Queen's University, Kingston, Ontario, Canada.

**Introduction:** ACE inhibitor (ACEi)-mediated angioedema (ACEi-AE) affects 0.1-0.7% of treated patients.[1] It is the most common cause of angioedema, representing 38-68% of cases; its mortality rate is 11%.[2] Risk factors include ethnicity (African-descents and Hispanics > Caucasians), female gender, smoking, elderly, history of drug-induced rash, seasonal allergies and use of immunosuppressive therapy.[1] It manifests as nonpitting edema of the face, lips, tongue, uvula, and/or upper airway without urticaria or pruritus, and in severe cases may require emergency airway management.

**Case Presentation:** Patient consent was obtained for publication of this case. A 76 year old man with hypertension, hyperlipidemia and anxiety presented for elective removal of an infected urethral sling. Medications included cephalexin, quinapril (held on the day of surgery), atorvastatin, amitriptyline and alprazolam. He denied any allergies. Following anesthesia induction, insertion of an LMA (i-Gel®, Intersurgical Ltd, Berkshire, UK) initially met mild resistance against the tongue, but was uneventful on subsequent attempt. There were no ventilation issues noted during the 3-hour procedure during which the patient was maintained on pressure-support ventilation under sevoflurane. Upon surgical completion, the LMA was removed and the patient transferred to the recovery room. Three hours later, he developed progressive slurred speech and respiratory distress. Initial assessment revealed rapidly progressive tongue swelling, prompting the anesthesiologist to perform an emergency awake fiberoptic nasal intubation. The extreme swelling was seemingly restricted to the tongue (Fig. 1). Hemodynamics and oxygenation were maintained throughout. There were no wheezing or rash; tryptase levels were normal. He was transferred to intensive care where his trachea was extubated 3 days later.

ACEi-AE is rare and may take years to develop, however a single episode requires ACEi therapy to be discontinued due to high recurrence rates with reportedly increasing severity at each episode. Controversy exists surrounding the safety of angiotensin-receptor blockers for patients who have developed ACEi-AE. Pathophysiology involves accumulation of bradykinin (which is normally metabolized by ACE), and marked bradykinin local release triggered by seemingly minor trauma[3] (e.g., LMA insertion). Attacks are self-limiting, resolving after 48-72 hours. Pharmacologic treatment with antihistamines, steroids and epinephrine remains debatable. While tranexamic acid, fresh frozen plasma, and C1-inhibitor concentrate infusion have shown some therapeutic efficacy,[1,4] icatibant (a bradykinin b2-receptor antagonist) has shown conflicting results.[1]
Perioperatively, ACEi-AE can be triggered by airway manipulation and/or surgical trauma from head and neck procedures including oral surgery, carotid endarterectomy, and cervical laminectomy.[3] A previous case of ACEi-AE following LMA insertion has been reported; management was expectant with no need for airway intervention.[5]

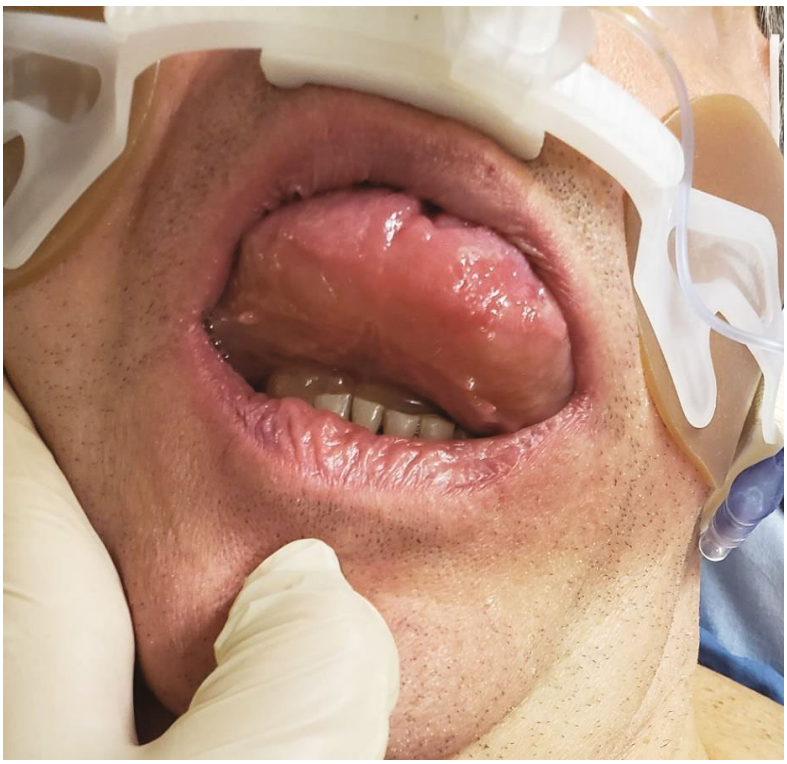
**Conclusion:** ACEi-AE is a potentially life-threatening complication that must be included in the differential diagnosis of perioperative slurred speech, upper airway edema, and/or respiratory

failure since prompt recognition and airway management are paramount to ensure a favorable outcome.

**REFERENCES:**


1. Montinaro V, Cicardi M. ACE inhibitor-mediated angioedema. Int Immunopharmacol 2020; 78:106081.
2. Reed LK, Meng J, Josh GP. Tongue swelling in the recovery room: a case report and discussion of postoperative angioedema. J Clin Anesth 2006; 18: 226-9.
3. Simmons BB, Folsom MA, Bryden LA, Studdiford JS. Angioedema after local trauma in a patient on angiotensin-converting enzyme inhibitor therapy. J Am Board Fam Med 2008; 21:577-9.
4. Beauchene C, Martins-Hericher J, Martin L, Maillard H. Tranexamic acid as first-line emergency treatment for episodes of bradykinin-mediated angioedema induced by ACE inhibitors. Rev Med Interne 2018; 39: 772-6.
5. Marques A, Retro-Marques C, Mota S, Cabral R, Campos M. Postanesthetic severe oral angioedema in patient's taking angiotensin-converting enzyme inhibitor. Case Rep Anesthesiol 2014; 2014: 693191.


Figure 1



## Comparison of Three Airway Management Techniques for Restricted Access in a Simulated Pediatric Motor Vehicle Entrapped Scenario – Direct Laryngoscopy Versus Video Laryngoscopy Versus Supraglottic Device

Arnim Vlatten[1,2], Tristan Dumbarton[1,2], David Vlatten[1], John Adam Law[1]

1 Department of Anesthesiology, Pain Management and Perioperative Medicine, Dalhousie University, Halifax, Nova Scotia, Canada.
2 IWK Health Centre, Department of Pediatric Anesthesia, Halifax, Nova Scotia, Canada.

**Introduction / Background:** Emergency pediatric airway management during restricted access to the head is challenging. The need for face-to-face airway management may relate to an entrapped motor vehicle trauma casualty but also applies to lost airways in sitting or prone position operative cases. All three of direct laryngoscopy, video laryngoscopy and supraglottic airways have separately been described to facilitate face-to-face airway management. We hypothesized that video laryngoscopy might be superior to direct laryngoscopy or supraglottic device use to establish ventilation during face-to-face airway management, studied in a simulated pediatric entrapped motor vehicle scenario.

**Methods:** Ethics approval was obtained from local REB. With their consent, 45 experienced airway practitioners (staff anesthesiologists and anesthesia residents with greater than 300 intubations) managed the airway of a pediatric manikin representing a 6 year old (SimJunior). With a cervical collar applied and in the sitting position, the manikin's head was only accessible from the left anterolateral side. Using the device in the right hand, a standardized demonstration of face-to-face use of a Macintosh #2 blade (DL), a Storz C-MAC® D-Blade (VL) and a #2.5 LMA Supreme™ (SD) was provided. Participants managed the airway with all 3 devices, randomized to start with DL, VL or SD. Outcomes included overall success rate, time to ventilation (TTV), percentage of glottic opening (POGO) for DL and VL and ease of use on a 10-point Likert scale (VAS). Data was analysed using analysis of variance for TTV and VAS and t-test for POGO. Statistical significance was deemed at $P<0.05$. Data are presented as median and interquartile range.

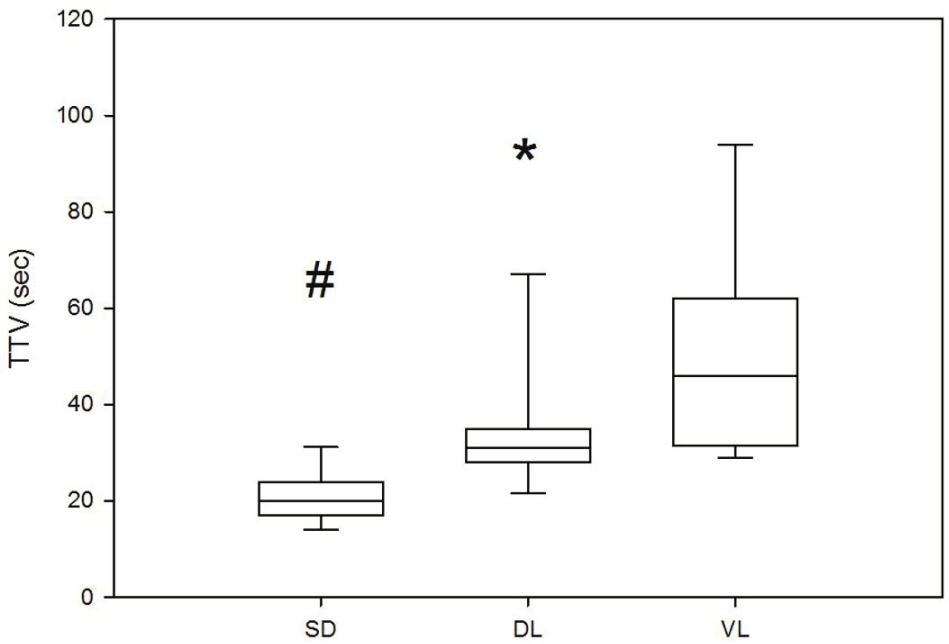
**Results:** Success rate was 95% (43/45) for both DL and SD and 93% (42/45) for VL. TTV was significantly less with SD compared to DL and VL (Figure). TTV was 31 sec (28, 35) for DL, 46 sec (31, 62) for VL and 20 sec (17, 24) for SD. POGO was significantly improved with VL compared to DL - 100 % (100, 100) for VL and 80% (60, 100) for DL. Participants rated SD significantly easier to use than VL (VAS 8 [6,9] SD vs. 6 [3.5,8] VL), but not easier than DL (VAS 7 [5.5,8]). Ease of use did not differ significantly between DL and VL.

**Discussion:** All three techniques have high success rates. Time to establish ventilation with the SD was significantly faster compared to DL and VL and participants rated SD easiest to use. The utility of face-to-face VL was limited due to significantly longer time to ventilation, despite significantly improved view compared to DL, similar to adult studies. Since both time and success are clinically important, this study suggests that supraglottic devices should be considered for primary emergency pediatric airway management in situations with restricted access to the head.

**REFERENCES:**


1. Kovacs G, Sowers N. Airway management in Trauma. Emerg Med Clin North Am. 2018, 36: 61-84
2. Black AE, Flynn PA, Smith HL, Thomas ML, Wilkinson KA. Development of a guideline for the management of the unanticipated difficult airway in pediatric patients. Pediatr Anesth. 2015, 25: 346-362
3. Steinmann D, Ahne T, Heringhaus C, Goebel U. Comparison of airway management techniques for different access in a simulated motor vehicle entrapped scenario. Eur J Emerg Med. 2016, 23: 279-285
4. Schober P, Krage R, Van Groningen D, Loer SA, Schwarte LA. Inverse intubation in entrapped trauma casualties: a simulation based, randomized cross-over comparison of direct, indirect and video laryngoscopy. Emerg Med J. 2014, 31: 959-963


Time to ventilation in seconds for supraglottic device, direct laryngoscopy and video laryngoscopy.
Data are presented as Median and interquartile range (Min, Max).
# SD versus DL and VL, P<0.001
* DL versus VL, P<0.05



## Emergency Airway Management in a Tertiary Trauma Centre: A 1-Year Prospective Longitudinal Study

Thomas Hall[1], Murdoch Leeies[2,3], Carmen Hrymak[2,3], Duane Funk[1,3], Faisal Siddiqui[1,3], Brenden Dufault[1], Stephen Kowalski[1,3]

1 Department of Anesthesiology, Perioperative and Pain Medicine, University of Manitoba, Max Rady College of Medicine, Winnipeg, Manitoba, Canada.
2 Department of Emergency Medicine, University of Manitoba, Max Rady College of Medicine, Winnipeg, Manitoba, Canada.
3 Department of Internal Medicine, Section of Critical Care, University of Manitoba, Max Rady College of Medicine, Winnipeg, Manitoba, Canada.

**Introduction:** Emergency airway management can be associated with difficulties that can result in complications ranging from transient adverse events to long term neurological injury, need for surgical airway and death. (1) A series of Canadian multi-centre studies showed that adverse events are common in emergency airway management and that that they are associated with poor patient outcomes. (2,3) Multiple attempts at laryngoscopy are associated with increased complications. (1,2,3) At the study site, a tertiary care trauma centre, there is a paucity of data regarding emergency airway management. The objectives of this study are:

1. To enumerate the number of emergent intubations that occur annually
2. To quantify the incidence of first pass success
3. To quantify the incidence of adverse events associated with emergency airway management
4. To identify predictors of successful first pass intubation
5. To identify predictors of adverse events

**Methods:** Ethics approval was obtained from the local REB. We performed a single centre, prospective, observational study, including all adult patients (>17 years old) intubated in the Emergency Department, Intensive Care Units (ICU), in-patient wards or a diagnostic imaging suite. The Respiratory Therapy Department assists at all intubations, as such, the Respiratory Therapist (RT) liased with the physician responsible for the intubation to complete the data collection sheet. We collected additional data via chart review retrospectively. Data collection was shortened to 7-months due to the COVID-19 pandemic.

**Results:** In a 7-month period, there were 416 emergency intubations and a first pass success rate of 73.08%. First pass success rates varied widely between locations; ward intubations were the lowest with 57.5% completed successfully, followed by 66.1% in the ICU's and 84.3% in the Emergency Department. Hypotension and hypoxemia occurred in 57 (13.7%) and 48 (11.5%) patients, respectively. Direct laryngoscopy (DL) was used as the primary technique in 199 patients (47.8%) but varied significantly by location; Emergency Room (35.0%) compared to on the ward (89.4%). Failure of first pass intubation was associated with inexperienced operator (OR: 2.06, CI: 1.30 – 3.24), use of paralysis (OR: 0.36, CI: 0.23 – 0.56), direct laryngscopy (OR: 1.74, CI: 1.12 – 2.70), physiologic difficult airways (OR: 2.04, CI: 1.25 – 3.32) and location (any vs. ER). Paralysis was used in 260 (62.5%) of patients and was not associated with hypoxia (OR: 1.15, CI: 0.60 – 2.20) or hypotension (OR: 0.99, CI: 0.54 – 1.81).

**Discussion**: Emergency intubation is a frequently performed life-saving procedure. First pass success is associated with a number of modifiable factors and the rate of success varies significantly between locations at the study hospital. Operator experience, choice of medications, and equipment used are associated with first pass success and are potential

targets for efforts to improve rates of successful first pass emergency airway management.

**REFERENCES:**

1. Cook TM, Woodall N, Harper J, Benger J. Major complications of airway management in the UK: Results of the Fourth National Audit Project of the Royal College of Anaesthetists and the Difficult Airway Society. Part 2: Intensive care and emergency departments. *Br J Anaesth*. 2011;106(5):632-642. doi:10.1093/bja/aer059
2. Green RS, Turgeon AF, McIntyre LA, et al. Postintubation hypotension in intensive care unit patients: A multicenter cohort study. *J Crit Care*. 2015;30(5):1055-1060. doi:10.1016/j.jcrc.2015.06.007
3. Green R, Hutton B, Lorette J, Bleskie D, Mcintyre L, Fergusson D. Incidence of postintubation hemodynamic instability associated with emergent intubations performed outside the operating room: A systematic review. *Can J Emerg Med*. 2014;16(1):69-79. doi:10.2310/8000.2013.131004

## First-Pass Success Rate of Endotracheal Intubation in Anesthetized Adults Comparing Video Laryngoscopy Using a Standard Blade to Direct Laryngoscopy - A Multicentre, Randomized Controlled Clinical Trial

Rüdiger R. Noppens[1]*, Jason Chui[1], Suzanne Flier[1], Sonja Payne[1], Timothy Turkstra[1], Marc Kriege[2] on behalf of the EMMA study group

1 Department of Anesthesia & Perioperative Medicine, Western University, London, Ontario, Canada.
2 Department of Anesthesiology, University Medical Center of the Johannes Gutenberg-University, Mainz, Germany.
* Corresponding author: rnoppens@uwo.ca

**Introduction/Background:** First-pass intubation success has long been an important goal, with multiple attempts at laryngoscopy associated with airway trauma and potential morbidity[1]. The COVID-19 pandemic has reinforced the importance of first-pass success (FPS) to increase patient and healthcare worker safety[2]. Video laryngoscopy (VL) has been reported to reduce the incidence of failed intubations. However, the impact of VL on FPS remains unclear[3]. We hypothesized that using the McGrath MAC VL (McG; Medtronic®, Dublin, Ireland) for routine intubation in the operating room would result in a higher FPS compared to conventional direct laryngoscopy (DL).

**Methods[4]:** Ethics committees of participating centres approved this international multicentre randomized controlled trial prior to patient recruitment. Adults for elective surgery under general anesthesia requiring endotracheal intubation, without predictors of difficulty, were consented and randomized to either DL or McG. The primary outcome was FPS; secondary endpoints were the influence of the provider experience, time to ventilation, and adverse events (e.g., hypoxia or soft tissue injury). Multiple logistic regression analysis of subgroup factors allowed assessing factors affecting successful first-time intubation comparing McG to DL. A chi-squared test was used to compare FPS between the two groups. Data are expressed as median (interquartile range [IQR]). $p < 0.05$ was considered to be statistically significant.

**Results:** A total of 3323 patients were assessed for eligibility. 2047 consented and were enrolled in the trial (McG n=1021; DL n=1026). FPS was higher with the McG (955/1021, 93.5%), compared with DL (839/1026, 82%; p<0.0001). Overall, 1011/1021 (99%) of the McG and 983/1026 (96%) of DL attempts were successful after two attempts. Years of anesthesia experience had a positive effect on the probability of FPS (p<0.001). Lack of experience had a stronger effect on failure when using DL (OR = 0.889, 95% CI = [0.859; 0.940]), compared to McG (OR=0.992, 95%CI=[0.951;1.034]). Time to ventilation was shorter with DL (34 s, IQR [26-45]), compared to McG (36 s, [26-48]; p<0.01). Overall, no differences in intubation-associated adverse events between groups were observed (p=0.19). However, soft tissue lesions were more frequent with DL (25/1026, 2%) than McG (12/1021, 1%; p=0.03).

**Discussion:** In this large randomized multicenter trial, using a video laryngoscope with a Macintosh blade improved the intubation first-pass success rate in adults under routine general anesthesia. Less experienced anesthesiologists were more likely to be successful with the McG, compared to DL. Intubation time was slightly shorter using DL, but this was not clinically relevant. Based on these results, video laryngoscopy using a Macintosh-shaped blade can be recommended as a first-choice instrument to improve FPS in patients without predictors for difficult airway management. These findings are highly relevant during the ongoing COVID-19 pandemic.

**REFERENCES:**

1 Law JA, Broemling N, Cooper RM, Drolet P, Duggan LV, Griesdale DE, et al. The difficult airway with recommendations for management – Part 1 – Difficult tracheal intubation encountered in an unconscious/induced patient. Can J Anesth Can Anesth. 2013 Nov 1;60(11):1089–118.
2 Cook TM, El-Boghdadly K, McGuire B, McNarry AF, Patel A, Higgs A. Consensus guidelines for managing the airway in patients with COVID-19. Anaesthesia 2020; 75(6): 785-99.
3 Lewis SR et al. Videolaryngoscopy versus direct laryngoscopy for adult patients requiring tracheal intubation. Cochrane Database Syst Rev 2016 11(11): CD011136.
4 Kriege M, Alflen C, Tzanova I, Schmidtmann I, Piepho T, Noppens RR. Evaluation of the McGrath MAC and Macintosh laryngoscope for tracheal intubation in 2000 patients undergoing general anaesthesia: the randomised multicentre EMMA trial study protocol. BMJ Open. 2017;7:e016907. doi:10.1136/bmjopen-2017-016907

# AMBULATORY

## Intrathecal Morphine Does Not Increase Pour in Joint Arthroplasty Surgeries. A Double Blind RCT

Naveed Siddiqui[1], Muhammad Imran Khan[1], Yehoshua Gleicher[1], Shiva Khandadashpoor[1], David Backstein[2], Ashok Kumar Jayaraj[1]

1 Department of Anesthesia, University of Toronto, Mount Sinai Hospital, Toronto, Ontario, Canada.
2 Department of Surgery, University of Toronto, Mount Sinai Hospital, Toronto, Ontario, Canada.

**Introduction:** The changing health economy has driven the need for greater patient throughput, rapid turnover, and shorter hospital stays whilst retaining high quality medical care. Use of intrathecal opioids has become a widely accepted technique for providing effective postoperative pain relief in joint arthroplasty surgeries[1]. However, intrathecal morphine (ITM) has its own adverse effects including urinary retention, and delayed respiratory depression[2]. Post-operative urinary retention (POUR) is one of the main reasons for the delayed discharge following hip and knee arthroplasties. Early removal is important, as a risk of UTI is reported to rise 5% for each day a urinary catheter remains in situ[3]. Avoiding intrathecal morphine would benefit patients by decreasing complications associated with prolonged catheterization such as urinary tract infection and improve cost effectiveness through early discharge of patients[4]. Our aim was to evaluate, whether removing the ITM would facilitate early removal of urinary catheter and earlier discharge from hospital.

**Methods:** Ethics approval was obtained from the local REB. A prospective, double-blind, RCT of 134 patients who are 18 to 85 years old, with BMI 18 to 40 and undergoing elective primary as well as revision knee and hip arthroplasty under regional anesthesia was conducted. Patients were excluded if they had language barrier, prior history of urinary retention or BPH. Intra-operatively, patients received ITM 100 mcg (group A) or saline (group B) in addition to the standard dose of bupivacaine and 15 mcg of fentanyl. None of these patients were catheterized. If they were unable to urinate, an in and out was performed according to preset ultrasound bladder residual volumes. Post-operatively, data collection includes the time of in and out catheterization, Post-op pain, opioids side effects and hospital length of stay.

**Results:** 112 out of 134 patients were recruited, with 99 completing the study, which 66 underwent knee surgery and 33 underwent hip surgery. Both groups; A (ITM) and B (Non-ITM) were similar at baseline. The use of ITM was found to significantly reduce the length of hospital stay at 48 hours post-operatively (with the Difference (95%CI) in the median of -15.3 (-29.9, -0.71) and p-value of 0.04). There was no significant difference in the incidence of opioid side effects, duration of bladder catheterization and requirement for In & Out catheterizations, pain score and patient satisfaction between the two groups.

**Discussion:** The results of our study show that traditional use of ITM in joint arthroplasties significantly reduces hospital length of stay. It does not increase the incidence of opioid side effects, duration of bladder catheterization and requirement for In & Out, patient satisfaction and pain score at rest and movement. The use of ITM in the context of Fast Track Knee and Hip Arthroplasty is still a useful modality.

**REFERENCES:**

1. Factors influencing urinary tract retention after elective open cholecystectomy. 174, 497–500, 1992.
2. Optimizing the dose of intrathecal morphine in older patients undergoing hip arthroplasty. 97, 1709–15, 2003.
3. Catheter-associated bacteriuria. 13,735–747, 1986.
4. High rates of postoperative urinary retention following primary total hip replacement performed under combined general and spinal anaesthesia with intrathecal opiate. 12, S157-S160, 2015.

Table 1. Baseline characteristics

| Characteristics | ITM | Non-ITM |
|---|---|---|
| # Patients | 48 | 51 |
| Age, median (IQR) | 67 (60, 74) | 68 (60, 74) |
| BMI, mean (SD) | 29.8 (4.3) | 31.8 (5.4) |
| Male, %(n) | 52.1 (25) | 52.9 (27) |
| ASA, %(n) | 52.1 (25) | 60.8 (31) |
| Surgery type (TKA), %(n) | 75.0 (36) | 58.8 (30) |
| Highest Bupivacaine, %(n) | 37.5 (18) | 33.3 (17) |
| Pain score at rest on screening day, median (IQR) | 2.0 (0, 4) | 1 (0, 3) |
| Pain score at movement on screening day, median (IQR) | 6 (4, 8) | 6 (5, 8) |

**Table 2(a). Comparison of outcomes**

| Outcomes | ITM | Non-ITM | Difference (95%CI) * | p-values* |
|---|---|---|---|---|
| # Patients | 48 | 51 | (ITM vs Non-ITM) | |
| Lengthofhospitalstay(hrs.), Median (IQR) | 28 (23.4, 48) | 43 (23.2, 68.5) | -15.3 (-29.9, -0.71) | 0.04 |
| Satisfaction, median (IQR) | 6 (5, 6) | 6 (5, 6) | 0 (-0.47, 0.47) | 0.99 |
| First In&out Catheterization needed (hrs.) %(n) | 37.5 (18) | 35.3 (18) | 2.2 (-16.8, 21.2) | 0.81 |
| Second In&out Catherization needed, %(n) | 8.3 (4) | 3.9 (2) | 4.4 (-5.1, 13.9) | 0.36 |
| Catheter duration, (hrs.) %(n/N) | 16.7 (3/18) | 27.8 (5/18) | -11.1 (-38.0, 15.8) | 0.41 |
| VASm24 | 4.5 (3, 8) | 6 (3, 7) | -1.0 (-3.10, 1.10) | 0.35 |
| VASm36 | 6 (5, 8) | 6 (5, 7) | 0.0 (-1.44, 1.44) | 0.99 |
| VASm48 | 7 (5, 8) | 6 (5, 7) | 1.0 (-1.32, 3.32) | 0.39 |
| VASr24 | 3 (1, 5) | 3 (1, 5) | 0.0 (-1.70, 1.70) | 0.99 |
| VASr36 | 4.5 (2, 6) | 3 (2, 4) | 1.0 (-0.98, 2.98) | 0.32 |
| VASr48 | 4 (3, 6) | 2 (1, 3) | 2.0 (0.73, 3.27) | 0.002 |

**Table 2(b)**

| Outcomes | ITM | Non-ITM | Difference (95%CI)* | p-values* |
|---|---|---|---|---|
| # Patients | 1 8 | 18 | (ITM vs Non-ITM ) | |
| Time to first in&out Catheterization (hrs.), median (IQR) | 6.48 (4.80, 9.75) | 6.03 (5.0, 6.80) | 0.33 (-1.69, 2.35) | 0.74 |

**Table 3. outcomes**

| | Baseline (at Screening day) | | Post surgery period | | |
|---|---|---|---|---|---|
| Side-effect | ITM (48) | Non-ITM (51) | ITM (48) | Non-ITM (51) | p-value |
| Nausea, %(n/N) | 0 (0/48) | 0 (0/51) | 18.75 (9/48) | 17.65 (9/51) | 0.89 |
| Vomiting, %(n/N) | 2.08 (1/48) | 0 (0/51) | 4.17 (2/48) | 0 (0/51) | 0.23 |
| Constipation, %(n/N) | 6.25 (3/48) | 5.88 (3/51) | 14.58 (7/48) | 7.84 (4/51) | 0.29 |
| Difficulty passing urine, %(n/N) | 2.08 (1/48) | 0 (0/51) | 12.5 (6/48) | 11.76 (6/51) | 0.91 |
| Concentration difficulty, %(n/N) | 4.17 (2/48) | 0 (0/51) | 6.25 (3/48) | 7.84 (4/51) | 0.99 |
| Drowsiness, %(n/N) | 4.17 (2/48) | 0 (0/51) | 8.33 (4/48) | 5.88 (3/51) | 0.71 |
| Dizziness, %(n/N) | 0 (0/48) | 0 (0/51) | 22.92 (11/48) | 27.45 (14/51) | 0.6 |
| Confusion, %(n/N) | 0 (0/48) | 1.96 (1/51) | 6.25 (3/48) | 1.96 (1/51) | 0.35 |
| Fatigue, %(n/N) | 4.17 (2/48) | 9.8 (5/51) | 25 (12/48) | 15.69 (8/51) | 0.25 |
| Itchiness, %(n/N) | 4.17 (2/48) | 5.88 (3/51) | 39.58 (19/48) | 23.53 (12/51) | 0.08 |
| Dry mouth, %(n/N) | 12.5 (6/48) | 11.76 (6/51) | 45.83 (22/48) | 47.06 (24/51) | 0.9 |
| Headache, %(n/N) | 6.25 (3/48) | 3.92 (2/51) | 10.42 (5/48) | 13.73 (7/51) | 0.61 |
| Any side-effect, %(n/N) | 33.33 (16/48) | 29.41 (15/51) | 75 (36/48) | 68.63 (35/51) | 0.48 |

## PreWarming to Prevent Perioperative Hypothermia in Short Duration Outpatient Surgery Under General Anesthesia: a Randomized Comparison Study

Marie-Eve Belanger[1,2], Amelie Sergent[1], Philippe Richebé[1,2], Julie Blain[3], Issam Tanoubi[1,2]

1 Department of Anesthesiology and Pain Medicine, University of Montreal, Montreal, Quebec, Canada.
2 Department of Anesthesiology and Pain Medicine, Maisonneuve-Rosemont Hospital CEMTL, Montreal, Quebec, Canada.
3 Department of Respiratory Therapy and Anesthesia Division, Maisonneuve-Rosemont Hospital CEMTL, Montreal, Quebec, Canada.

**Introduction:** Prevention of perioperative hypothermia is a major challenge as hypothermia leads to adverse outcomes such as wound infections, coagulopathy, delayed recovery and cardiac events (1,2). The heat redistribution from central to peripheral compartment is the main mechanism of early heat loss under general anesthesia (GA), and a 30-minutes forced-air prewarming (PW) minimizes this phenomenon (3,4). The actual trend for fast-tracking surgery demands an aggressive perioperative temperature control. Therefore, as intraoperative active warming is limited during short duration outpatient surgeries, it seems pertinent to evaluate the impact of PW. The goal of this study was to evaluate, in short duration outpatient surgeries and compared to standard care, if the use of PW will impact patients' core temperature at the end of surgery.

**Methods:** After ethic approval, 60 adult patients scheduled for outpatient, short surgery (30-120min) under GA were randomized to PW Group (PWG) using a forced-air warming system (Flex gown, BairPaw system, 3M$^{TM}$) for at least 30 minutes preoperatively, or to control group (CG, standard care). CG received passive isolation with warm blankets. Intraoperative forced-air warming blankets (BairHugger, 3M$^{TM}$) were used for both groups. Perioperative temperatures were measured using the SpotOn 3M$^{TM}$ system. The primary outcome was the patients' temperature at the end of the surgery ($T_{end}$). Secondary outcomes included: intraoperative temperature drop from OR entry ($T_0$) to the lowest intraoperative temperature ($T_{nadir}$), incidence of hypothermia (< 36°C), patient comfort level, length of stay (LOS) in PACU, and incidence of postoperative shivering.

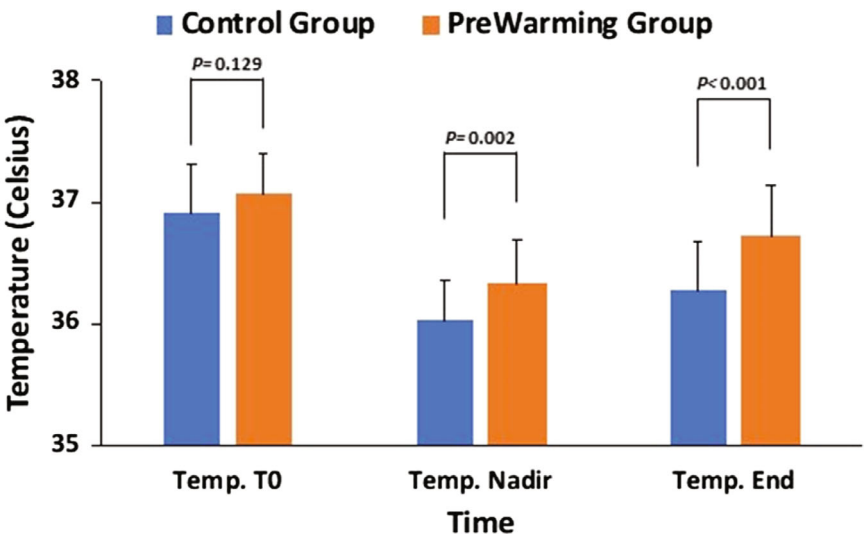
**Results:** 57 patients were analyzed (29 PWG; 28 CG). Demographic data and patients' basal temperature ($T_{basal}$) were similar. The $T_0$ were comparable between PWG and CG (*37.1°(0.3) vs 36.9°(0.4) respectively; p=0.129*). PWG showed a higher $T_{end}$ compared to CG patients *(36.7°(0.4) vs 36.3°(0.4); p<0.001)*. The temperature drop was less in PWG compared to CG *(-0.7°(0.3) vs -0.9°(0.3); p=0.044)*. The incidence of intraoperative hypothermia was not different *(PWG: 21% vs CG: 43%; p=0.072)*. The patients' comfort level on a 0-10 Likert scale was higher in PWG compared to CG (*10 [8-10] vs 7.5 [6.25-9] respectively; p=0.0005*). There was no difference in LOS nor in the incidence of shivering in PACU.

**Discussion:** Compared to standard care, a minimum of 30-minutes continuous forced-air PW was effective in maintaining higher core temperature by the end of a short duration outpatient surgery. National Institute for Care and Health Excellence defined as clinically relevant a perioperative difference of 0.5°C in core temperature over 36°C (5). Thus, the present 0.4°C gain, when using PW, is relevant in short surgery, as intraoperative warming is limited. Moreover, PW increases patients' comfort and slightly reduces the incidence of hypothermia. Not surprisingly, the incidence of shivering and the length of stay in PACU were unchanged for

this type of short surgery.

**REFERENCES:**


1. Madrid E, Urrútia G, Roqué i Figuls M, Pardo-Hernandez H, Campos JM, Paniagua P, et al. Active body surface warming systems for preventing complications caused by inadvertent perioperative hypothermia in adults. Cochrane Database of Syst Rev. 2016 Apr, Issue 4. DOI: 10.1002/14651858.CD009016.pub2.
2. Boet S., Patey A, Braon J, Mohamed K, Pigford AA, Bryson GL, et al. Factors that influence effective perioperative temperature management by anesthesiologists : A qualitative study using the Theoretical Domains Framework. Can J Anesth. 2017 June; 64(6) :581-596
3. Sessler DI. Perioperative thermoregulation and heat balance. Lancet. 2016 Jun 25;387(10038):2655-2664. doi: 10.1016/S0140-6736(15)00981-2. Epub 2016 Jan 8. PMID: 26775126.
4. Lau A, Lowlaavar N, Cooke EM, West N., German A., Morse DJ., et al. Effect of preoperative warming on intraoperative hypothermia : a randomized-controlled trial. Can J Anesth. 2018 Sep, 65(9); 1029-1040
5. National Institute for Health and Care Excellence (NICE). Hypothermia : prevention and management in adults having surgery. Guidelines 2008, updated 14 dec 2016

# BASIC SCIENCE

## Understanding the Integrative Physiology of Acute Anemia: Linking Renal Tissue O2 Sensing with Adaptive Cardiovascular Responses to Preserve Tissue Oxygen Delivery

Hannah Joo[1], Kyle Chin[1,2], Iryna Savinova[3], Helen Jiang[1], Chloe Lin[1], Melina Cazorla-Bak[1,2], Jeremy A Simpson[3], Andrew J. Baker[1,4,5], C. David Mazer[1,2,4,5], Gregory M.T. Hare[1,2,5], William Darrah[1]

1 Department of Anesthesia, St. Michael's Hospital, University of Toronto, Toronto, Ontario, Canada.
2 Department of Physiology, University of Toronto, Toronto, Ontario, Canada.
3 Department of Human Health and Nutritional Sciences, University of Guelph, Guelph, Ontario, Canada.
4 Institute of Medical Science, University of Toronto, Ontario, Canada.
5 Keenan Research Centre for Biomedical Science in the Li Ka Shing Knowledge Institute, St. Michael's Hospital, Toronto, Ontario, Canada.

**Introduction:** The integrative physiological response to anemia is complex and incompletely understood. We utilized data from studies of acute anemia in rodents to determine the relationship between changes in blood oxygen content ($C_aO_2$) and the heterogenous response of the kidney, heart and brain. We hypothesize that renal hypoxia sensing mechanisms contribute to adaptive physiological responses to maintain cerebral oxygen delivery ($DO_2$) during acute anemia.

**Methods:** With animal care committee approval, we synthesized novel and published data from 5 previously published studies (REF). Outcomes included: assessment of the relationship between $C_aO_2$ and microvascular renal and brain $PO_2$ (phosphorescence quenching of oxyphor G4); cardiac output (CO) and renal and cerebral blood flow (ultrasound Doppler); hypoxia induced cellular responses (brain and kidney erythropoietin (EPO) mRNA and serum protein levels (ELISA)). Statistical analysis (SigmaPlot 14) was performed by ANOVA, Holm-Sidak and Mann-Whitney rank sum test when appropriate. Significance was assigned at $p<0.05$.

**Results:** In two models of anemia (hemodilution and RBC antibody mediated), acute reductions in blood $C_aO_2$ were associated with larger decreases in renal microvascular $PO_2$, relative to brain microvascular $PO_2$ ($p<0.05$). After acute hemodilution, there was a strong relationship between $C_aO_2$ and renal microvascular $PO_2$ ($r^2=0.75$). The magnitude of reduction in renal microvascular $PO_2$ correlated with the degree of renal EPO mRNA expression and serum EPO protein levels. The magnitude of the increase in EPO mRNA was much larger in the kidney than in the brain ($p<0.03$). While no change in renal blood flow was observed in either model, a significant increase in common carotid and internal carotid blood flow was observed in both models ($p<0.012$). When $DO_2$ was assessed, the kidney $DO_2$ was reduced at all levels of anemia ($p<0.01$) whereas brain tissue $DO_2$ was maintained in mild and moderate (Hb 90 and 70 g/L) ($p=0.44$) anemia but reduced in severe anemia (Hb 50 g/L) ($p<0.02$). The role of active cardiovascular increases in brain blood flow and maintained $DO_2$ during anemia was impaired by systemic beta blockade, suggesting that active cardiovascular mechanisms are required to maintain optimal brain $DO_2$ during anemia.

**Discussion:** Our analysis demonstrated: evidence of quantitative renal $PO_2$ sensing of changes in $C_aO_2$; the clamping of renal blood flow (reduced $DO_2$) during anemia may be a central mechanism allowing for sensing of changes in $C_aO_2$; reduced arterial $C_aO_2$ resulted in a local renal hypoxia response (increased serum EPO) and may have initiated the cardiovascular response to increase cerebral blood flow and maintain cerebral $DO_2$. Inhibition of the adrenergic system impaired these responses and resulted in reduced brain $DO_2$. Understanding the heterogeneous adaptive responses to acute anemia may inform clinical practice and optimize management of acutely anemia patients.

## REFERENCES:

Am J Physiol Regul Integr Comp Physiol. 2007 Jan; 292(1):R403-14. PMID: 16973934
Anesthesiology. 2009 Nov;111(5):988-1000. PMID: 19809291
Proc Natl Acad Sci U S A. 2011 Oct 18;108(42):17544-9. PMID: 21976486
Am J Physiol Regul Integr Comp Physiol. 2014 Jul 1;307(1):R13-25. PMID: 24760996
Am J Physiol Regul Integr Comp Physiol. 2018 Apr 1;314(4):R611-622. PMID: 29351418
Am J Physiol Regul Integr Comp Physiol. 2020 Apr 1;318(4):R799-R812. PMID: 32130021

## GRANT ACKNOWLEDGEMENT:

GH, CAS RA Gordon Award; GH, AJB, CDM University of Toronto Merit Awards.

# CARDIOVASCULAR AND THORACIC

## Analgesic Efficacy of Surgeon Placed Paravertebral Catheters Compared with Thoracic Epidural Analgesia After Ivor Lewis Esophagectomy: A Retrospective Non-Inferiority Study

Haotian Wang[1], Daniel French[2], David MacDonald[1]

1 Department of Anesthesia, Pain Management and Perioperative Medicine, Dalhousie University, Halifax, Nova Scotia, Canada.
2 Department of Thoracic Surgery, Dalhousie University, Halifax, Nova Scotia, Canada.

**Background:** The Ivor Lewis esophagectomy is an operation that involves a laparotomy and a right thoracotomy, both of which are associated with severe postoperative pain and subsequent impairment of respiratory function. [1] Currently, the accepted “gold standard” for postoperative analgesia for thoracotomies and upper abdominal incisions is the thoracic epidural. [2] A systematic review showed paravertebral catheters (PVC) were equivalent to epidural analgesia for post-thoracotomy pain control [3] and they have also been associated with less nausea and vomiting and hypotension. [3] To our knowledge, the use of the paravertebral catheter in open Ivor Lewis esophagectomy has not been formally studied.

**Methods:** We performed a retrospective chart review of the open Ivor Lewis Esophagectomy patients from 2012 to 2018 at our local institution. Local ethics board approval was obtained. A total of 96 patients underwent open Ivor Lewis esophagectomies: 44 patients had a surgeon placed paravertebral and 52 patients had a thoracic epidural.

**Results:** Our primary outcome was the area under the curve (AUC) pain scores in the first 48 hours after surgery using the trapezoid method as described by Aloia et al. [4]. Overall, the PVC group was non-inferior and statistically equivalent to the epidural group. A non-inferiority margin of 2 on the pain scale was used [5]. Although there was a significant difference between the two groups ($t(84.6)=2.61$, $p=0.011$), the mean difference of 35.2 was contained within the 90% CI equivalence bounds. With respect to our secondary outcomes, the highest pain score was non-inferior and equivalent between PVC and epidurals ($t(90)=1.53$, $p=0.13$). The total opioid consumption in the PVC group was significantly less compared to the epidural group. In addition to assessing pain through various outcomes, we also reviewed the patients' time to ambulation (TTA) and length of stay (LOS) in hospital as a surrogate of function: the PVC group had a mean TTA of 25.6 hours, versus 29.8 hours; the PVC group had a mean LOS of 14.02 days versus 13.86 days in the epidural group. One aspect of epidurals that clinicians often cite against them are the side effects. [3] This was also demonstrated in our study. Epidurals had a much higher incidence of pruritus than the PVC group (15 versus 4). The incidence of nausea/vomiting, somnolence and hypotension were similar.

**Discussion:** Our retrospective study continues to challenge the role of epidurals as the gold standard of pain control post thoracotomy and upper midline abdominal incision. A surgeon placed paravertebral under direct vision may be more safe than a thoracic epidural placement, and has less side effects postoperatively. Recently, a study is underway for minimally invasive esophagectomy comparing epidurals to PVC in the Netherlands. Further prospective studies, with a larger population are needed in order to better compare the two modalities.

**REFERENCES:**

[1] R. Davies, P. Myles and J. Graham, "A comparison of the analgesic efficacy and side-effects of paravertebral vs epidural blockade for thoracotomy - a systematic review and meta-analysis of randomized trials," British Journal of Anesthesia, vol. 96, pp. 418-426, 2006.
[2] P. Howells, M. Bieker and J. Yeung, "Oesophageal cancer and the anaesthetist," BJA Education, vol. 17, no. 2, p. 68–73, 2017.
[3] G. Joshi, F. Bonnet, R. Shah, R. Wilkinson, F. Camu, B. Fischer, E. Neugebauer, N. Rawal, S. Schug, C. Simanski and H. Kehlet, "A Systematic Review of Randomized Trials Evaluating Regional Techniques for Postthoracotomy Analgesia," Anesthesia & Analgesia, vol. 107, no. 3, pp. 1026-1040, 2008.
[4] T. Aloia, B. Kim, Y. Segraves-Chun, J. Cata, M. Truty, Q. Shi, A. Holmes, J. Soliz, K. Popat, T. Rahlfs, J. Lee, X. Wang, J. Morris, V. R. Gottumukkala and V. Jean-Nicolas, "A Randomized Controlled Trial of Postoperative Thoracic Epidural Analgesia Versus Intravenous Patient-controlled Analgesia After Major Hepatopancreatobiliary Surgery.," Annals of Surgery, vol. 266, no. 3, p. 545–554, 2017.
[5] J. Farrar, R. B. J. Portenoy, J. Kinman and B. Strom, "Defining the clinically important difference in pain outcome measures.," Pain, vol. 88, no. 3, p. 287–294, 2000.

## Association Between Handover of Anesthesiology Care and One-Year Mortality Among Patients Undergoing Cardiac Surgery

John O'Connor[1], Philip M. Jones[2,3], Duminda N. Wijeysundera[3,4], Anan Bader Eddeen[3], Louise Y. Sun[1,3,5]

1 Division of Cardiac Anesthesiology, University of Ottawa Heart Institute, Ottawa, Ontario, Canada.
2 Department of Anesthesia and Perioperative Medicine, University of Western Ontario, London, Ontario, Canada.
3 Institute for Clinical Evaluative Sciences, Ontario, Canada.
4 Department of Anesthesia, University of Toronto, Toronto, Ontario, Canada.
5 School of Epidemiology and Public Health, University of Ottawa, Ottawa, Ontario, Canada.

**Background**: Recent studies have identified handover of care from one anesthesiologist to another during noncardiac surgery as a risk factor for increased morbidity and mortality(1,2). However, the impact of anesthesiologist handover (AH) has not been thoroughly investigated in the practice of cardiac anesthesiology, where the operative risk is higher and the probability of handover is greater due to longer operative duration. We hypothesized that complete AH during cardiac surgery is associated with higher rates of one-year mortality.

**Methods:** Ethics approval was waived by the local REB. We conducted a population-based, retrospective cohort study in Ontario, Canada, using clinical registry and administrative health care databases with information on all Ontario residents. Included were adult patients ≥ 18 years of age, who underwent coronary artery bypass grafting (CABG), and/or aortic, mitral, tricuspid valve surgery, or thoracic aorta procedures between October 1, 2008 and September 30, 2019. Excluded were patients who underwent cardiac transplantation and implantation of ventricular assist devices. The primary exposure was complete handover of anesthesiology care, as identified from physician billing codes on the day of or after surgery (in case of handover occurring after midnight). The primary outcome was all-cause mortality within one year after surgery. Mortality rates were calculated using the Kaplan-Meier method. The relative hazard of death was assessed using a multivariable Cox proportional hazard model.

**Results:** A total of 102,209 patients met the inclusion criteria, of whom 1,926 (1.9%) experienced a complete handover of anesthesiology care. Patients who experienced an anesthesiology handover were more likely to be male, be undergoing emergent and/or thoracic aorta surgery, and to have endocarditis and more advanced cardiac symptoms. In addition, anesthesiology handovers occurred more frequently at teaching hospitals, when the primary anesthesiologist was female, and when the surgeon was less experienced. Anesthesiology handover was associated with an increased rate of mortality at one-year (Figure), and was an independent predictor of this outcome (HR 1.41, 95% CI 1.12-1.76) after adjustment for patient, procedure, anesthesiologist, surgeon, and hospital characteristics.

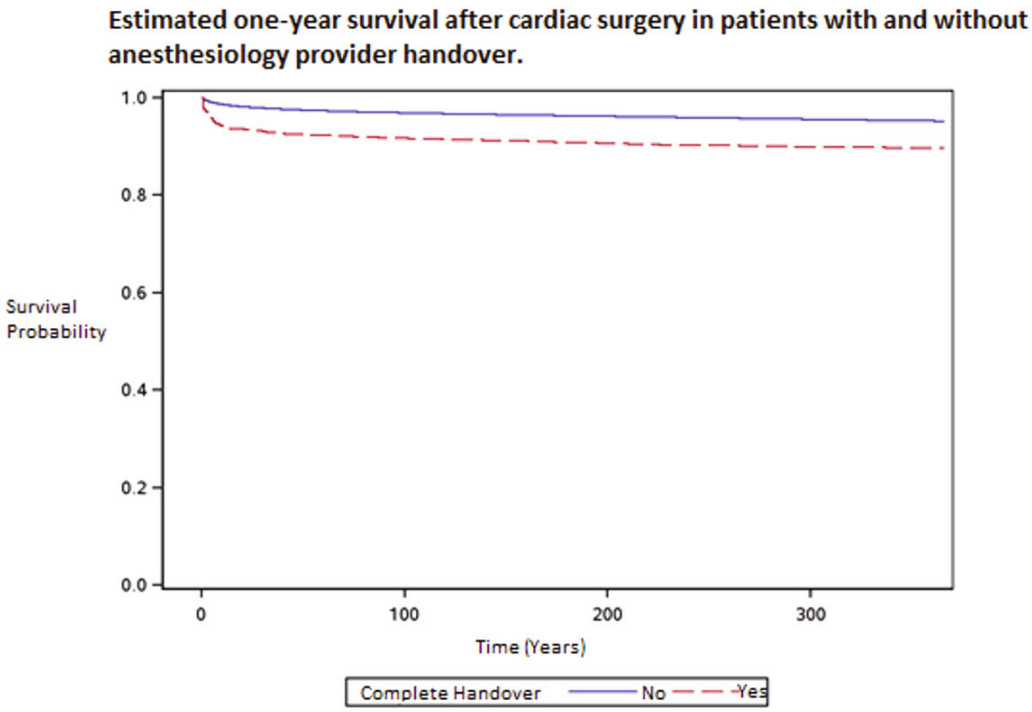
**Discussion:** We found that the handover of anesthesiology care was associated with increase in one-year mortality after major cardiac surgery. Handover is a critical event that impacts patient safety. Further research is needed to qualitatively evaluate, and systematically improve the handover process.

**REFERENCES:**

1. Sentinel Event | The Joint Commission [Internet]. [cited 2020 Jun 16]. Available from: https://www.jointcommission.org/resources/patient-safety-topics/sentinel-event/
2. Hudson CCC, McDonald B, Hudson JKC, Tran D, Boodhwani M. Impact of anesthetic handover on mortality and morbidity in cardiac surgery: a cohort study. J Cardiothorac Vasc Anesth. 2015 Feb;29(1):11–6.

**GRANT ACKNOWLEDGEMENT:**

This research was supported by a grant from the Canadian Institutes of Health Research (CIHR)



## IGFBP7 as a Pre-Operative Predictor of Congestive Acute Kidney Injury in Adults Undergoing Cardiac Surgery

Yannick MacMillan[1,2], Peter Liu[3], Louise Y. Sun[2,4]

1 University of Ottawa Faculty of Medicine, Ottawa, Ontario, Canada.
2 Division of Cardiac Anesthesiology, University of Ottawa Heart Institute, Ottawa, Ontario, Canada.
3 Division of Cardiology, University of Ottawa Heart Institute, Ottawa, Ontario, Canada.
4 School of Epidemiology and Public Health, University of Ottawa, Ottawa, Ontario, Canada.

**Introduction/Background:** Right ventricular failure (RVF) and acute kidney injury (AKI) are known risk factors for morbidity and mortality following cardiac surgery[1-3]. Congestive acute kidney injury (c-AKI) refers to AKI in the presence of RVF and is deadlier than its individual components[1]. Early identification and prediction of these outcomes is critical for appropriate treatment, through clinical risk stratification that is complemented by biomarkers[1]. Prior work has shown N-terminal pro hormone B-type natriuretic peptide (NT-proBNP) and pulmonary artery pulsatility index (PAPi) to have good predictive power for post-operative AKI and RVF[1,4]. Insulin-like growth-factor binding protein 7 (IGFBP7) is a novel biomarker that has shown to be associated with diastolic dysfunction and heart failure[5]. This study will investigate the predictive ability of serum IGFBP7 in predicting c-AKI, AKI and RVF.

**Methods:** Ethics approval was obtained from the local REB. This prospective nested case-control study consisted of 350 adult patients undergoing major elective cardiac surgery at a tertiary center between 2015 and 2017. The primary outcome was c-AKI, while AKI and RVF were secondary outcomes. For each outcome, cases were matched 1:1 to controls based on age and sex. Conditional logistic regression was used to assess the predictive ability of IGFBP7 for c-AKI, AKI and RVF. NT-proBNP and PAPi were used as alternative predictors, for comparison. Univariable, as well as multivariable models were generated. Multivariable models included the biomarkers (IGFBP7 or NT-proBNP) and additional variables selected based on the strength of their known association with AKI and RVF in cardiac surgical patients. For each model, the area under the curve (AUC) was calculated as a measure of the model's ability to distinguish cases from controls.

**Results:** We identified 85 cases and 85 controls, of whom 18 developed c-AKI. For each of the outcomes, IGFBP7 outperformed NT-proBNP and PAPi as a univariate predictor (Figure 1). For prediction of c-AKI, the IGPBP7 model had an AUC of 0.81 (95% CI, 0.66-0.96), as compared to 0.51 (0.31-0.71) for NT-proBNP and 0.61 (0.36-0.87) for PAPi. IGFBP7 had less predictive power for AKI and RVF, while still outperforming NT-proBNP and PAPi. The optimal cutoff for predicting either AKI or c-AKI with IGFBP7 was 102 ng/mL. For each of the outcome variables, the multivariable NT-proBNP and IGFBP7 models had very similar AUCs. These multivariable models performed well for c-AKI, with AUCs of 0.90 (0.81-1.00) for IGFBP7 and 0.87 (0.76-0.99) for NT-proBNP.

**Conclusion:** In summary, IGFBP7 outperformed NT-proBNP and PAPi as a univariate predictor for all three outcomes. The AUCs for prediction of AKI and c-AKI with IGFBP7 are particularly promising, and these improve further with the addition of clinical variables. Thus, IGFBP7 is a promising biomarker for prediction of AKI and c-AKI and warrants further investigation in future studies.

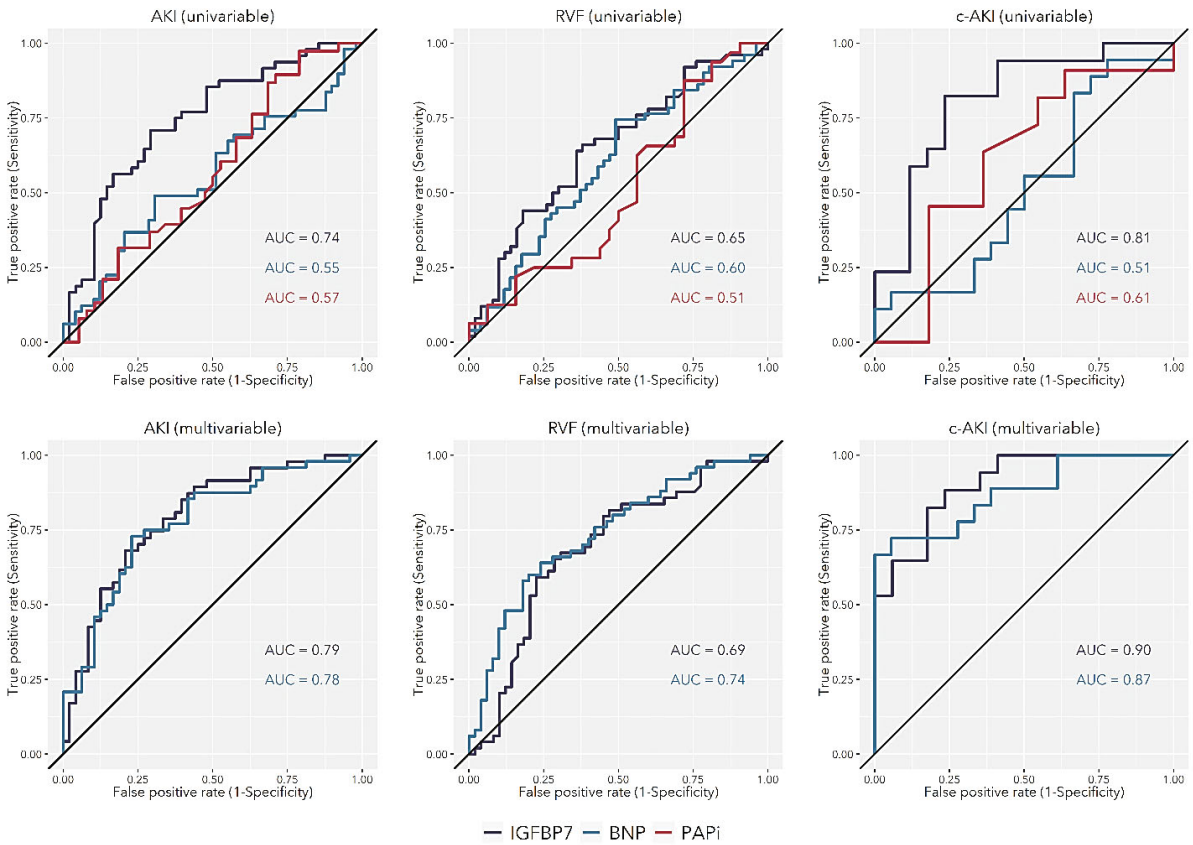
## REFERENCES:


1. Zelt J, Mielniczuk L, Liu P et al. Utility of Novel Cardiorenal Biomarkers in the Prediction and Early Detection of Congestive Kidney Injury Following Cardiac Surgery. *Journal of Clinical Medicine* 2018; **7**: 540.
2. Haddad F, Doyle R, Murphy DJ, Hunt SA. Right ventricular function in cardiovascular disease, part II: Pathophysiology, clinical importance, and management of right ventricular failure. *Circulation* 2008; **117**: 1717–31.
3. Hussain ML, Hamid PF, Chakane N. Will urinary biomarkers provide a breakthrough in diagnosing cardiac surgery-associated AKI?–A systematic review. *Biomarkers* 2020; **25**: 375–83.
4. Rong LQ, Rahouma M, Neuburger PJ et al. Use of Pulmonary Artery Pulsatility Index in Cardiac Surgery. *Journal of Cardiothoracic and Vascular Anesthesia* 2020; **34**: 1220–5.
5. Gandhi PU, Gaggin HK, Redfield MM et al. Insulin-Like Growth Factor–Binding Protein-7 as a Biomarker of Diastolic Dysfunction and Functional Capacity in Heart Failure With Preserved Ejection Fraction: Results From the RELAX Trial. *JACC: Heart Failure* 2016; **4**: 860–9.


## GRANT ACKNOWLEDGEMENT:

"ORACLE Innovations Fund" from the University of Ottawa Heart Institute

Figure 1



## Introduction of the Serratus Anterior Plane Catheter with Programmed Intermittent Bolus for Minimally Invasive Cardiac Surgery: A Retrospective Study

Russell Christie[1,2], Peter Rose[3,4], Daniel Law[2], Reva Ramlogan[1,2], Donna Nicholson[2,3], Diem Tran[2,3]

1 Department of Anesthesiology and Pain Medicine, The Ottawa Hospital, Ottawa, Canada
2 University of Ottawa Faculty of Medicine, Ottawa, Ontario, Canada.
3 Department of Anesthesiology and Perioperatve Care, Vancouver Acute (Vancouver General and UBC Hospitals), Vancouver, British Columbia, Canada.
4 University of British Columbia Faculty of Medicine, Vancouver, British Columbia, Canada.
5 University of Ottawa Heart Institute, Ottawa, Ontario, Canada.

**Introduction/Background:** Minimally invasive heart surgery (MIHS) is rapidly progressing with proposed benefits over sternotomy including reduced recovery time, inflammatory response and transfusion requirements[1-3]. In addition to the surgical ports, MIHS requires a mini-thoracotomy in the 4-5$^{th}$ intercostal space resulting in significant postoperative pain for which regional anesthetic techniques may be used. One such technique is the serratus anterior plane (SAP) block, which has been described previously for thoracic surgery and MIHS[4-9]. The objective of this study was to compare postoperative analgesia efficacy and opioid consumption, as well as clinical outcomes between patients that did and did not receive SAP catheters.

**Methods:** REB approval was obtained from the local REB for this retrospective cohort study comparing analgesic control and patient outcomes from May 2017 until May 2020 in patients undergoing MIHS at a single cardiac surgery center. Clinical use of the SAP block and catheters was started in November 2018. Patients were excluded if they were less than 18 years of age, had incomplete documentation of anesthetic technique, conversion from MIHS to open or a surgical procedure within 72 hrs of the index surgery. Continuous data are expressed as means and standard deviations for variables with normal distribution and as medians and interquartile ranges (IQR) otherwise. Groups were compared using unadjusted t-tests and logistic regression models (adjusted for age, sex and BMI) or fisher's exact tests as appropriate. A value $p \leq 0.05$ was considered significant for differences between the two groups.

**Results:** There were 115 patients that met inclusion during the study period (41 in the SAP catheter group and 74 in the control group). Demographic data were balanced between the two groups. After adjusting for age, sex and body mass index, there was no difference in opioid consumption (OR: 0.995, 95% CI: 0.990 - 1.000) , pain score at extubation (OR: 0.93, 95% CI: 0.789 – 1.098) average pain score in the first 24 hours after surgery (OR: 0.869, 95% CI: 0.702 – 1.077), Intensive Care Unit length of stay (OR: 0.990, 95% CI: 0.773 0 1.268) or hospital length of stay (OR: 0.998, 95% CI 0.904 – 1.101) between groups. There was a significant decrease in opioid related side effects in the SAP group (OR: 2.702, 95% CI: 0.773- 1.268). As well, the duration of post-operative intubation was 218 minutes shorter in the SAP group compared to the usual care group (OR: 0.998, 95% CI: 0.904 – 0.999).

**Discussion:** We have shown that patients undergoing MIHS who have a SAP catheter placed for post-operative analgesia do not have a decrease in opioid consumption, pain at extubation or pain scores. They do experience less time intubated and have less opioid related adverse effects.

**REFERENCES:**

1. Whellan DJ, McCarey MM, Taylor BS, et al. Trends in robotic-assisted coronary artery bypass grafts: A study of The Society of Thoracic Surgeons Adult Cardiac Surgery Database, 2006 to 2012. Ann Thorac Surg 2016;102:140–6.
2. Bonaros N, Schachner T, Wiedemann D, et al. Quality of life improvement after robotically assisted coronary artery bypass grafting. Cardiology 2009;114:59–66.
3. Bonatti J, Ramahi J, Hasan F,et al. Long-term results after robotically assisted coronary bypass surgery. Ann Cardiothorac Surg 2016;5:556–62.
4. Berthoud V, Ellouze O, Nguyen M, Konstantinou M, Aho S, Malapert G, Girard C, Guinot P, Bouchot O and Bouhemad B. Serratus anterior plane block for minimally invasive heart surgery. BMC Anesthesiology. 2018; 18: 144-150.
5. Ökmen K, Metin Ökmen B. Evaluation of the effect of serratus anterior plane block for pain treatment after video-assisted thoracoscopic surgery. Anaesth Crit Care Pain Med 2017; https://doi.org/10.1016/j.accpm.2017.09.005.

## Is Negative Aortic Wall Strain Possible?

Alexander Gregory[1,2], Gary M. Dobson[1], Miriam Nightingale[2,3], Elena S. Di Martino[2,3,4]

1 Department of Anesthesiology, Perioperative and Pain Medicine, University of Calgary, Calgary, Alberta, Canada.
2 Libin Cardiovascular Institute, University of Calgary, Calgary, Alberta, Canada.
3 Biomedical Engineering Graduate Program, University of Calgary, Calgary, Alberta, Canada.
4 Centre for Bioengineering Research and Education University of Calgary, Calgary, Alberta, Canada.

**Introduction:** Non-invasive measures of aortic biomechanical properties, obtained using speckle-tracking echocardiography (STE), have demonstrated potential for studying the pathogenesis and risk-stratifying aortic disease.[1] Previous STE-based studies of aortic biomechanics have focused on global strain.[2] Given the known regional heterogeneity of aortic tissue microstructure and function in the diseased state, a global approach risks missing data on local material properties.[3] We report preliminary findings of segmental STE-derived strain in patients with ascending aortic aneurysms.

**Methods:** Ethics approval was obtained from the local REB. Adult patients undergoing elective resection of ascending aortic aneurysms were included. Intra-operative trans-esophageal echocardiography was performed (Philips iE33, Koninklijke Philips N.V.,Netherlands) and a short-axis image of the aneurysm acquired prior to resection. Post-acquisition STE analysis was performed (EchoInsight, Epsilon Imaging, USA) to obtain circumferential aortic strain values through the cardiac cycle on 4 subdivided aortic regions (anterior, lateral, medial, and posterior) [Figure 1A]. Tracking quality was assessed using 4 parameters: the software's Data Quality Index (both minimum and average values), wall drop-out, and subjective grading of adequate wall tracking. Segments failing in ≥ 3 parameters were excluded.

**Results:** Ten patients were included in this preliminary analysis. Most segments (27/40) had excellent wall-tracking with ≤ 1 sub-optimal quality parameter, while 7 were excluded. The posterior (3/7) and lateral (3/7) segments had the highest proportion of excluded segments, often due to wall dropout. Eight patients, and 10 of 33 segments (8 with excellent tracking indices) demonstrated a significant degree of negative strain during systole, with the lateral (5/10) and posterior (3/10) segments accounting for the majority [Figure 1B]. Global strain (average of all included segments) was positive for all patients.

**Discussion:** Intuitively, negative strain of the ascending aortic wall during systole seems implausible. However, it has been previously observed with STE and could reflect an intrinsic error in software algorithms, or external error from out-of-plane motion or torsion.[2] Its regular appearance in our study, on tissue tracking optimally, and localizing to the posterior/lateral wall segments suggests this may be an actual phenomenon warranting additional study. One potential explanation could be external compression by mediastinal structures, a hypothesis supported by a previous study demonstrating reduced posterior wall aortic expansion using m-mode ultrasound.[4] Another could be tissue heterogeneity causing an "accordion-effect" from a rapidly expanding adjacent segment. If this is the cause, then regional aortic strain should be included in imaging-based biomechanical studies so that local material properties, and the underlying microstructural pathology they represent, are not missed.[5] Our study, which is currently ongoing, includes a 4-segment analysis of pre-operative MRI strain, as well as biomechanical and histologic testing of excised aortic tissue. With this additional information, we should be better able to elucidate the cause of our observed negative aortic strain.

## REFERENCES:

1. Rong LQ, Kim J, Gregory AJ. Speckle tracking echocardiography: imaging insights into the aorta. *Curr Opin Cardiol.* 2020;35(2):116-122.
2. Alreshidan M, Shahmansouri N, Chung J, et al. Obtaining the biomechanical behavior of ascending aortic aneurysm via the use of novel speckle tracking echocardiography. *J Thorac Cardiovasc Surg.* 2017;153(4):781-788.
3. Ruddy JM, Jones JA, Spinale FG, Ikonomidis JS. Regional heterogeneity within the aorta: relevance to aneurysm disease. *J Thorac Cardiovasc Surg.* 2008;136(5):1123-1130.
4. Modak RK, Koullias GJ, Govindarajulu US, Tranquilli M, Barash PG, Elefteriades JA. Ascending aortic aneurysms: asymmetrical differences in aortic cross-sectional wall motion detected by epiaortic echocardiography. *J Cardiothorac Vasc Anesth.* 2010;24(5):776-779.
5. Martufi G, Forneris A, Appoo JJ, Di Martino ES. Is There a Role for Biomechanical Engineering in Helping to Elucidate the Risk Profile of the Thoracic Aorta? *Ann Thorac Surg.* 2016;101(1):390-398.

## GRANT ACKNOWLEDGEMENT:

This research was supported by a Canadian Anesthesiologists' Society Research Grant (2017 Dr Earl Wynands Research Award in Cardiovascular Anesthesia) and the Canadian Anesthesia Research Foundation (CARF).

Figure 1 (A & B)

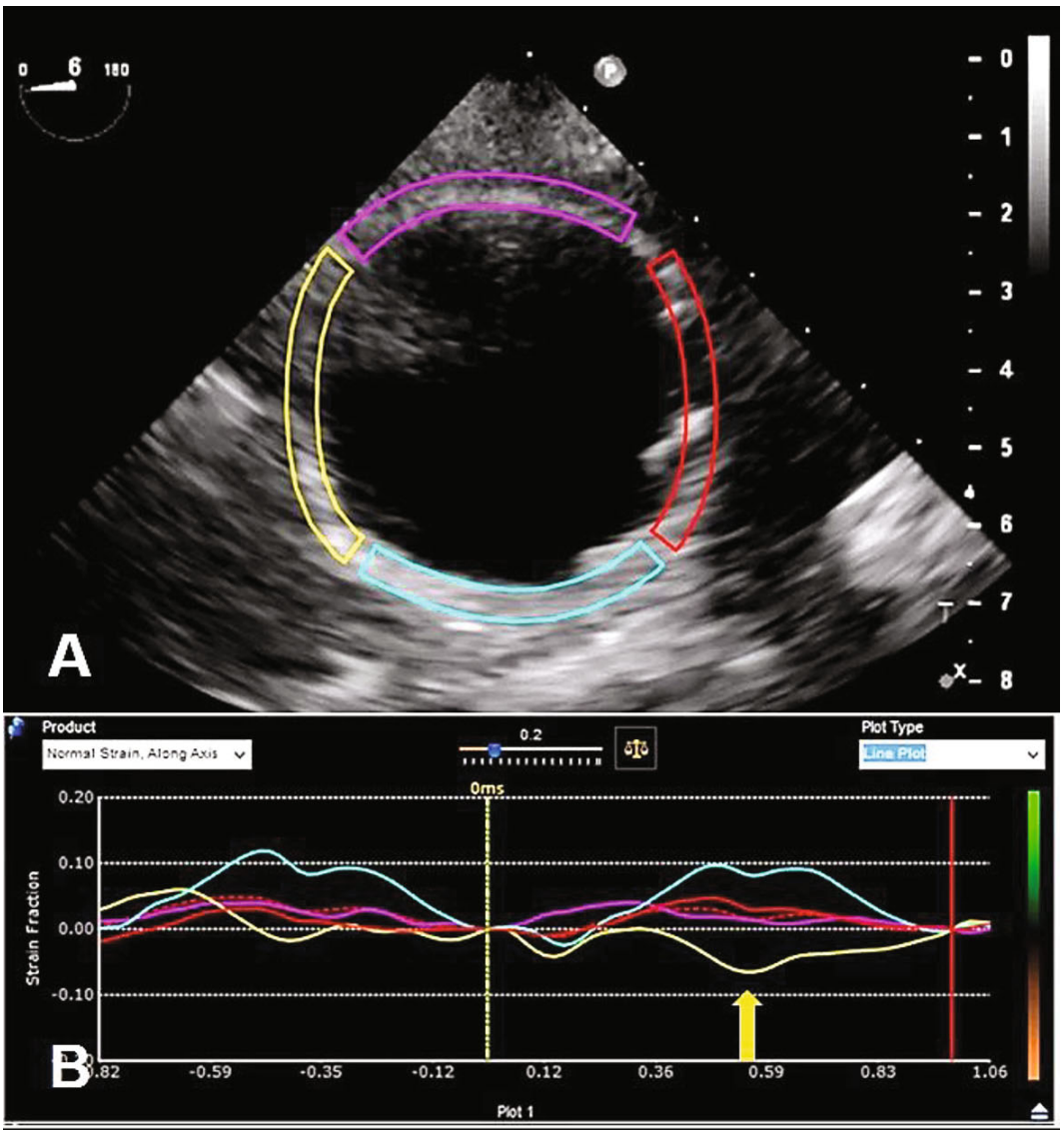



**Figure 1**. Selected example of circumferential ascending aortic strain analysis from our study using EchoInsight speckle-tracking echocardiography software (Epsilon Imaging, USA). (**A**) The short axis image of the ascending aortic aneurysm obtained from intra-operative TEE is divided into 4-regions: anterior (**cyan**), lateral (**yellow**), posterior (**purple**), and medial (**red**). (**B**) Strain analysis during systolic pulse-wave transmission shows the lateral wall with negative strain (yellow arrow) while the other walls have positive strain. *Note: Color of solid plot lines in (**B**) correspond to regions identified on (**A**), while the red-hashed line demarks global strain.*

## Pilot Study Measuring the 7-Day Stability of Epinephrine, Norepinephrine and Phenylephrine in Syringes for Intravenous Infusions Using Liquid Chromatography-Tandem Mass Spectrometry

Luke K. Wiseman[1], Alejandro M. Cohen[2], Pantelis Andreou[3], Richard Hall[1], Izabela Panek[1], Victor M. Neira[1]

1 Department of Anesthesia, Pain Management & Perioperative Medicine, Dalhousie University, Halifax, Nova Scotia, Canada.
2 Biological Mass Spectrometry Core Facility, Faculty of Medicine, Dalhousie University, Halifax, Nova Scotia, Canada.
3 Communiity Health and Epidemiology, Faculty of Medicine, Dalhousie University, Halifax, Nova Scotia, Canada.

**Introduction/Background**: Syringe infusion pumps are increasingly used in critical care to allow accurate small volume administration of medications. Medication safety guidelines recommend the use of pre-prepared medications by pharmacy or industry.[1] Health Canada has published concerns about decreased potency of pre-prepared medications in syringes.[2] There is conflicting information regarding sympathomimetic drug stability related to methodology and experimental conditions.[3] The objective of this pilot study was to develop a liquid chromatography-tandem mass spectrometry (LC-MS/MS) method to determine the stability of epinephrine (EPI), norepinephrine (NE), and phenylephrine (PE), stored in Becton Dickinson© (BD) syringes. A secondary objective was to derive a power analysis for a larger study.

**Methods:** Ethics approval was not applicable because the study did not involve human or animal research. Research grade (purity >99.9%) EPI, NE and PE were used as standards for the calibration curves spanning the target concentrations. The calibration standards and test samples were each spiked with the corresponding isotope labeled internal standard. The area under the curve (AUC) of each drug was obtained by LC-MS/MS using a custom-developed Selected Reaction Monitoring (SRM) method.[4,5] Each drug was normalized by the AUC of the appropriate internal standard. Medical vials of EPI 4 mg, NE 4 mg, and PE 5 mg were diluted with normal saline solution to 50 mL in BD© syringes. Syringes were prepared aseptically, protected from UV radiation with plastic amber bags, and stored in a medical fridge (5-8 °C) for fresh (<4h), 3 days, and 7 days until testing. Preparations were analyzed in triplicate using LC-MS/MS with the investigator blinded to the preparation date. Linear regression analysis for the calibration standard and power analysis for a future study using three syringe brands and 6-time periods up to 14 days were performed.

**Results:** Total AUC ratio calibration standard linear regressions of the drugs were robust (EPI $R^2$; 0.96, NE $R^2$: 0.97, PE $R^2$: 0.98, ($p< 0.001$ for all)). Estimated fresh syringe concentrations were higher than expected. Compared to fresh, the percentage decrease in concentration at 3 and 7 days for EPI and NEPI was less than 10%. Compared to fresh, PE percentage decrease in concentration was 20% at 3 days with no significant further decrease at 7 days (Table 1). The power analysis estimated a sample size of 4 syringes per time period for six time periods using 3 syringe brands.

**Discussion:** The sample preparation and LC-MS/MS methods demonstrated high through-put (acquisition times <2min per sample), good reproducibility and a strong positive correlation between drug concentration and MS signal. Medical preparation concentrations were likely higher than expected due to measurement error. A future study is planned with a larger sample

size and three syringe brands to determine sympathomimetic drug stability stored up to 14 days.

## REFERENCES:


1. Billstein-Leber M, Carrillo CJD, Cassano AT, Moline K, Robertson JJ. ASHP Guidelines on Preventing Medication Errors in Hospitals. Am J Heal Pharm 2018;75:1493–517. Available at: http://www.ajhp.org/lookup/doi/10.2146/ajhp170811.
2. Health Canada. Becton-Dickinson - Disposable Syringes and Reduced Drug Potency Issues. 2015. Available at: http://healthycanadians.gc.ca/recall-alert-rappel-avis/hc-sc/2015/55044a-eng.php.
3. Hoellein L, Holzgrabe U. Ficts and facts of epinephrine and norepinephrine stability in injectable solutions. Int J Pharm 2012;434:468–80. Available at: http://dx.doi.org/10.1016/j.ijpharm.2012.05.017.
4. Li X, Li S, Wynveen P, Mork K, Kellermann G. Development and validation of a specific and sensitive LC-MS/MS method for quantification of urinary catecholamines and application in biological variation studies. Anal Bioanal Chem 2014;406:7287–97.
5. Tiwari G, Tiwari R. Bioanalytical method validation: An updated review. Pharm Methods 2010;1:25.


## GRANT ACKNOWLEDGEMENT:

Department of Anesthesia, Pain Management & Perioperative Medicine Research Fund.

Table 1. Medication concentrations at fresh (< 4 hours), 3 days, and 7 days.

| | Concentration in Micrograms/mL [95 % Confidence Interval] | | |
|---|---|---|---|
| **Storage time** | **EPI** | **NE** | **PE** |
| Fresh (< 4 hours) | 105 [92 – 120] | 80 [73.5 – 88.5] | 120 [108 – 130] |
| 3 Days | 96 [85 – 110] | 80 [73.5 – 88.5] | 95 [85 – 106] |
| 7 Days | 105 [92 – 120] | 80 [73.5 – 88.5] | 95 [85 – 106] |

# CHRONIC PAIN

## Determining the Need for an Interdisciplinary Approach to Managing Chronic Pelvic Pain

Allana Munro[1,2], Elizabeth Randle[2,3], Sherry Jin[1,2], Krista C. Ritchie[1,4]

1 Department of Women's and Obstetric Anesthesia, IWK Health, Halifax, Nova Scotia, Canada.
2 Dalhousie University, Halifax, Nova Scotia, Canada.
3 Department of Obstetrics and Gynecology, IWK Health, Halifax, Nova Scotia, Canada.
4 Mount Saint Vincent University, Halifax, Nova Scotia, Canada.

**Introduction/ Background:** Chronic Pelvic Pain (CPP) is a difficult clinical problem that presents in approximately 15% of women of reproductive age.[1] CPP management is challenging due to its multifactorial etiology, diagnostic uncertainties and complexity of treatments.[1] An integrated, interdisciplinary approach to management is more effective than traditional segmented strategies.[2] We anticipated that locally, a large number of women seek help for CPP and are faced with long waits between referral and clinical assessment. A feasibility study was completed to facilitate future evidence-informed clinic design and implementation. The objectives of this feasibility study were to:

1. Determine the number of women with CPP referred to Gynecologists and the Pain Management Unit (PMU) in one year and their wait time for appointment.
2. Determine the annual CPP visits for a) gynecology, b) PMU and c) Emergency Department (ED)
3. Develop a preliminary demographic description and referral pattern to facilitate a future evidence-informed clinic design and implementation.

**Methods:** Ethics approval was obtained from the local REB. Billing codes for "pelvic pain" and "endometriosis" were used to determine the number of CPP patient visits between Aug 1, 2018 and July 31, 2019. Exclusion criteria included males and females with pain not attributed to CPP. The associated hospital unit number was used to access electronic health records. Health records confirmed new or return appointments and determined the referral wait time and source. The number of clinic appointments, patients that visited the ED, and ED visits per year were documented. Medical or surgical management for CPP that occurred historically was extracted. Descriptive statistics were completed using SPSS.

**Results:** Patient age, number of patient referrals and visits, wait times, and ED visits are presented in Table 1. In the study period, there were 1415 patients seeking care for CPP, with an average of 3 appointments per year. Most women were referred by a family physician (n = 481, 75%). Endometriosis (n=271, 34%) was the most common referral diagnosis. The most common surgeries that women underwent prior to referral were laparoscopy (n = 259, 32%) and Cesarean delivery (n = 98, 12%). Physiotherapy (n = 21, 2.8%) and counselling (n = 23, 3.1%) were the most common interventions trialed historically other than surgery. Hormone therapy (n = 506, 68%), and non-opioid analgesics (n = 322, 43.6%) were the most common medical management options trialed prior to referral.

**Discussion:** Our study demonstrates a significant number of women suffer from CPP. These women present frequently to the ED for management and experience significant wait times to access specialty consultation. The demand for care demonstrates the need for centralized management of CPP via an interdisciplinary clinic. Authors can recommend managing CPP as

an institutional priority.

## REFERENCES:

1. Allaire C, Williams C, Bodmer-Roy S, Zhu S, Arion K, Ambacher K, et al. Chronic pelvic pain in an interdisciplinary setting: 1-year prospective cohort. Am J Obstet Gynecol. 2018;218(1):114.e1-.e12.
2. Jarrell J, Vilos G, Allaire C, Burgess S, Fortin C, Gerwin R, et al. Consensus guidelines for the management of chronic pelvic pain. J Obstet Gynaecol Can. 2005;27(9):869-910.

## GRANT ACKNOWLEDGEMENT:

This work was supported by the IWK Foundation's Translating Research into Care Healthcare Improvement Research Funding Program [IWK 1024655, 2019].

Table 1. Patient age, number of patient referrals and visits, wait times, and ED visits.

| Variable | Mean (SD) |
|---|---|
| Age | 38 years (10) |
| Gynecology patients | N = 815 |
| Gynecology wait time (avg) | 128 days (82) |
| Gynecology visits per patient (avg) | 3 (range 1 to 12) |
| PMU patients | N = 18 |
| PMU wait time (avg) | 189 days (217) |
| PMU visits per patient (avg) | 3 (range 1 to 13) |
| ED patients | N = 582 |
| ED visits per patient (avg) | 2 (range 1 to 11) |

Note: Data from one study year

## The Impact of Shared Familial Chronic Pain Experiences on Healthcare Utilization

Alicia Ling[1], Jordana L. Sommer[1,2], Dr. Renée El-Gabalawy[1,2,3,4]

1 Department of Anesthesiology, Perioperative and Pain Medicine, Max Rady College of Medicine, University of Manitoba, Winnipeg, Manitoba, Canada.
2 Department of Psychology, Faculty of Arts, University of Manitoba, Winnipeg, Manitoba, Canada.
3 Department of Psychiatry, Max Rady College of Medicine, University of Manitoba, Winnipeg, Manitoba, Canada.
4 Department of Clinical Health Psychology, Max Rady College of Medicine, University of Manitoba, Winnipeg, Manitoba, Canada.

**Introduction:** Chronic pain is highly prevalent across Canada and a large proportion of chronic pain patients do not suffer in isolation. There is a significant amount of research examining the impact of chronic pain on family members, when a sole member has a chronic pain condition. However, little research has examined the impacts of having multiple family members with a chronic pain condition. We first aimed to examine pain-related and mental health characteristics among chronic pain patients with a family member with chronic pain (spouse, child, sibling, or other relative) compared to those without. We further aimed to examine associations between having a family member with chronic pain on pain-related healthcare utilization.

**Methods:** Ethics approval was obtained from the local REB to gain access to self-reported data from a comprehensive Patient Intake Questionnaire (PIQ) completed by outpatients entering the Chronic Pain Clinic at a tertiary hospital between January 20, 2015 and February 12, 2018. Patients self-reported whether they had a family member with a chronic pain condition and completed validated self-report measures on indicators of chronic pain status (pain severity, pain interference), mental health (depressive features, pain catastrophizing), and healthcare utilization (medication use, healthcare encounters, specialists, imaging and tests). The primary analysis included multivariable logistic and linear regression models controlling for sociodemographic characteristics (age, sex, highest level of education completed) and duration of the chronic pain condition.

**Results:** 367 chronic pain patients were retrospectively identified and 339 were included in analyses, with 44% having a family member with chronic pain. Pain severity, pain interference, pain catastrophizing, and depression scores did not significantly differ between those with and without a family member with chronic pain, and there were no significant differences according to type of family member. There were differences amongst the subgroups in the type of specialists seen (Chi-square value = 9.51, $p < 0.05$) with the highest proportion of those seeking alternative therapies among those who have a child or other family with chronic pain. Having a family member with chronic pain, particularly close members (e.g. child or spouse), was also associated with increased hospital admissions for that individual ($H(4) = 11.184$, $p < 0.05$).

**Discussion:** Having shared chronic pain experiences with a family member may influence pain-related healthcare utilization (e.g. medication use, seeking alternative specialists and therapies, hospital admissions). Based on the trends observed, the type of familial relationship may play a key role. Determining the impact that various familial relationships have on healthcare utilization will allow for the development of targeted interventions catered towards families and will ascertain whether differences in use translate to differences in healthcare services satisfaction and/or treatment outcomes.

**REFERENCES:**


1. Cardol M, van den Bosch WJHM, Spreeuwenberg P, Groenewegen PP, van Dijk L, de Bakker DH: All in the Family: Headaches and Abdominal Pain as Indicators for Consultation Patterns in Families. Annals of Family Medicine 4(6):506-511, 2006
2. Che X, Cash R, Ng SK, Fitzgerald P, Fitzgibbon BM: A Systematic Review of the Processes Underlying the Main and the Buffering Effect of Social Support on the Experience of Pain. Clinical Journal of Pain 34(11):1061-1076, 2018
3. Kraljevic S, Banozic A, Maric A, Cosic A, Sapunar D, Puljak L: Parents' pain catastrophizing is related to pain catastrophizing of their adult children. International Journal of Behavioural Medicine 19(1):115-119, 2012
4. Mann EG, Johnson A, VanDenKerkhof EG: Frequency and characteristics of healthcare visits associated with chronic pain: results from a population-based Canadian study. Can J Anaesth 63(4):411-41, 2016
5. Meyler D, Stimpson JP, Peek MK: Health concordance within couples: A systematic review. Social Science & Medicine 64(11):2297-2310, 2007


Table 1. Sample characteristics

| | Family member with CP | No family member with CP | Spouse with CP | Child with CP | Sibling with CP | Other family member |
|---|---|---|---|---|---|---|
| *n* (%) of total sample | 149 (44.0%) | 190 (56.0%) | 17 (5.1%) | 17 (5.1%) | 36 (10.7%) | 75 (22.4%) |
| Age (*M, SD*) | 52.97 (14.61) | 55.41 (14.48) | 62.29 (8.84) | 67.4 (10.40) | 59.03 (11.66) | 44.34 (12.31) |
| Sex | | | | | | |
| Male | 54 (36.2%) | 82 (43.2%) | 9 (52.9%) | 5 (29.4%) | 9 (25.0%) | 31 (41.3%) |
| Female | 95 (63.8%) | 108 (56.8%) | 8 (47.1%) | 12 (70.6%) | 27 (75.0%) | 44 (58.7%) |
| Education | | | | | | |
| High school or less | 82 (55.8%) | 99 (53.2%) | 12 (70.6%) | 11 (64.7%) | 20 (55.6%) | 38 (52.1%) |
| Some college or higher | 65 (44.2%) | 87 (46.8%) | 5 (29.4%) | 6 (35.3%) | 16 (44.4%) | 35 (47.9%) |
| Employment status | | | | | | |
| Employed | 68 (45.6%) | 54 (28.6%) | 10 (58.8%) | 15 (88.2%) | 22 (61.1%) | 32 (42.7%) |
| Unemployed | 81 (54.4%) | 135 (71.4%) | 7 (41.2%) | 2 (11.8%) | 14 (38.9%) | 43 (57.3%) |
| Marital status | | | | | | |
| Single | 26 (17.8%) | 32 (17.4%) | 0 (0%) | 1 (5.9%) | 3 (8.3%) | 22 (30.1%) |
| Married/common-law | 93 (63.7%) | 117 (63.6%) | 15 (93.8%) | 12 (70.6%) | 18 (50.0%) | 45 (61.6%) |
| Widowed/separated/ divorced | 27 (18.5%) | 35 (19.0%) | 1 (6.3%) | 4 (23.5%) | 15 (41.7%) | 6 (8.2%) |

Note. Values represent *n* (%); *M* = mean, *SD* = standard deviation; CP = chronic pain.
Continuous variables are represented as means and standard deviations and categorical groups as percentages.

# CRITICAL CARE MEDICINE

## Impact of Community-Based Resuscitation Interventions on Bystander Cardiopulmonary Resuscitation and Survival Rates After Out-of-Hospital Cardiac Arrest: A Systematic Review and Meta-Analysis

Kayla Simmons[1], Sarah McIsaac[2], Aidan Goertzen[1], Robert Ohle[3]

1 Department of Undergraduate Medicine, Northern Ontario School of Medicine, Sudbury, Ontario, Canada.
2 Department of Critical Care, Department of Anesthesia, Northern Ontario School of Medicine, Sudbury, Ontario, Canada.
3 Department of Emergency Medicine, Health Sciences North Research Institute, Northern Ontario School of Medicine, Sudbury, Ontario, Canada.

**Introduction:** Out-of-hospital cardiac arrest (OHCA) is a leading cause of morbidity and mortality worldwide (1, 2). Approximately 350,000 OHCAs occur in the United States and 40,000 in Canada per annum (1, 3). Studies consistently find that early bystander cardiopulmonary resuscitation (B-CPR) enhances survival following OHCA (2). In response, community-based interventions targeting B-CPR rates have been implemented internationally (4, 5). The effects of these interventions are yet to be evaluated and synthesized collectively. Therefore, the objective of this study is to describe the effect of community-based interventions targeting resuscitation training or awareness on temporal B-CPR rates as well as survival following OHCA.

**Methods:** Ethics approval was not applicable as the study did not involve human or animal research. Medline/PubMed and Embase were searched from inception to July 2020 using a librarian assisted search strategy. Grey literature was hand-searched. Two reviewers independently conducted title and abstract screening, then selected publications for full text review according to predetermined inclusion criteria. Two reviewers completed data extraction and evaluated risk of bias using the Newcastle-Ottawa Scale. Cochrane's Review Manager 5.4 was used to conduct random effects meta-analyses on the primary outcome, B-CPR rates, and secondary outcomes: survival to hospital discharge, 30-day survival, and survival with a favourable neurological outcome following OHCA.

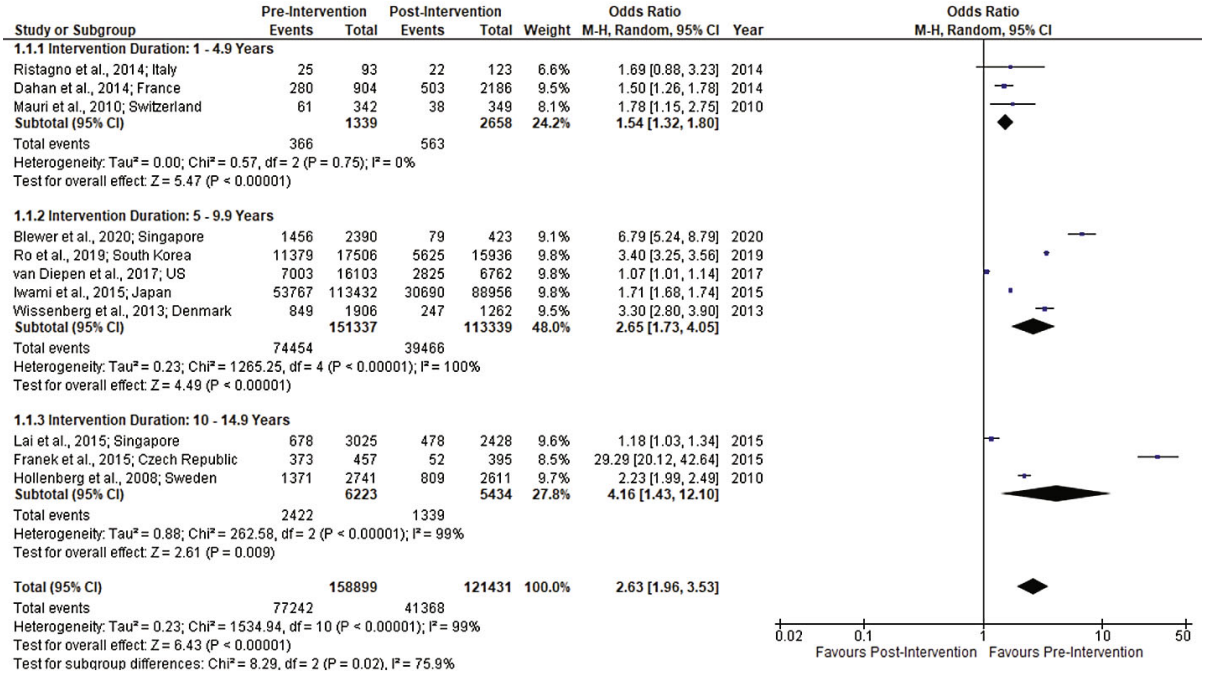
**Results:** The search identified a total of 2,304 records of which 122 underwent full text review; 12 were included for data extraction and final analyses. Included studies reported a total of 1,081,040 OHCAs across 11 countries. Median age of those experiencing OHCA ranged from 64 to 78 years. The most common interventions included community-based CPR training (n = 9), community-based AED training (n = 9), and dispatcher-assisted CPR (n = 8). The average quality assessment score was 5.5/8 on the Newcastle-Ottawa Scale. All 12 studies reported higher B-CPR rates post-intervention, increasing 19.5% on average. On meta-analysis, there was a significant difference in post-intervention B-CPR rates (n = 280,330; OR 2.63; 95% CI 1.96 to 3.53; $I^2$ = 99%; Figure 1.1). For secondary outcomes in the post-intervention period, survival following OHCA was significantly increased (n = 73,784; OR 1.68; 95% CI 1.19 to 2.36; $I^2$ = 96%; Figure 1.2), while survival with favourable neurological outcome was not significantly altered (n = 61,760; OR 1.16; 95% CI 0.79 to 1.71; $I^2$ = 96%; Figure 1.3).

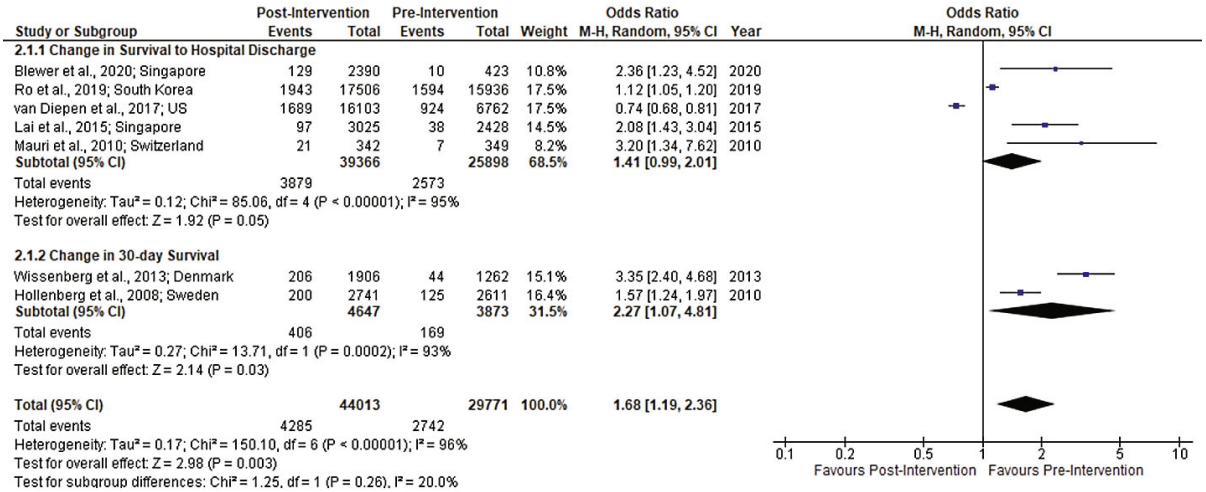
**Discussion:** The findings of this systematic review and meta-analysis suggest that globally, community-based interventions targeting resuscitation training or awareness were associated with higher rates of B-CPR and survival following OHCA, while survival with a favourable neurological outcome was not significantly improved. As the provision of B-CPR is associated

with better outcomes following OHCA, additional research is required to elucidate these relationships and identify which community-based interventions are most effective.

**REFERENCES:**

1. Virani SS, Alonso A, Benjamin EJ, et al. *Heart Disease and Stroke Statistics—2020 Update: A Report from the American Heart Association.* Circulation; 2020. doi:10.1161/CIR.0000000000000757
2. Committee on the Treatment of Cardiac Arrest: Current Status and Future Directions; Institute of Medicine. *Strategies to Improve Cardiac Arrest Survival: A Time to Act*. (Graham R, McCoy MA, Schultz AM, eds.). National Academies Press; 2015. doi:10.17226/21723
3. Vaillancourt C, Stiell IG. Cardiac arrest care and emergency medical services in Canada. *Can J Cardiol*. 2004;20(11):1081-1090
4. van Diepen S, Girotra S, Abella BS, et al. Multistate 5-year initiative to improve care for out-of-hospital cardiac arrest: Primary results from the HeartRescue project. *J Am Heart Assoc*. 2017;6(9). doi:10.1161/JAHA.117.005716
5. Wissenberg M, Lippert FK, Folke F, et al. Association of national initiatives to improve cardiac arrest management with rates of bystander intervention and patient survival after out-of-hospital cardiac arrest. *JAMA*. 2013;310(13). doi:10.1001/jama.2013.278483



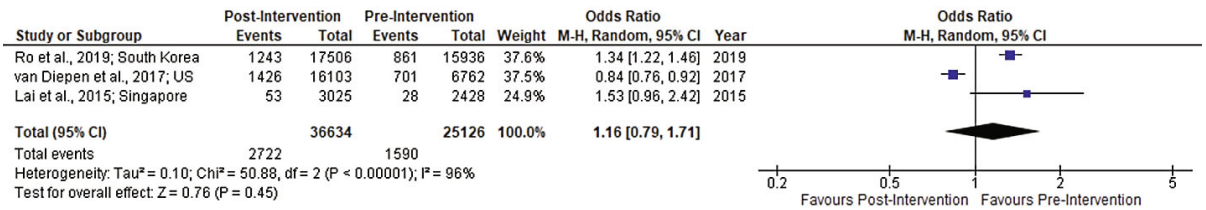




**Figure 1.** Forest plots illustrating the results of meta-analyses comparing the association between community-based interventions targeting resuscitation training or awareness and (1.1) rates of bystander cardiopulmonary resuscitation, (1.2) survival following OHCA (survival to hospital discharge and 30-day survival), and (1.3) survival with favourable neurological outcome

# EDUCATION AND SIMULATION IN ANESTHESIA

## "The Airwayve Podcast": A Novel Anesthesia Educational Tool for Medical Students

Puru Panchal[1], Alexa Caldwell[1], Grace Martin[1], Sean Xia[1,2], Nicholas Timmerman[1,2], Jordan Albaum[1,2], Gwen Lovsted[1], Anushka Nair[1], Amy Ajay[1], Daniel Cordovani[2]

1 Michael G. DeGroote School of Medicine, McMaster University, Hamilton, Ontario, Canada. 2 Department of Anesthesia, McMaster University, Hamilton, Ontario, Canada.

**Introduction/Background:** Medical students remain underexposed to anesthesiology before clerkship.(1) Few accessible introductory-level materials in anesthesia exist, and the COVID-19 pandemic has compounded this issue by restricting clinical access to the specialty.(2) We developed "The Airwayve Podcast" to provide fundamental teaching in anesthesia using succinct, student-generated episodes reviewed by senior students, residents and faculty. Episodes explore core topics in anesthesia, tips for learners and feature guest speakers to facilitate career exploration. For episodes and summaries, visit www.airwayvepodcast.com.

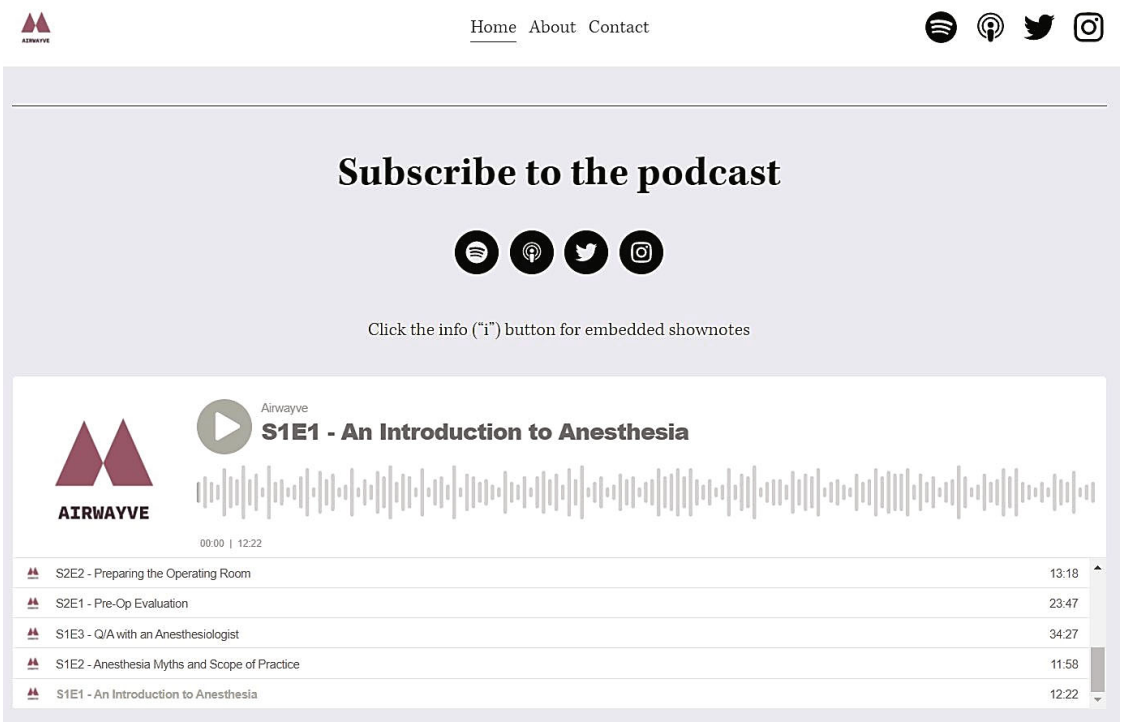
**Methods:** Ethics approval was not applicable because the study did not involve human or animal research. Six medical students, three residents and one faculty anesthesiologist have collaborated on the podcast. Each episode undergoes a three-step editorial process prior to recording and distribution via podcast apps. We administered a survey to capture students' perspectives regarding: preferences for the podcast as a learning and career exploration tool, podcast content, barriers to listening and preferences for future directions. Data were gathered via Likert-based assessments and multiple-choice options, which were represented as means and percentages.

**Results:** Thirteen episodes published across two series ("Introduction to Anesthesia" and "General Anesthesia") have received over 1100 downloads worldwide since September 2020. Data from the podcast hosting software indicates that 73% of listeners access episodes from mobile devices and listeners most commonly access episodes via the free online player on the podcast website (20%) and Spotify (19%). The Airwayve Podcast has been faculty-endorsed and shared nationally across medical schools. Survey data from 21 participants indicate that the podcast has helped students explore anesthesiology as a career path (mean 4.5/5), exposed students to anesthesia for the first time (mean 4.1/5), was perceived as effective in teaching fundamental anesthesia concepts (mean 4.4/5), was perceived as an accessible learning tool (mean 4.7/5), and helped students understand the skills and content to be successful in anesthesia (mean 4.2/5). Clerks (self-identified; n=11) indicated that the podcast was useful for clinical anesthesia rotations (mean 4.2/5). The top three requested topics for future episodes were: episodes about general anesthesia (76.2%), episodes about career advice (71.4%), and episodes featuring guest speakers (66.7%). Nine participants (42.9%) indicated that a lack of time to listen to episodes was a barrier to using the podcast as a learning tool; however, the majority of respondents (n=11; 52.4%) did not identify any barriers to listening to the podcast.

**Discussion:** The Airwayve Podcast is the first faculty-endorsed anesthesia podcast geared towards medical students. Preliminary results suggest strong approval of the podcast as a learning and career exploration tool. Listeners' feedback may be leveraged to optimize the content of this educational tool to ultimately support medical students' learning in the current distance-learning environment posed by the COVID-19 pandemic.

**REFERENCES:**

1. Adudu OP, Le NH, Devito I, Campbell FA, Levine MF. Medical student impressions of anesthesiology and anesthesiologists. Can J Anaesth. 2010 Aug;57(8):792-3. doi: 10.1007/s12630-010-9334-0. Epub 2010 Jun 4. PMID: 20524102.
2. Niburski, K., Nguyen, DD., Ingelmo, P. et al. Impact of COVID-19 on Canadian anesthesia resident matching: challenges and opportunities for applicants. Can J Anesth/J Can Anesth (2020). https://doi.org/10.1007/s12630-020-01878-z



## Anesthesia Virtual Resuscitation Room: A Novel, Low-Cost Simulation Platform for Undergraduate Anesthesia Education

Puru Panchal[1], Gabriel Simchovich[1,2], Alexa Caldwell[1], Sean Xia[1,2], Sarah Foohey[3], Daniel Cordovani[2]

1 Michael G. DeGroote School of Medicine, McMaster University, Hamilton, Ontario, Canada.
2 Department of Anesthesia, McMaster University, Hamilton, Ontario, Canada.
3 Department of Emergency Medicine, Trillium Health Partners, Mississauga, Ontario, Canada.

**Introduction/Background:** Medical students remain underexposed to anesthesiology and often encounter the specialty later in their training.(1) This challenge has been exacerbated by reduced clinical hours during clerkship rotations and medical schools pivoting to virtual learning due to COVID-19.(2,3) These conditions necessitate finding novel avenues to promote exposure to anesthesia and teach fundamental concepts. Though high-fidelity simulations remain active, there is no virtual simulation platform that has been explored for the modern "distance learning" environment.

**Methods:** Ethics approval was not applicable because the study did not involve human or animal research. Using the Virtual Resus Room (VRR), an open-access, low-fidelity simulation platform developed on Google Drive, we created a virtual simulation for students aimed at various process- and content-oriented objectives:(4)

1. Discuss effective communication in the operating room
2. Learn anesthesiologists' roles in resuscitation scenarios
3. Perform a focused pre-operative assessment
4. Discuss components of a normal induction and modifications for emergency situations
5. Identify options for monitoring and vascular access

We modified a faculty-reviewed case of a ruptured ectopic pregnancy. This was facilitated by residents in the VRR for students who were recruited via convenience sampling. We administered pre- and post-event surveys to capture metrics including: interest in anesthesiology, comfort level in simulation settings and preferences for low-fidelity simulation as a learning tool. Quantitative data were gathered via Likert-based assessments, and qualitative data via free-text responses. Mean quantitative scores were compared via Wilcoxon signed-rank test, and qualitative data were analyzed to identify emergent themes.

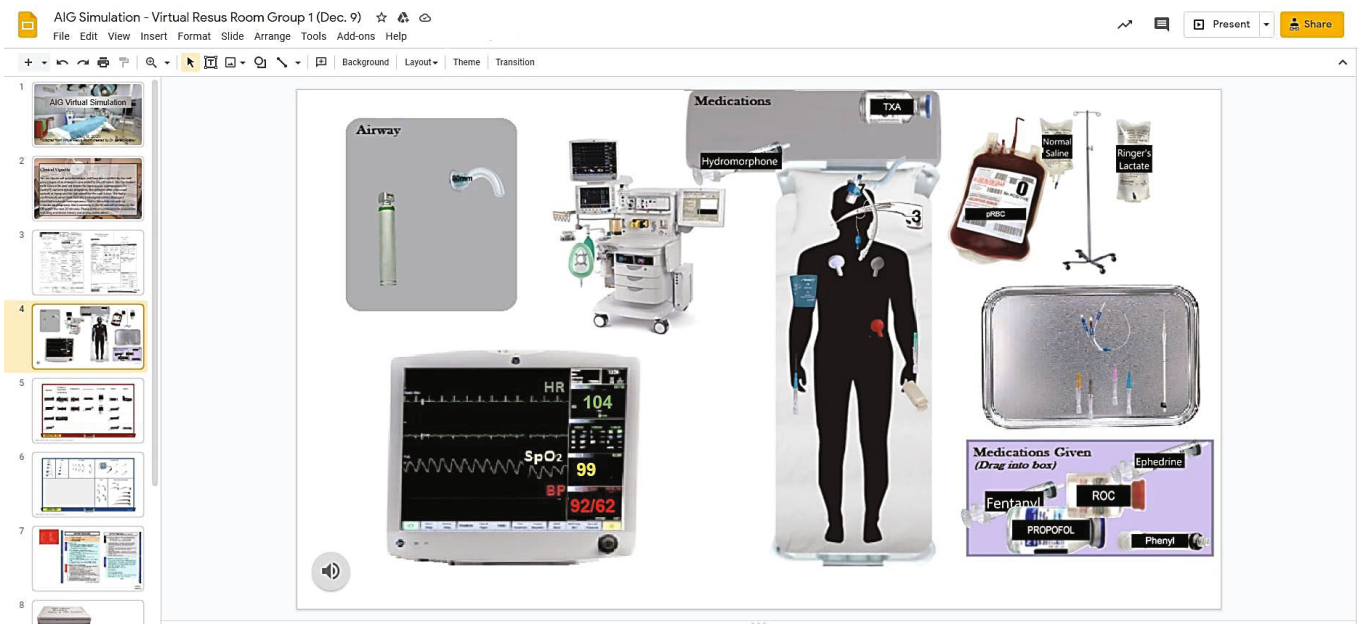
**Results:** Thirty-four medical students across all years of training registered for this simulation. Qualitatively, participants indicated a consistent preference for resident-led facilitation and believed that the virtual simulation stimulated learning, promoted exploration of anesthesiology and was appropriate for meeting the learning objectives. Compared to pre-event data, post-event assessments indicated higher mean scores for students' preparedness to discuss the roles of anesthesiologists and their preparedness to communicate, delegate and make clinical decisions in crisis settings. Post-event data also indicated that this simulation was a valuable experience to learn about anesthesiology (mean 4.62/5) and an effective medium for knowledge acquisition (mean 4.3/5). Participants indicated significant interest in participating in future simulation cases (mean 4.67/5) and interest in using VRR to supplement pre-clerkship/clerkship curricula (mean 4.7/5).

**Discussion:** To our knowledge, this was the first low-fidelity virtual simulation opportunity ever piloted in undergraduate anesthesia education. Preliminary results suggest a strong preference among medical students for low-fidelity simulation as a learning tool and for more such opportunities to be implemented across undergraduate training. Our pilot simulation presents an

opportunity to refine this platform based on participants' feedback and offer simulation exposure more accessibly and potentially at a lower cost than high-fidelity simulations. Future simulations can be targeted at learning objectives identified in undergraduate core clerkship curricula.

## REFERENCES:


1. Adudu OP, Le NH, Devito I, Campbell FA, Levine MF. Medical student impressions of anesthesiology and anesthesiologists. Can J Anaesth. 2010 Aug;57(8):792-3. doi: 10.1007/s12630-010-9334-0. Epub 2010 Jun 4. PMID: 20524102.
2. Niburski, K., Nguyen, DD., Ingelmo, P. et al. Impact of COVID-19 on Canadian anesthesia resident matching: challenges and opportunities for applicants. Can J Anesth/J Can Anesth (2020). https://doi.org/10.1007/s12630-020-01878-z
3. Rose S. Medical Student Education in the Time of COVID-19. JAMA. 2020;323(21):2131–2132. doi:10.1001/jama.2020.5227
4. Foohey S. Virtual Resus Room [Internet]. EM Sim Cases. 2020 [cited 2021Feb4]. Available from: https://emsimcases.com/2020/06/16/virtual-resus-room/

## Anesthesiology Education in the 2020's: The Power and Challenges of Social Media

Lior Krimus[1], Cheng Zhou[1], Abdulkarim Muhaseen[1], Clemence Cote[1], Justin Hsu[1],Vikas Patel[1], Anita Sarmah[1]

1 Department of Anesthesiology and Pain Medicine, University of Toronto, Toronto, Ontario, Canada.

**Background:** From spreading humorous pictures to disseminating information about world crises in a matter of seconds, social media has made a strong mark on modern civilization. Its ubiquitous use makes it a prime platform for spreading educational material to medical trainees. We have used the social media platform Instagram to create an account focused on anesthesiology-related concepts, inspiring interest in the specialty, and assisting with career coaching for medical students.

**Methods:** Ethics approval was not applicable because the study did not involve human or animal research. The account is run by a faculty member in collaboration with residents and medical students. Our content is carefully screened to follow university guidelines and is always referenced with copyright laws respected. We have several thousand followers, most outside of Canada and the United States.

**Results:** To promote our content, we use international hashtags and track our content's success through various Instagram metrics (likes, follows, comments etc.) Being an open-source platform presents many challenges such as content theft prevention and handling of inappropriate commenting. We will be presenting some of the solutions we have used to solve these challenges.

**Discussion:** With our account growing in followers and popularity, we seek to expand the outreach through further engagement utilizing Instagram tools, collaborating with other academic centers, incorporating the platform into our school's undergraduate medical curriculum, and using different social media platforms.

## Development and Implementation of a Resident Assessment Dashboard for Competency-Based Medical Education in Anesthesiology: A Mixed Methods Study

Rebecca Dubé[1], Alayne Kealey[2,3], Celia Cassiani[4], Lisa Bahrey[2,5], Clyde Matava[2,6]

1 Département d'anesthésie, Centre hospitalier universitaire Sainte Justine, 3175 Chemin de la Côte-Sainte-Catherine, Montréal; Département d'anesthésiologie et de médecine de la douleur, Université de Montréal, Montréal, Quebec, Canada.
2 Department of Anesthesiology and Pain Medicine, Temerty Faculty of Medicine, University of Toronto, Toronto, Ontario, Canada.
3 Department of Anesthesiology and Pain Medicine, Sunnybrook Health Sciences Centre, Toronto, Ontario, Canada.
4 Child Health Evaluative Sciences, Hospital for Sick Children, Toronto, Ontario, Canada.
5 Department of Anesthesia and Pain Medicine, University Hospital Network, Toronto General Hospital, Toronto, Ontario, Canada.
6 Department of Anesthesia and Pain Medicine, SickKids Hospital, Toronto, Ontario, Canada.

**Introduction**: Competency-based medical education (CBME) demands frequent assessment of resident performance.[1,2] Challenges in accessing the high volume of assessments in CBME may impede resident use of self-regulated learning (SRL) skills,[3,4] including self-assessment and goal setting. We describe the use of an iterative design-based framework to create a resident assessment dashboard (RAD) whereby residents access results of multiple assessments on a consolidated platform. We incorporated faculty and resident stakeholder perspectives into the development of the RAD. Our aims were to enhance resident access to assessment data, and understand the potential utility of a RAD in the context of SRL theory.

**Methods**: Ethics approval was obtained from the local REB. We employed a mixed-methods approach to gain an in-depth understanding of resident and educator perspectives on the elements of the dashboard that facilitate the use of assessment information for performance improvement, and the anticipated uses of the RAD in the context of SRL theory. We first used an anonymous survey to investigate elements faculty and residents felt were important for a RAD. We then performed resident and faculty focus groups to deepen survey findings, and probe stakeholder perspectives on the utility of an RAD in SRL. Thematic analysis using a grounded theory approach was used to analyse focus group transcripts.

**Results**: The RAD design proceeded iteratively, incorporating the results of each analysis into subsequent versions. Quantitative survey analysis revealed that 92% (24/26) of residents and 92% (17/19) of faculty felt that timely access to assessment results was important, and 77% (20/26) of residents felt that comparing their performance to anonymized peer assessment data was an important RAD feature. Thematic analysis of focus groups revealed that residents and faculty viewed the RAD as a tool to help residents accurately assess their performance, target their learning efforts, plan their learning strategy, and monitor for progress. Faculty and resident perspectives diverged on issues relating to confidentiality. Where residents were concerned that use of the RAD could threaten assessor anonymity resulting in reduced faculty engagement with assessment, faculty expressed concern that it could compromise peer assessment information privacy for trainees. Access to anonymized peer assessment data for comparison was viewed as important by a subset of residents to help them accurately self-assess. Although the RAD displayed a mix of summative and formative assessment data, in line with SRL theory, residents viewed the RAD primarily as a formative assessment tool.

**Discussion**: In our study, resident and faculty stakeholder co-development of a RAD permitted the inclusion of varied viewpoints in the iterative design and development of a tool to improve

resident engagement with assessment. The anticipated uses of the RAD overlapped with processes inherent to SRL. Use of a RAD may enhance resident engagement with learning and assessment.

## REFERENCES:

1. Iobst WF, Sherbino J, Cate OT, et al. Competency-based medical education in postgraduate medical education. Med Teach 2010; 32: 651-6.
2. Lockyer J, Carraccio C, Chan MK, et al. Core principles of assessment in competency-based medical education. Med Teach 2017; 39: 609-16.
3. van Houten-Schat MA, Berkhout JJ, van Dijk N, et al. Self-regulated learning in the clinical context: a systematic review. Med Educ 2018; 52: 1008-15.
4. Zimmerman BJ. Self-efficacy: an essential motive to learn. Contemp Educ Psychol 2000; 25: 82-91.

## GRANT ACKNOWLEDGEMENT:

This work was supported by an Education Research Scholarship Grant from Sunnybrook Health Sciences Centre.

## Does Leniency Bias Persist in Workplace-Based Assessments that Use Entrustment-Supervision Scales?

Alayne Kealey[1,2], Fahad Alam[1,2,8], Graham McCreath[3], Clyde T. Matava[2,3,4], Lisa A. Bahrey[2,5], Catharine M. Walsh[3,6,7,8]

1 Department of Anesthesia, Sunnybrook Health Sciences Centre, Toronto, ON, Canada.
2 Department of Anesthesiology and Pain Medicine, Temerty Faculty of Medicine, University of Toronto, Toronto, Ontario, Canada.
3 SickKids Research Institute, Hospital for Sick Children, Toronto, Ontario, Canada.
4 Department of Anesthesia and Pain Medicine, Hospital for Sick Children, Toronto, Ontario, Canada.
5 Department of Anesthesia and Pain Management, University Health Network-Toronto General Hospital, Toronto, Ontario, Canada.
6 Division of Gastroenterology, Hepatology and Nutrition, Hospital for Sick Children, University of Toronto; Department of Paediatrics, Toronto, Ontario, Canada.
7 SickKids Learning Institute, Hospital for Sick Children, Toronto, Ontario, Canada.
8 The Wilson Centre, Faculty of Medicine, University of Toronto, Toronto, Ontario, Canada.

**Introduction/Background:** Workplace-based assessments (WBA) play a crucial role in the assessment system of competency-based medical education programs. Entrustment-supervision scales frame assessors' decisions around the degree of supervision a trainee requires for safe patient care, reflecting the trainee's progression toward independent practice.[1] Basing WBAs on entrustment-supervision scales may encourage assessors to use the entire scale and to overcome the central tendency and leniency biases associated with proficiency scales.[2] We aimed to examine whether entrustment-supervision scales resolved leniency bias in a WBA used for postgraduate anesthesiology training.

**Methods:** Ethics approval was obtained from our local REB.
One of our program's WBAs for perioperative care, the Anesthesia Clinical Encounter Assessment (ACEA), includes a global rating scale (GRS) assessing 8 clinical competencies and overall independence. Supervisors rate residents on a 5-point entrustment-supervision scale, with descriptive anchors for each point (i.e., from '*Intervention*': required frequent direction or significant involvement from staff for this case; to '*Consultancy level*': could teach or supervise others for this case). We extracted ACEA data for anesthesia residents from July 2017 to January 2020. We analyzed data from assessors who completed at least ten assessments, for the frequency of low scores (i.e., '*Intervention*' or '*Direction*') and high scores (i.e., '*Autonomous*' or '*Consultancy level*') on the GRS items and the overall independence rating.

**Results:** We analyzed 7871 assessments for 137 residents, completed by 214 assessors. Across all residents, 10.75% (23/214) of assessors never assigned low scores for any GRS items and 27.10% (58/214) for the overall independence rating. In their first year of training, residents received a mean of 38.86 (±13.85) assessments. On at least one ACEA, 94.64% (53/57) of first year residents were rated as '*Autonomous*' or '*Consultancy level*' for overall independence, and 24.79% (±15.35) of overall independence ratings for PGY1s were assigned as '*Autonomous*' or '*Consultancy level*.' Additionally, 2.63% (2/76) assessors never assigned low scores to PGY1s for any GRS items and 11.84% (9/76) for the overall independence rating.

**Discussion:** As entrustment-supervision scales reference the level of supervision required for safe and high-quality care, it would be expected that a first-year resident's readiness to be trusted with clinical responsibility would start off requiring '*Intervention*' (i.e., frequent direction

and/or staff involvement). Nevertheless, assessors rated junior residents in our anesthesiology program as ready for independent practice nearly 25% of the time, which suggests that leniency bias in resident assessment persists even with entrustment-supervision scales. Leniency bias can impede tracking of a resident's progress, preclude identification of learners in difficulty, and restrict the coaching and corrective feedback that trainees receive.[3] These findings highlight the need for further research to determine the promoters of leniency bias with entrustment-supervision scales and approaches to mitigate its consequences in a competency-based assessment system.

## REFERENCES:

1. ten Cate O, Schwartz A, Chen HC. Assessing Trainees and Making Entrustment Decisions: On the Nature and Use of Entrustment-Supervision Scales. *Acad Med*. 2020;95(11):1662-1669.
2. Rekman J, Gofton W, Dudek N, Gofton T, Hamstra SJ. Entrustability Scales: Outlining Their Usefulness for Competency-Based Clinical Assessment. *Acad Med*. 2016;91(2):186-190.
3. Weller JM, Jones A, Merry AF, Jolly B, Saunders D. Investigation of trainee and specialist reactions to the mini-Clinical Evaluation Exercise in anaesthesia: implications for implementation. *Br J Anaesth*. 2009;103(4):524-530. doi:10.1093/bja/aep211

## GRANT ACKNOWLEDGEMENTS:

1. This project was supported by an Education and Research Scholarship Grant from the Sunnybrook Education advisory Council (SEAC) and Education Research Unit (ERU).
2. CMW holds an Early Researcher Award from the Ontario Ministry of Research and Innovation.

## Education About Sexual and Gender Minorities Within Canadian Anesthesia Residency Programs: Where Do We Stand?

Christopher Cheung[1], Hilary MacCormick[1,2], Allanna Munro[1,2], Ronald B. George[1,3]

1 Department of Anesthesia, Pain Management and Perioperative Medicine, Dalhousie University, Halifax, Nova Scotia, Canada.
2 Department of Women's and Obstetric Anesthesia, IWK Health Centre, Halifax, Nova Scotia, Canada.
3 Department of Anesthesia and Perioperative Care, UCSF, San Francisco, USA.

**Introduction:** Patients of marginalized groups require specific and individualized care, which results in better outcomes. Improving outcomes for sexual and gender minorities (SGM) has been identified as a priority area for research and education.[1] However, there is a paucity of studies regarding SGM-related health issues in anesthesia, especially within postgraduate anesthesia training. A previous study found only 19% of obstetric anesthesia fellowship programs have formalized SGM curricular content.[2] The objective of this study was to perform a national scan of SGM curricular content within Canadian postgraduate anesthesia training.

**Methods:** Ethics approval was obtained from the local REB. A survey was developed guided by the modified Delphi method and the CHERRIES checklist. The survey was validated by an expert panel comprising of individuals who are part of curriculum development, who work with SGM/2SLGBTQIA+ individuals and/or identify as part of the SGM community. The final survey was built on Research Electronic Data Capture software and distributed through the program administrators to current residents undergoing postgraduate anesthesia training and faculty identified as part of the programs' residency-training-committee or its equivalent. Using a modified Dillman approach, the survey was distributed to each program a maximum of three times between November 2020 and January 2021. All data was analyzed and presented via descriptive statistics.

**Results:** All 17 anesthesia residency programs across Canada received the survey and were represented to various degrees in the collected data. Responses from 159 residents (25%; 159/632) and 48 faculty (18%; 48/269) for a total of 207 responses (23%; 207/901) were compiled. Only 2 faculty members (4%, 2/48) and 18 residents (11%, 18/159) stated they had SGM curricular content (such as didactic lectures, simulated encounters, etc.). Additionally, when stratified by province, fewer than 20% of all respondents stated that their program had formal SGM curricular content. Twenty-three percent of resident participants felt their residency program trained them to provide competent care to SGM individuals and 55% wanted more SGM curriculum in their training. The largest barrier amongst resident respondents was perceived lack of need (65%). Fifty-six percent of the faculty surveyed wanted more SGM content in their curricula with the greatest barrier being perceived lack of need (72.1%).

**Discussion:** Despite a majority of residents and faculty stating that there is an ongoing need for SGM curricular content in anesthesia postgraduate training, there appears to be a lack of formal teaching in place nationally. The response rate (23%) was in keeping with typical survey response rates,[3] and may have been further negatively affected by the ongoing COVID-19 pandemic. As competence-by-design is restructuring curricula and training, now is an opportune time to integrate SGM content into anesthesia residency training.

**REFERENCES:**

1. Klein DA, Paradise SL, Goodwin ET. Caring for transgender and gender-diverse persons: What clinicians should know. Am Fam Physician. 2018;98(11):645–53.
2. MacCormick H, George RB. Sexual and gender minorities educational content within obstetric anesthesia fellowship programs: a survey. Can J Anesth [Internet]. 2020;67(5):532–40. Available from: https://doi.org/10.1007/s12630-019-01562-x
3. Fincham JE. Response rates and responsiveness for surveys, standards, and the Journal. Am J Pharm Educ. 2008;72(2):43.

## Front of Neck Access (FONA): A Survey of Teaching Curriculums Among Canadian Anesthesiology Residency Programs

Steven L. Long[1], Daniel Cordovani[1]

1 Department of Anesthesiology, McMaster University, Hamilton, Ontario, Canada.

**Introduction:** Front of Neck Access (FONA) is an emergency procedure that involves securing an airway through the anterior neck to facilitate alveolar oxygenation [1]. It is a last resort intervention in the cannot intubate, cannot oxygenate (CICO) scenario. The way FONA is taught during residency training is important, especially given that education and training have been implicated as significant causal factors in major airway complications [2].

Among various FONA techniques, scalpel-bougie-tube is the preferred method described in the most recent Difficult Airway Society guidelines. However, Canadian anesthesiologists have demonstrated a preference for needle techniques [3], despite its proven lower success rate [4, 5]. Given this discrepancy, we sought to determine if Canadian anesthesia residents are taught FONA techniques based on the most recent guidelines or anesthesiologist preference.

**Methods:** An 11-item questionnaire was developed to survey Canadian anesthesiology residency curriculums based on two domains: (1) preferred techniques of FONA taught to residents in adult and pediatric anesthesia, and (2) the duration, timing, and methods of teaching. Local ethics board approval was obtained.

Program directors of all 17 Canadian residency programs were contacted to inquire about survey completion. Surveys were distributed via email link and completed voluntarily by program director or residency curricular leads from January - June 2020. Three reminder emails were sent encouraging survey completion. Results were analyzed descriptively, using counts and percentages.

**Results:** Of 17 surveys distributed to Canadian anesthesia residency programs, 14 (82%) were returned.

In adult anesthesia, cricothyroidotomy by scalpel-bougie method was most commonly selected (n=10, 71%) as the preferred method of FONA taught to residents for the CICO scenario; cricorthyroidotomy by scalpel open-surgical methods (n=3, 21%) and wire-guided (seldinger) method (n=1, 7%) were also selected. In pediatric anesthesia, deferring to tracheostomy by surgeon was most commonly selected as the preferred method for FONA (n=6, 43%); cricothyroidotomy by a variety of other techniques were also selected.

**Discussion:** Based on a nationwide survey from 2014, Canadian anesthesiologists have previously demonstrated a preference for intravenous catheter and wire-guided techniques for FONA [3]. In contrast, the results of this survey demonstrate that most Canadian residency programs in anesthesiology (13/14, 93% of respondents) prefer to teach open surgical methods including scalpel-bougie technique for adult FONA.

It is notable and perhaps reassuring that the majority of residency programs are favouring scalpel techniques, given its superior speed and success rate in the emergency setting [1,4,5]. Nevertheless, this preference is not unanimous, with one program selecting a preference for wire-guided methods. This finding may speak to the known preference for non-surgical techniques among Canadian anesthesiologists that still permeates to teaching at the resident level. Alternatively, it may speak to the ongoing debate that still remains regarding optimal

FONA technique [1].

In pediatric FONA, the results of our survey were more varied, which may parallel the equivocal evidence in the literature.

**REFERENCES:**

[1] Price TM, et al. Emergency front of neck access in airway management. BJA Education. 2019 June;19(8):246-253
[2] Baker PA, et al. Education in airway management. Anaesthesia. 2011 Nov;66(s2):101-111
[3] Wong DT, et al. A survey of Canadian anesthesiologists' preferences in difficult intubation and "cannot intubate, cannot ventilate" situations. Can J Anaesth. 2014 Aug;61(8):717-26
[4] 4th National Audit Project of The Royal College of Anaesthetists and The Difficult Airway Society. Major complications of airway management in the United Kingdom. Mar 2011.
[5] Lockey D, et al. Observational study of the success rates of intubation and failed intubation airway rescue techniques in 7256 attempted intubations of trauma patients by pre-hospital physicians. Br J Anaesth. 2014 Aug;113(2):220-5

# EQUIPMENT MONITORING

## Acute Elevation of End-Tidal Carbon Dioxide as the Only Indicator of Inferior Vena Cava (IVC) Injury

Edward Choi[1], Michelle Choi[2], Heather Hurdle[1]

1 Department of Anesthesia and Perioperative Medicine, University of Calgary, Cumming School of Medicine, Calgary, Alberta, Canada.
2 Department of Biological Sciences, University of Calgary, Calgary, Alberta, Canada.

**Introduction:** Capnography assesses adequacy of ventilation by quantifying end-tidal carbon dioxide measurement ($ETCO_2$). Capnography is recommended for general anesthesia and specifically laparoscopic cases for early detection of venous carbon dioxide ($CO_2$) embolism.[1, 2] The differential diagnosis for an acute rise in $ETCO_2$ includes increased $CO_2$ production from hypermetabolic disease states, exogenous $CO_2$, hypoventilation, and equipment malfunction.[2] We describe an unusual presentation of inferior vena cava (IVC) injury resulting in an isolated abrupt rise in ETCO2.

**Case Presentation:** Patient consent was obtained for publication of this case. A 30-year-old male with Cushing's disease was scheduled for endoscopic bilateral adrenalectomy. His other co-morbidities included asthma, hypertension, Hodgkin's lymphoma and obesity (BMI 39). Standard CAS monitors, large bore intravenous access and an arterial line were placed. An 8.0mm endotracheal tube was inserted and sevoflurane used for maintenance. Patient was placed in prone position using a Cloward saddle. Mechanical ventilation consisted of tidal volumes of 600mL, 14 breaths per minute, PEEP of 8, and a target $ETCO_2$ between 35-40mmHg.

$ETCO_2$ gradually increased to 51mmHg as expected with prolonged retroperitoneal $CO_2$ insufflation. As the surgeons were exposing the right adrenal gland, $ETCO_2$ increased suddenly from 51mmHg to 70mmHg with no obvious etiology. Surgery was paused, the retroperitoneum desufflated, and minute ventilation increased. The arterial blood gas drawn when $ETCO_2$ decreased to 49mmHg showed pH = 7.27, $PaO_2$ = 300mmHg, $HCO_3$ = 24mmHg $PaCO_2$ = 53mmHg, and $PaCO_2$-$ETCO_2$ gradient = 4mmHg. Eventually, $ETCO_2$ decreased to 45mmHg and the retroperitoneum was re-insufflated. Within seconds, the $ETCO_2$ rose to 69mmHg again. All other vital signs were stable.

Surgical exploration revealed a 2mm IVC hole with no visible hemorrhage. The lesion was packed with good hemostasis and no acute rises in $ETCO_2$ levels occurred for the remainder of the procedure. Postoperatively, CT angiography revealed no extravasation from the IVC. The patient was placed on bed rest for 24 hours and underwent successful open adrenalectomy 48 hours later.

**Discussion:** IVC injuries are a rare complication of retroperitoneal laparoscopic adrenalectomy, given the proximity of the right adrenal gland to the IVC. With large vascular injuries, hemorrhage and $CO_2$ emboli can occur.[3] These typically present as hypotension, dyspnea, cyanosis, arrythmia, or a decrease in $ETCO_2$ secondary to right ventricular outflow obstruction and cardiovascular collapse.[4] In smaller injuries, laparoscopic insufflation pressures can prevent

hemorrhage, making the diagnosis challenging.[5] In our case, an abrupt rise in $ETCO_2$ was the only early diagnostic clue for vascular injury. The patient was hemodynamically stable with no signs of hemorrhage. Had insufflation continued without addressing the injury, the patient could have developed a large $CO_2$ embolism.

This case report reinforces the importance of $ETCO_2$ monitoring during laparoscopy and its potential role in diagnosing vascular injury.

**REFERENCES:**

1. Dobson G, Chow L, Flexman A, et al. Guidelines to the Practice of Anesthesia. Canadian Journal of Anesthesia. 2019;66:75-108.
2. Bhavani-Shankar K, Moseley H, Kumar A.Y, et al. Capnometry and anaesthesia. Canadian Journal of Anaesthesia. 1992;39(6):617-632.
3. Teng HC, Yeh HM, Wang SM et al. Massive Carbon dioxide embolism during pneumoperitoneum for laparoscopic adrenalectomy: A case report. General Internal Medicine Clinical Innovations. 2017;2(1):1-3.
4. Gutt CN, Oniu T, Mehrabi A, et al. Circulatory and Respiratory Complications of Carbon Dioxide Insufflation. Digestive Surgery. 2004;21:95-105.
5. Zonča P, Peteja M, Vávra P, et al. The risks of retroperitoneoscopic adrenalectomy. Perspectives in Surgery. 2017;96(3):130-133.

## Comparison of the Novel Membrane-Based Carbon Dioxide Filter Memsorb® with a Chemical Granulate Absorbent Using a Lung Simulator Device: A Prospective, Randomized, In-Vitro Feasibility Trial

Sujoy Banik[1], Dietmar Enk[2], Sonja Marie Payne[1], Ruediger R Noppens[1]

1 Department of Anesthesia and Perioperative Medicine, London Health Sciences Centre, Schulich School of Medicine and Dentistry, Western University, London, Ontario, Canada.
2 Medical Faculty, University of Muenster, Muenster, Germany.

**Introduction:** Memsorb™ is a novel device for carbon dioxide ($CO_2$) removal from anesthesia circuits. A semipermeable polymeric membrane removes $CO_2$ from the anesthesia circuit while conserving inhalational agents[1]. First clinical trials indicate functionality with Draeger anesthesia machines[2]. We evaluated the performance of the Memsorb (DMF Medical, Halifax, Canada) device for removal of $CO_2$ from a General Electric Datex-Ohmeda Aisys CS2 (GE, USA) anesthesia machine compared to a standard chemical granulate absorber (CGA) (Amsorb, GE, USA), using a high-fidelity lung simulator[3]. We hypothesized that Memsorb device performance would be non-inferior to standard CGA for maintenance of end-tidal $CO_2$ ($EtCO_2$) and fraction of inspired $CO_2$ ($FiCO_2$) at commonly used, pre-defined fresh-gas flows.

**Methods**: Ethics approval was not applicable because the study did not involve human or animal research. The in-vitro lung simulator based on a U-tube manometer (DuCT, Dr. Enk, Muenster, Germany) allows controlled $CO_2$ release, imitating alveolar gas exchange. $CO_2$ gas was released in the water portion of the simulator device at a flow of 0.175 l/min. The lung simulator was connected to the anesthesia machine ventilator via a standard anesthesia circuit tubing and an endotracheal tube (ID 7.5 mm). An air-oxygen blender for $CO_2$ washout of the Memsorb was used ($FiO_2$: 0.40, flow: 15 l/min). Fresh gas flow (FGF) was randomized to either 0.5 L/min or 2 L/min, completing 3 trials for each FGF. Ventilator settings were identical for all measurements. $EtCO_2$, $FiCO_2$, ventilation pressures and dynamic compliance were evaluated at 5-minute intervals for 30 minutes duration. Statistical analysis was performed using two-way ANOVA, $p<0.05$ was considered statistically significant.

**Results:** Ventilation parameters and dynamic compliance were similar between groups. $EtCO_2$ was comparable between groups with 2 l/min FGF over the observation period (Fig. 1 A). $FiCO_2$ was significantly higher in the Memsorb group during the trial (2 l/min; difference between means 3.9 mmHg, 95%CI of difference 4.4-3.3, $p<0.0001$). $EtCO_2$ with 0.5 l/min FGF was different between the two groups (3.7 mmHg, 95%CI 2.7-4.7, $p<0.001$, Fig 1B). With 0.5 l/min FGF, $FiCO_2$ was significantly higher in the Memsorb group compared to CGA (6 mmHg, 95%CI 6.4-5.5, $p<0.0001$).

**Discussion:** We showed for the first time under controlled conditions that Memsorb was non-inferior to standard CGA in $CO_2$ elimination in a high-fidelity lung simulator. With 0.5 l/min FGF, statistically significant higher $EtCO_2$ levels were observed using Memsorb. However, the magnitude of difference is unlikely to be clinically relevant. In this experimental setup, use of Memsorb resulted in higher $FiCO_2$ compared to CGA. Despite these higher concentrations of inspired $CO_2$, this did not translate into a meaningful increase in EtCO2. These results indicate that Memsorb is a suitable device for $CO_2$ removal under simulated conditions and justifies clinical trials with GE anesthesia machines in the future.

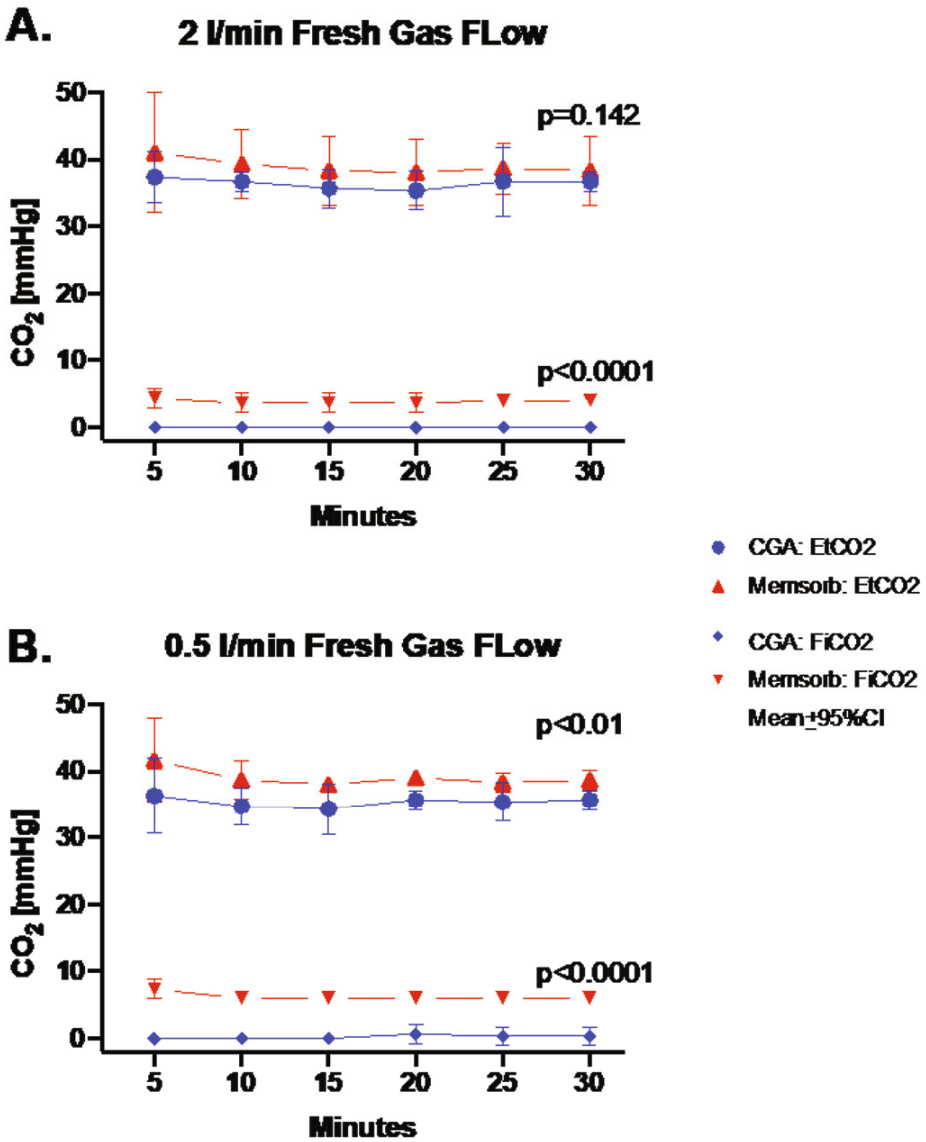
**REFERENCES:**

1. Hung O, Wilfart FM, Ford Z, Morrison L, Roach DC, Schmidt MK. An innovative device for CO2 removal using membrane technology instead of chemical absorbent in anesthetic circuits. Conference paper, ASA meeting San Francisco, 2018. Abstract A1061.
2. Sodalime Absorber versus Membrane CO2 Filter Performance during Automated Closed-circuit Anesthesia: A Case-Report. Eerlings SA, Carette R, Vandenbroucke G, De Wolf AM, Hendrickx,JFA. EJA 2019; 36 (e-supplement 57): 27-28.
3. Enk D, Enk S, Enk W, de Wolf M. A new U-tube lung simulator (DUCt). Conference paper, World Airway Management Meeting 2015. Available from www.epostersonline/wamm2015/node/82.

**GRANT ACKNOWLEDGEMENT:**

Sujoy Banik, Sonja Marie Payne and Ruediger Noppens (Principal Investigator) received a partial grant of 40000 CAD from the AMOSO Innovation Funding 2019 competition for the study titled "Decreasing environmental impact and costs of using inhalational anesthetics by replacing chemical absorbers with an innovative carbon dioxide membrane filter system – a prospective, randomized, clinical trial", of which this current study is a part. Dietmar Enk is the inventor of the DUCt lung simulator device used in this study.

Figure 1. Figure showing mean end-tidal carbon dioxide (EtCO2) and inspired carbon dioxide (FiCO2) at 2 l/min and 0.5 l/min fresh gas flow. CGA= Chemical Granulate Absorbent.



# GENDER STUDIES

## Unconscious Gender or Sexuality-Based Bias Within Anesthesiology: A Cross-Sectional National Survey

John K. Peel[1], Alana M. Flexman[2], Kyle R. Kirkham[1,3], Gianni R. Lorello[1,3,4,5]

1 University of Toronto, Department of Anesthesiology and Pain Medicine, Toronto, Ontario, Canada.
2 University of British Columbia, Department of Anesthesiology, Pharmacology and Therapeutics, Vancouver, British Columbia, Canada.
3 Toronto Western Hospital, University Health Network, Toronto, Ontario, Canada.
4 The Wilson Centre, University Health Network, Toronto, Ontario, Canada.
5 Women's College Research Institute, Toronto, Ontario, Canada.

**Introduction:** While the evidence is clear that women and lesbian, gay, bisexual, transgender, queer, and two-spirited (LGBTQ2S+) anesthesiologists are disproportionately under-represented, under-paid, and under-promoted, the reasons behind these disparities remain unclear.[1-4] The workplace culture in anesthesiology may contribute to this imbalance.[5] The purpose of this study was to characterize experiences of discrimination attributed to gender and/or sexuality among Canadian anesthesiologists.

**Methods:** Ethics approval was obtained from the local REB. We conducted an internet-based, open, cross-sectional survey. The survey was distributed to resident, fellow, and staff-level anesthesiologists. Survey questions were developed to characterize the intersection between respondent gender and/or sexuality with experiences of discrimination in the workplace. Binary outcomes were assessed using Fisher's exact test and logistic regression; responses on a 5-point Likert scale were analyzed using Kruskal-Wallis and Dunn's tests.

**Results:** We received 162 survey responses (response rate 7%). Respondents perceived anesthesiology to be significantly more welcoming to men than women (p=0.005) or LGBTQ2S+ people (p<0.001). Respondents similarly indicated that men were significantly better represented in their department than women (p<0.001) or LGBTQ2S+ people (p<0.001). Being a woman (vs man) was associated with higher likelihood of experiencing discrimination (OR 3.7 [95% confidence interval (CI) 1.7 – 8.1]; p=0.004), harassment (OR 2.4 [95%CI 1.2 – 4.9]; p=0.02), or barriers to career advancement (OR 3.70 [95%CI 2.1 – 6.5]; p<0.001). In contrast, a non-heterosexual (vs heterosexual) orientation was only associated with higher likelihood of experiencing discrimination (OR 3.6 [95%CI 1.3 – 9.5]; p=0.01), with no effect on harassment of career trajectory. The majority of respondents expressed that the work environment would be unaffected (102 [63%]) if a colleague were to disclose their LGBTQ2S+ identity, and only a minority of LGBTQ2S+ respondents expressed that they were unlikely (5 [17%]) or very unlikely (1 [3%]) to disclose their identity with the department. Heterosexual and non-heterosexual anesthesiologists reported similar comfort with caring for LGBTQ2S+ patients (p=0.102).

**Conclusions:** Women and LGBTQ2S+ people are disproportionately affected by discrimination. Women in particular additionally reported experiencing harassment and limited career advancement. However, disclosure of one's sexuality or gender identity in anesthesiology was perceived to neither affect workplace dynamics, nor have respondents been discouraged from "coming out". This discrepancy between perceived comfort with LGBTQ2S+ patients and colleagues but persistent gender and sexuality-related mistreatment may reflect unconscious, rather than deliberate, bias. Further work is required to qualitatively characterize sources and

experiences of bias.

**REFERENCES:**


1. Lorello GR, Flexman AM. Potential gender remuneration gaps in anesthesiology. *Can J Anesth/J Can Anesth*. 2018;66(4):470-471. doi:10.1007/s12630-018-1259-z.
2. McKeen DM, Bryson GL, Lundine J. Underrepresentation of women in Canadian Journal of Anesthesia publications: no surprise—take the pledge! *Can J Anesth/J Can Anesth*. 2019;66(5):485-490. doi:10.1007/s12630-019-01329-4.
3. Lorello GR, Cil T, Flexman AM. Women anesthesiologists' journeys to academic leadership: a constructivist grounded theory-inspired study Les parcours des femmes anesthe´siologistes avant d'atteindre le leadership acade´mique : une e´tude inspire´e de la the´orie ancre´e constructiviste. *Can J Anesth/J Can Anesth*. 2020;67(9):1130-1139. doi:10.1007/s12630-020-01735-z.
4. Bosco L, Lorello GR, Flexman AM, Hastie MJ. Women in anaesthesia: a scoping review. *Br J Anaesth*. 2020;124(3):e134-e147. doi:10.1016/j.bja.2019.12.021.
5. Ginsburg S, Regehr G, Hatala R, et al. Context, conflict, and resolution: a new conceptual framework for evaluating professionalism. *Academic Medicine*. 2000;75(10 Suppl):S6-S11. doi:10.1097/00001888-200010001-00003.

# NEUROANESTHESIA

## The Efficacy of Perioperative Pharmacological and Regional Pain Interventions in Adult Spine Surgery: A Network Meta-Analysis and Systematic Review of Randomized Controlled Trials

Sandy Bae[1], Abdulrahman Alboog[1,2], Alina Abbasi[1], James Zhou[3], Jason Chui[1]

1 Department of Anesthesia & Perioperative Medicine, Schulich School of Medicine and Dentistry, Western University, London, Ontario, Canada.
2 Department of Anesthesia, University of Jeddah, Jeddah, Saudi Arabia.
3 Michael G. DeGroote School of Medicine, McMaster University, Hamilton, Ontario, Canada.

**Introduction:** The development of a widely accepted standardized analgesic pathway for adult spine surgery was hampered by difficult interpretation of the current literature in pain management [1, 2]. We conducted a systematic review and network meta-analysis to compare and rank different pharmacological and regional interventions used in adult spine surgery.

**Methods:** Ethics approval was not applicable because the study did not involve human or animal research. A predefined protocol was published at PROSPERO (CRD42020171326). A systematic search was performed in MEDLINE, Embase, and a variety of other sources from their inception to January 25, 2021. Study screening, selection, and data extraction were performed by two independent investigators. We included all randomized controlled trials investigating either pharmacological or regional interventions for acute postoperative pain management in adults undergoing spine surgery. The co-primary outcomes were cumulative opioid consumption (in intravenous morphine equivalents) and visual analogue score (VAS) of pain (range 0-10) at postoperative 24 hours. A network meta-analysis was performed using the Bayesian approach (random-effect model) to synthesize the direct and indirect effects of all interventions. We also performed a meta-regression to assess the effects of the use of pharmacological agents in the postoperative period against the use in preoperative or intraoperative period.

**Results:** We screened 4054 studies and included 88 studies comprised of 6621 participants. Nine out of 19 pharmacological intervention combinations were effective at reducing both opioid consumption and pain score against placebo (Fig 1). The most effective interventions were triple-agent therapy, consisting of paracetamol and NSAID with adjunct (MD (morphine) -26 [95% Credible Interval (CrI): -39 to -12] mg and MD (VAS) -2.2 [95% CrI -3.0 to -1.4]), or paracetamol, NSAID, and gabapentinoid (MD (morphine) -28 [95% CrI: -53 to –3] mg and MD (VAS) -1.5 [95% CrI: -2.4 to -0.7]). Double-agent therapy, high-dose gabapentinoid (gabapentin ≥ 900 mg/day or pregabalin ≥ 300 mg/day) and ketamine infusion were less effective, with morphine reduction of 15-18 mg and pain score reduction of 1-1.5. Single-agent interventions were largely ineffective. No regional intervention was found to reduce both co-primary outcomes, with the caveat that all regional interventions studied for opioid consumption were only given as single-shot injections. Our meta-regression showed all but one pharmacological interventions were only effective when they were used in the postoperative period. The risk of bias was overall low amongst all studies. There was no inconsistency nor publication bias.

**Conclusion:** Triple-agent multimodal therapy consisting of paracetamol and NSAID with either adjunct or gabapentinoid is the most effective pain intervention in adult spine surgery. A graded treatment response is found supporting multimodal pain management against double- or single-

agent management. Pharmacological agents given as single dose in preoperative or intraoperative period are not effective at reducing pain score and opioid consumption.

**REFERENCES:**

1. Alboog A, Bae S, Chui J (2019) Anesthetic management of complex spine surgery in adult patients: a review based on outcome evidence. Curr Opin Anaesthesiol 32:600–608.
2. Ali ZS, Flanders TM, Ozturk AK, et al (2019) Enhanced recovery after elective spinal and peripheral nerve surgery: pilot study from a single institution. J Neurosurg Spine 30:532–540.

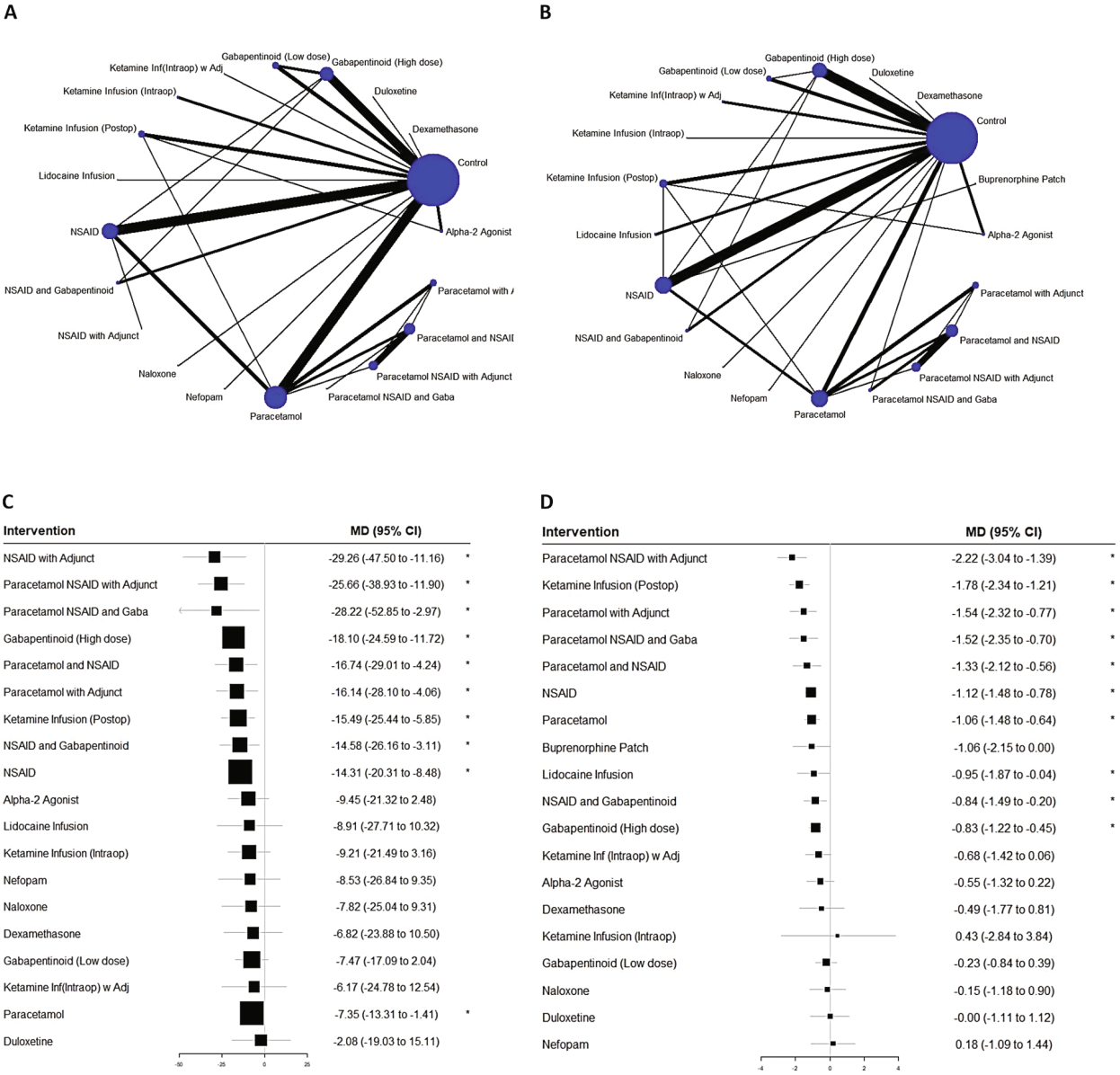



Figure 1: Network meta-analysis of eligible comparisons of pharmacological interventions at postoperative 24 hours for (A) total opioid consumption and (B) pain score. Forest plots of network meta-analysis of all trials of pharmacological interventions at postoperative 24 hours for (C) total opioid consumption and (D) pain score

# OBSTETRIC ANESTHESIA

## A Novel Cognitive Aid for Management of Cardiac Arrest in a Coronavirus Disease 2019 (COVID-19) Positive or Suspected Parturient

Rui Hu[1], Vandana Vaishnav[1]

1 Department of Anesthesiology, McMaster University, Hamilton, Canada.

**Introduction:** Cardiac arrest in a parturient is a rare and challenging clinical scenario, requiring multi-disciplinary involvement and coordination. The American Heart Association (AHA) guidelines suggest immediate perimortem caesarean delivery (PMCD) to facilitate maternal resuscitation if there is no revival by 5 minutes[1]. The COVID-19 pandemic has added another layer of complexity with the need for protected code blue and safe airway management, which delay the intervention. The aim of this quality improvement (QI) study is to incorporate critical tasks from the protected code blue and COVID-19 airway management protocols to design a new cognitive aid for safe and efficient management of maternal cardiac arrest in a COVID-19 positive or suspected parturient.

**Methods:** As a QI initiative, ethical review was waived by local REB. The checklist was drafted through a brainstorming session with anesthesiologists, anesthesia residents, obstetric clinical educators, and maternal intensive care unit (WHICU) physician to compile elements from the AHA maternal cardiac arrest algorithm[1,2], the protected code blue algorithm and recommendations for COVID-19 airway management[3]. We performed a pilot simulation to assess the practicality of the checklist for PMCD. Next, an in-situ high-fidelity simulation in the WHICU involving multidisciplinary members of the code blue team was conducted to assess the workflow and modify the checklist based on participants' feedback. The updated checklist was circulated to 6 anesthesiologists and 2 obstetric clinical educators to rate each item between 0-4, where 0 meant the item is not important and 4 is very important to patient management. A final cognitive aid was prepared after two rounds of modified Delphi process of consensus generation.

**Results:** The in-situ simulation revealed that the time to PMCD using the draft cognitive aid was 13 minutes, signifying a need to increase efficiency. Our survey responses indicated a consensus among raters (100%) regarding the priority to call for help from the anesthesiologist, obstetrician, and neonatal team; and the need for essential equipment such as video-laryngoscope, PMCD set, and neonatal resuscitation equipment. Full PPE and high-quality CPR were also highlighted by 100% of raters as being critical checklist components. Items rated by the majority as unimportant were removed from the algorithm to improve efficiency. For example, pre-oxygenation and clamping of endotracheal tube were not considered important steps of the algorithm as indicated by 62.5% and 75% of participants, respectively.

**Discussion:** The cognitive aid facilitates safety of the responders while promoting early call for help and resuscitation of the parturient (figure 1). There is enhanced focus on airway management to promote oxygenation of the patient while maintaining airborne precautions. This aid can be potentially utilized for any maternal cardiac arrest scenario requiring airborne precautions. Further simulations will be performed to assess and enhance the efficiency of the cognitive aid.

## REFERENCES:


1. Lavonas, E. J. (2020). Highlights of the 2020 American Heart Association's Guidelines for CPR and ECC. American Heart Association.
2. Jeejeebhoy, F. M., et al. (2015). Cardiac arrest in pregnancy. *Circulation*, 132(18), 1747-1773. doi:10.1161/cir.0000000000000300.
3. Adult Protected Code Blue. (2020). Hamilton, Ontario: HHS Corporate Code Blue Committee.


Figure 1. Cognitive Aid for Management of Cardiac Arrest in a Positive or Suspected COVID-19 Parturient

| | | |
|---|---|---|
| **First Responder** | ☐ Don PPE (surgical mask, face shield, gown, gloves)<br>☐ Check for pulse<br>☐ Activate code blue/call for help: OB, Anesthesia, NICU, RT<br>☐ Crash cart/maternal airway equipment/video-laryngoscope/PMCD set/neonatal resuscitation equipment/portable PPE cart | |
| **Code Team Arrival** | ☐ Don PPE before entering room (N95, face shield, gown, gloves)<br>☐ Donning buddy present | |
| **Circulation** | **Pulse present**<br>☐ 100% O2 non-rebreather mask with filter<br>☐ Head tilt-chin lift<br>☐ No BMV<br>☐ Manual left uterine displacement<br>☐ IV access (above diaphragm) | **Pulse absent**<br>☐ High quality chest compression<br>☐ Manual left uterine displacement<br>☐ AED applied<br>☐ If rhythm shockable → shock, resume CPR<br>☐ If unshockable rhythm → Continue CPR<br>☐ IV access/other ACLS interventions (e.g. epinephrine) |
| **Airway** | ☐ Hold CPR for intubation<br>☐ No BMV<br>☐ If BMV required, two operators required for tight seal and use low tidal volume<br>☐ Intubate with video-laryngoscope<br>☐ Inflate cuff<br>☐ Attach HEPA filter to ETT<br>☐ Connect to Ambu bag<br>☐ EtCO2 confirmation<br>☐ Resume CPR<br>☐ Firmly secure tube with tape<br>☐ Tape to prevent accidental disconnection of tube and HEPA filter<br>☐ Failed intubation attempt--Go to plan B or C<br>☐ A separate bin or plastic bag to throw used airway, stylet etc. | |
| **Delivery/Differentials** | ☐ Consider differentials<br>☐ OB decision for perimortem cesarean delivery within 5 min if unable to obtain ROSC<br>☐ Baby handed over to NICU team<br>☐ Continue CPR and ACLS<br>☐ Transfer patient to OR/ICU | |
| **Doffing** | ☐ Doffing of PPE<br>☐ Doffing buddy present | |

PPE = Personal protective equipment; OB = obstetrics; NICU = neonatal intensive care unit; PMCD = perimortem caesarean delivery; BMV = Bag mask ventilation; AED = automated external defibrillator; CPR = Cardiopulmonary resuscitation; ACLS = Advanced Cardiovascular Life Support, ETT = endotracheal tube; EtCO2= End-tidal Carbon Dioxide; HEPA = High-Efficiency Particulate Air; ROSC= Return of Spontaneous Circulation; OR= Operating Room.

## Carbetocin Versus Oxytocin Following Vaginal and Cesarean Delivery: A Before-After Study

Ahmad Ben Tareef[1], Kristi Downey[1], Bernard Ma[1], Wendy Whittle[2], Jose Carvalho[1]

1 Department of Anesthesia and Pain Management, Mount Sinai Hospital, University of Toronto, Toronto, Ontario, Canada.
2 Department of Obstetrics and Gynecology, Mount Sinai Hospital, University of Toronto, Toronto, Ontario, Canada.

**Introduction:** Oxytocin is the routine postpartum uterotonic at our institution. A nationwide shortage of oxytocin resulted in an abrupt temporary switch from oxytocin to carbetocin for all postpartum patients at our institution. This temporary change in practice offered a unique opportunity to conduct a pragmatic comparative assessment of the efficacy of oxytocin and carbetocin to prevent postpartum hemorrhage.

**Methods:** Ethics approval was obtained from the local REB. This was a retrospective before-after study. Medical records from 641 and 752 women were retrospectively reviewed and included in the analysis in the carbetocin and oxytocin groups respectively. The standard carbetocin dosing was 100 mcg intravenous bolus following vaginal deliveries and intrapartum cesarean deliveries, while for elective cesarean deliveries it was 50 mcg intravenous bolus, with an additional 50 mcg bolus used if required. The standard oxytocin dosing was 5 IU intravenous bolus followed by 20 IU/L maintenance at a rate of 120 ml/hour for 4-6 hours following vaginal delivery, while for cesarean delivery it was 1-3 IU boluses, 3 minutes apart, up to 10 IU if required, followed by 20 IU/L maintenance infusion at a rate of 120 ml/hour. In all patients, if uterine tone was suboptimal, the maintenance solution could be changed to 40 IU/L with the same infusion rate, and additional uterotonics (ergot, carboprost, mysoprostol) were used as appropriate. Outcomes of interest were the need for additional uterotonics, estimated blood loss and calculated blood loss (only for cesarean deliveries), the occurrence of postpartum hemorrhage and the need for blood transfusion.

**Results:** The incidence of postpartum hemorrhage was higher in the carbetocin group compared to the oxytocin group (10.3% versus 6.6% respectively, p=0.01). More women in the carbetocin group required additional uterotonic drugs as compared to those in the oxytocin group (12% versus 8.8%, respectively, p=0.05). In addition, more women in the carbetocin group required blood transfusion as compared to those in the oxytocin group (1.4% versus 0.3% respectively, p=0.02).

**Discussion:** Oxytocin is superior to carbetocin for both vaginal and cesarean deliveries when used according to our institutional protocol.

**REFERENCES:**

1. Danserau J et al. Double-blind comparison of carbetocin versus oxytocin in prevention of uterine atony after cesarean section. Am J Obstet Gynecol 1999; 180:670-6
2. Whigham CA et al. Carbetocin versus oxytocin to reduce additional uterotonic use at non-elective caesarean section. J Matern Fetal Neonatal Med 2016; 29:3866-9
3. Gallos I et al. Uterotonic agents for preventing postpartum haemorrhage: a network meta-analysis. Cochrane Database Syst Rev. 2018 Apr5; 4(4):CD011689

Obstetric outcomes in the carbetocin and oxytocin groups

| | Oxytocin N=752 | Carbetocin N=641 | p |
|---|---|---|---|
| Vaginal | 503 (66.9) | 369 (57.6) | <0.01 |
| Cesarean section | 249 (33.1) | 272 (42.4) | |
| Vaginal | | | |
| Spontaneous | 417 (55.5) | 288 (44.9) | 0.07 |
| Assisted | 86 (11.4) | 81 (12.6) | |
| Cesarean section | | | |
| Elective | 142 (18.9) | 159 (24.8) | 0.74 |
| In labor | 107 (14.2) | 113 (17.6) | |
| EBL (by physician), ml | | | |
| Vaginal | 298 (149) | 332 (172) | <0.01 |
| Elective CS | 661 (184) | 677 (197) | 0.49 |
| In labor CS | 716 (213) | 745 (259) | 0.37 |
| EBL (calculated), ml | | | |
| Elective CS | 992 (563) | 865 (560) | 0.07 |
| In labor CS | 1153 (621) | 1230 (588) | 0.37 |
| Primary PPH diagnosis | 50 (6.6) | 66 (10.3) | 0.01 |
| Blood Transfusion | 2 (0.3) | 9 (1.4) | 0.02 |
| Use of 2nd uterotonic | 66 (8.8) | 77 (12.0) | 0.05 |

Numbers are N (%) and mean (SD); EBL: estimated blood loss;

PPH: postpartum hemorrhage; CS: cesarean section

## Carbetocin vs Oxytocin at Elective Cesarean Deliveries: A Double-Blind, Randomized Controlled Non-Inferiority Trial of High and Low Dose Regimens

Fergal McDonagh[1], Jose Carvalho[1], Sadiq Abdulla[1], Daniel Cordovani[2], Kristi Downey[1], Xiang Y Ye[3], Dan Farine[4], Michelle Morais[5], Mrinalini Balki[1]

1 Department of Anesthesia and Pain Management, Mount Sinai Hospital, University of Toronto, Toronto, Ontario, Canada.
2 Department of Anesthesia, Hamilton Health Sciences, McMaster University, Hamilton, Ontario, Canada.
3 Maternal and Infant Care Research Center, Mount Sinai Hospital, University of Toronto, Toronto, Ontario, Canada.
4 Department of Obstetrics and Gynecology, Mount Sinai Hospital, University of Toronto, Toronto, Ontario, Canada.
5 Department of Obstetrics and Gynecology, Hamilton Health Sciences, McMaster University, Hamilton, Ontario, Canada.

**Introduction:** Oxytocin or carbetocin are recommended for routine administration after delivery of the fetus during cesarean delivery (CD) to prevent post-partum hemorrhage (PPH) [1]. Traditionally, higher doses of these drugs have been used. However, there is increasing evidence that lower doses may be as effective and produce less side effects [2-4]. We sought to compare the effect of (i) low and high dose oxytocin, and (ii) low and high dose carbetocin on uterine tone at elective CD. Our hypothesis was that the low dose (LD) would be non-inferior to the high dose (HD) for both drugs.

**Methods:** Ethics approval was obtained from the local REB. We included ASA 2-3 women with no risk factors for PPH undergoing elective CD under spinal anesthesia. Women were randomized into 4 groups: (OxyLD) oxytocin 0.5IU bolus + infusion of 40 mIU/min for 8 hours; (OxyHD) oxytocin 5IU bolus + infusion of 40mIU/min for 8 hours; (CarLD) carbetocin 20µg + placebo infusion; (CarHD) carbetocin 100µg + placebo infusion. The study drug was given as a slow IV bolus after delivery of the fetus. The obstetrician was asked to assess uterine tone intensity at 2,5 and 10 minutes after administration of the study drug using a verbal numerical rating scale (VNRS) of 0-10. The primary outcome was uterine tone 2 minutes after study drug administration. The pre-specified non-inferiority margin was 1.2 points on the 11 point scale. Secondary outcomes were uterine tone after 5 and 10 minutes, use of additional uterotonics, blood loss and side effects.

**Results:** We included 277 women in the analysis. Results for the primary outcome and some secondary outcomes are shown in Table 1. The mean (SD) uterine tone at 2 minutes was similar across all groups, with OxyLD being non-inferior to OxyHD and CarLD being non-inferior to CarHD : 7.1 (1.4) and 7.3 (1.9) for OxyLD and OxyHD: difference (95% CI) -0.20 (-0.76, 0.36); 7.4 (1.7) and 7.6 (1.5) for CarLD and CarHD: -0.18 (-0.71, 0.36). As a secondary analysis comparing the four groups, no significant difference was observed for the primary outcome. Uterine tone at 5 and 10 minutes was non-inferior when OxyLD and CarLD were compared to OxyHD and CarHD respectively. Use of additional uterotonics, blood loss and side effects were similar across all groups.

**Discussion:** At elective cesarean delivery, the uterine tone determined by low dose oxytocin (0.5IU) is non-inferior to that determined by high dose oxytocin (5IU); similarly, the uterine tone determined by low dose carbetocin (20µg) is non-inferior to that determined by high dose carbetocin (100µg). Low dose and high dose regimens of both oxytocin and carbetocin seem to

be associated with similar need for additional uterotonic drugs, blood loss, and similar side effects.

## REFERENCES:

1. Heesen et al. Anaesthesia 2019; 74:1305-1319
2. Carvalho et al. Obstet Gynecol 2004; 104:1005-1010
3. Khan et al. Can J Anesth 2014; 61:242-248
4. Tabl et al. Anaesthesia 2019; 74:190–196

Table 1. Carbetocin vs oxytocin at elective cesarean deliveries: results for the primary outcome and some secondary outcomes

| | Oxytocin 0.5IU N=69 | Oxytocin 5IU N=69 | Carbetocin 20mcg N=70 | Carbetocin 100mcg N=69 | p-value |
|---|---|---|---|---|---|
| Uterine tone, mean (SD) | | | | | |
| 2 min | 7.1 (1.4) | 7.3 (1.9) | 7.4 (1.7) | 7.6 (1.5) | 0.33 |
| 5 min | 7.4 (1.4) | 8 (1.5) | 7.8 (1.2) | 7.9 (1.3) | 0.049 |
| 10 min | 7.9 (1.4) | 8 (1.5) | 8 (1.4) | 8.3 (1.5) | 0.35 |
| Additional uterotonics intraoperatively, N(%) | 17 (24.6) | 11 (15.9) | 11 (15.7) | 12 (17.4) | 0.48 |
| Additional uterotonics in 1st 24 hours post-op, N(%) | 7 (10.1) | 5 (7.3) | 4 (5.7) | 2 (2.9) | 0.37 |
| Blood Loss, median (IQR) | 777 (492,1090) | 829 (502,1169) | 844 (502,1163) | 887 (484,1186) | 0.83 |

## Evaluating The Effect of a Quality Improvement Bundle to Reduce Opioid Prescriptions After Cesarean Delivery

Isabelle Laksono[1], John Matelski[2], David Flamer[3,4], Shira Gold[5], Amanda Selk[5,6]

1 Faculty of Medicine, University of Toronto, Toronto, Ontario, Canada.
2 Biostatistics Research Unit, Sinai Health System and University Health Network, Toronto, Ontario, Canada.
3 Department of Anesthesiology and Pain Medicine, Mount Sinai Hospital, Toronto, Ontario, Canada.
4 Department of Anesthesiology and Pain Medicine, University of Toronto, Toronto, Ontario, Canada.
5 Department of Obstetrics and Gynaecology, University of Toronto, Toronto, Ontario, Canada.
6 Department of Obstetrics and Gynaecology, Mount Sinai Hospital, Toronto, Ontario, Canada.

**Introduction**: The United States and Canada are the first and second-largest per capita consumers of opioids worldwide.[1] Health Quality Ontario has emphasized that there is an immediate need to integrate quality improvement plans for post-operative prescribing of opioid pain medication.[2] It has been established that cesarean delivery is the most commonly performed inpatient surgery in Canada and the United States.[3] Numerous studies have shown that post-cesarean delivery opioid prescriptions are routinely provided at discharge in large excess.[4,5] The objective of this study is to evaluate whether there has been a decrease in opioid prescriptions at discharge after cesarean delivery following a quality improvement bundle.

**Methods**: Ethics approval was obtained from the local REB. A quality improvement bundle was instituted in a large Canadian tertiary academic centre. Interventions included (1) resident education, (2) postpartum nursing education, (3) posters, (4) patient educational materials, and (5) electronic discharge prescriptions. We used retrospective cohort study design and included all patients who had a cesarean delivery six months pre-intervention and post-intervention. For the primary outcome, linear regression was used to compare the amount of opioids prescribed at discharge in both periods, while allowing for temporal effects and controlling for confounding variables. Secondary outcomes were assessed using bivariate methods and included whether opioids were used for breakthrough pain in-hospital, and the amount of opioids prescribed by prescriber program and level of training.

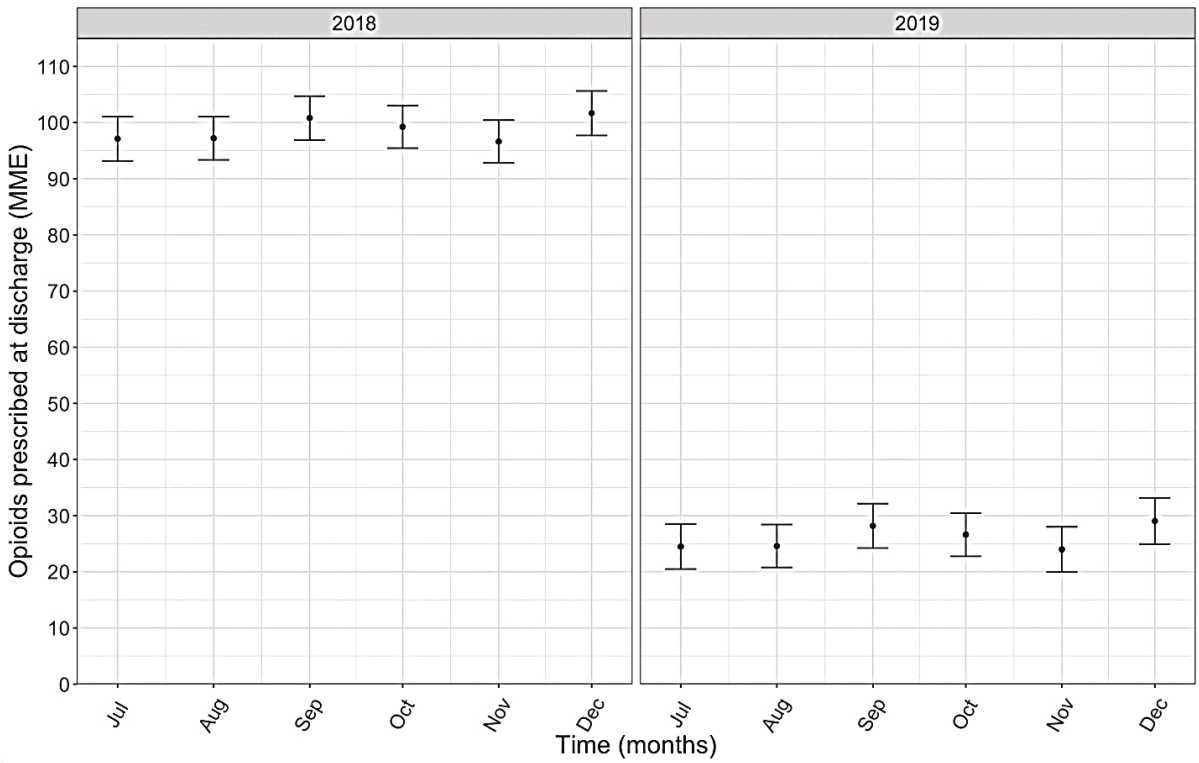
**Results**: 2,578 women were included in our analysis. Based on the multiple regression analysis, opioid prescribing decreased from 95.6 morphine milliequivalents (MME) in 2018 (95% CI 82.8 - 108.5) to 23.0 MME in 2019 (95% CI 10.2 - 35.8), (P<.001) which was sustained over the study period. Post-intervention, opioid prescriptions were significantly reduced in those who did not require opioids in-hospital (41.1%) compared to those who did (74.8%) (P<.001). In both the pre-intervention and post-intervention groups, prescriber level of training made a significant difference in amount of opioid prescribed at discharge (P<.001). Attending physicians prescribed the most pre-intervention and post-intervention. Prescriber training program was associated with a change in opioids prescribed post-intervention (P=.002) but not pre-intervention. Prescribers from obstetrical and radiology programs were found to prescribe the most. Obstetricians were asked if there were extra visits or phone calls postpartum regarding pain management and no change was reported.

**Discussion**: A quality improvement bundle led to a dramatic sustained decrease in discharge prescriptions of opioids post-cesarean delivery at a large Canadian tertiary academic hospital. The ongoing opioid crisis in North America highlights the need for continued evaluation of and education about best prescribing practices. We recommend that similar interventions be

implemented and assessed across Canada and the United States in obstetrical units and in other clinical settings such as inpatient surgery.

**REFERENCES:**


1. Canadian Institute for Health Information. Opioid Prescribing in Canada: How Are Practices Changing? (2019). Available at: https://www.cihi.ca/sites/default/files/document/opioid-prescribing-canada-trends-en-web.pdf. (Accessed: 20th January 2021)
2. Health Quality Ontario. Recommendations for Adoption: Opioid Prescribing for Acute Pain. Available at: http://www.hqontario.ca/Portals/0/documents/evidence/quality-standards/qs-opioid-acute-pain-recommendations-for-adoption-en.pdf. (Accessed: 20th January 2021)
3. McDermott, KW., Freeman, WJ., Elixhauser, A. Most Common Operations in Hospital Inpatient Stays - HCUP Fast Stats. Available at: https://www.hcup-us.ahrq.gov/faststats/NationalProceduresServlet. (Accessed: 20th January 2021)
4. Gold, S., Figueiro-Filho, E., Agrawal, S. & Selk, A. Reducing the Number of Opioids Consumed After Discharge Following Elective Cesarean Delivery: A Randomized Controlled Trial. J. Obstet. Gynaecol. Canada (2020). doi:10.1016/j.jogc.2020.02.123
5. Mehraban, S. S. et al. Opioid-free multimodal analgesia pathway to decrease opioid utilization after cesarean delivery. J. Obstet. Gynaecol. Res. jog.14582 (2020). doi:10.1111/jog.14582

## Management of Laryngeal Sarcoidosis During Pregnancy

Shri Vidya Niranjan Kumar[1], Richard Kolesar[1], Thomas Riekki[1], Alena Skrinskas[1], Aron Kugler[1], Gharid Nourallah[2], Carmela Sciarra[3], Alexander Norgaard[3], Lisa Yang[3]

1 Dept. of Anesthesia, McMaster University, Hamilton, Ontario, Canada.
2 Dept. of Maternal-Fetal Medicine, McMaster University, Hamilton, Ontario, Canada.
3 Dept. of Obstetrics and Gynecology, McMaster University, Hamilton, Ontario, Canada.

**Introduction:** Sarcoidosis is a chronic inflammatory disease which occurs in genetically susceptible individuals and is characterized by an exaggerated immune response to foreign substances. This response results in the formation of granulomas in various organs, typically lung, skin, and lymph nodes. The estimated incidence of sarcoidosis varies greatly according to the region and is 17.8 per 100,000 per year among African-Americans and 7.6-8.8 cases per 100,000 per year in the USA. Isolated laryngeal sarcoidosis (ILS) is extremely rare and occurs in only 0.8-5% of all sarcoid patients. ILS can further alter the anatomy of the pregnant airway and pose challenges for emergent airway intervention.

**Case discussion:** Patient consent was obtained for publication of this case. A 40yr old G4P3L3 female was scheduled for induction of labour at 38 weeks and 1 day. At 26 weeks gestation she a reported fullness sensation in her throat, dry cough, and inability to clear secretions. Maternal-foetal medicine service coordinated multidisciplinary care and arranged consultations with anesthesiology and otolaryngology. Laryngoscopy was performed and showed widespread lesions but no evidence of airway compromise. Systemic steroid therapy was initiated with prednisone, 50 mg. PO. daily. Originally diagnosed with ILS in 2010, she subsequently underwent three debulking surgeries in 2014,2016 and 2018. Co-morbidities complicating the current pregnancy included: morbid obesity (BMI 55), OSA (CPAP non-compliant), and gestational diabetes mellitus. Foetal macrosomia was identified on ultrasound.

Shortly after admission to the high-risk obstetrical unit, reliable intravenous access was established. An epidural catheter was inserted immediately after the initiation of oxytocin. The epidural was placed with aid of ultrasound guidance. The dural puncture technique was employed mainly to avoid false loss of resistance and subsequent mal-placement of the catheter. Finally, the patient's spine was extended prior to fixing the catheter to prevent its migration. Good labour analgesia was achieved.

During cervical exam to assess for artificial rupture of membranes, the obstetrical team discovered that the baby had verted to breech position. Urgent caesarean section was undertaken. Although the epidural appeared to be working well, an approach to secure the airway was also meticulously planned. Adequate anaesthesia was successfully achieved using the epidural catheter. Delivery was uneventful. The catheter was left in place for postoperative analgesia. The patient was discharged from the operating room to a high-dependency unit ("step-down") where she remained for one day. After an uneventful 24 hours, she was then discharged to a post-partum unit.

**Conclusion:** To date, there are no published reports of ILS in a pregnant woman. Accordingly, optimal anaesthetic management in the peripartum period has not been described. In this case, the care team relied on early preoperative consultation, patient education, and multidisciplinary planning to optimize the outcome of labour and delivery in a patient with this rare condition.

**REFERENCES:**

1. Arkema EV, Cozier YC. Epidemiology of sarcoidosis: current findings and future directions. *Ther Adv Chronic Dis*. 2018;9(11):227-240. Published 2018 Aug 24. doi:10.1177/2040622318790197
2. Dean CM, Sataloff RT, Hawkshaw MJ, Pribikin E. Laryngeal sarcoidosis. J Voice. 2002 Jun;16(2):283-8. doi: 10.1016/s0892-1997(02)00099-1. PMID: 12150382.

## Obstetric and Anesthetic Management of Deliveries in Women with Fontan Circulations: Single Centre Experience and Trends in Practice Over the Past 21 Years

Aidan Spring[1], Bashu Dev Parajuli[1], Kristi Downey[1], Jose Carvalho[1]

1 Department of Anesthesia and Pain Management, Mount Sinai Hospital, Toronto, Ontario, Canada.

**Introduction/Background:** The Fontan procedure is undertaken in infants with a single functional ventricle. In a staged fashion over childhood the systemic venous return is routed to the pulmonary arteries without the interposition of a ventricle(1). Currently the estimated 20-year survival of these patients is 61% to 85%(2). Improvements in care means that survival rates are predicted to improve further. Obstetric anesthetists will increasingly be involved in the management of these women. The limitations of the Fontan circulation means that the physiological burdens of pregnancy can pose a significant health risk to these women(3, 4). We sought to examine the anesthetic management and complications suffered by these women during delivery.

**Methods:** Ethics approval was obtained fron the local REB. We reviewed the medical records of women with Fontan circulation who delivered at our institution, from 2000 to 2020. A register of these women is maintained by the High Risk Obstetric team. We extracted data related to co-morbidities, underlying cardiac functional status, anesthetic management, mode of delivery and peripartum complications.

**Results:** Over 21 years there were a total of 28 deliveries to 20 women. 20 of these deliveries occurred since 2010. There were no deaths. One woman had three deliveries over 15 years and there was one twin delivery. The functional status of these women pre-pregnancy was good. The average maternal age at delivery was 27.7 years. The average gestation at delivery was 34 weeks. 19 deliveries were vaginal and 9 were by cesarean section. 16 of the vaginal deliveries had epidurals. Of the 9 deliveries by cesarean section 6 had epidural anesthesia, 1 had spinal anesthesia, 1 had a combined spinal-epidural and 1 had continuous spinal anesthesia. Central line insertion for delivery was not performed after 2004. After 2012, 75% of eligible vaginal deliveries did not have arterial lines. Postpartum care on the obstetric floor as opposed to CCU also became more common (74%) after 2006. Complications were frequent, particularly arrythmias (18%), with just 10 of 28 deliveries having no recorded complications.

**Discussion:** This is the largest published case series describing the anesthetic management of women with Fontan circulation. It is noteworthy that 20 of these deliveries occurred since 2010. Reassuringly there were no deaths in our series. Increasing familiarity in managing these complex patients is reflected in the trend of reduced invasive vascular access use and post partum care on the obstetric floor. However we should not be complacent as complications were frequent, particularly arrythmias. Multi-disciplinary care by anesthetists, obstetricians and cardiologists is the hidden narrative underpinning the care provided to these women.

**REFERENCES:**

1. Gewillig M, Brown SC. The Fontan circulation after 45 years: update in physiology. Heart. 2016;102(14):1081-6.
2. Rychik J, Atz AM, Celermajer DS, Deal BJ, Gatzoulis MA, Gewillig MH, et al. Evaluation and Management of the Child and Adult With Fontan Circulation: A Scientific Statement From the American Heart Association. Circulation. 2019:CIR0000000000000696.

3. Garcia Ropero A, Baskar S, Roos Hesselink JW, Girnius A, Zentner D, Swan L, et al. Pregnancy in Women With a Fontan Circulation: A Systematic Review of the Literature. Circ Cardiovasc Qual Outcomes. 2018;11(5):e004575.
4. Monteiro RS, Dob DP, Cauldwell MR, Gatzoulis MA. Anaesthetic management of parturients with univentricular congenital heart disease and the Fontan operation. Int J Obstet Anesth. 2016;28:83-91.

# PAIN MANAGEMENT

## Nonopioid Drug Combinations for Cancer Pain: A Systematic Review

Gursharan Sohi[1], Augusto Caraeni[2], Dwight E. Moulin[3], Camilla Zimmermann[4], Leonie Herx[5], Ian Gilron[1, 6-8]

1 Department of Anesthesiology & Perioperative Medicine, Kingston Health Sciences Centre, Queen's University, Kingston, Ontario, Canada.
2 Fondazione IRCCS—Istituto Nazionale dei Tumori, Italy.
3 Departments of Clinical Neurological Sciences and Oncology, Western University, Canada.
4 Division of Palliative Medicine, Department of Medicine, University of Toronto, Ontario, Canada.
5 Division of Palliative Medicine, Department of Medicine, Queen's University, Kingston, Ontario, Canada.
6 Department of Biomedical & Molecular Sciences, Queen's University, Kingston, Ontario, Canada.
7 Centre for Neuroscience Studies, Queen's University, Kingston, Ontario, Canada.
8 School of Policy Studies, Queen's University, Kingston, Ontario, Canada.

**Introduction:** Cancer pain – defined as pain caused by neoplastic disease or its treatment – is extremely common, affecting 80% of cancer patients(1, 2). Currently, standard management of cancer pain relies heavily on opioid analgesics which, while effective, are not benign. Several nonopioid analgesic agents have proved efficacious in managing pain, including anticonvulsant and antidepressant drug classes for treating neuropathic pain etiologies. Existing guidelines do not yet account for the implications of nonopioid combinations for use in treating cancer pain(3). The present systematic review sought to summarize the safety & efficacy of nonopioid drug combinations for cancer pain management.

**Methods:** Ethics approval was not applicable because this study did not involve human or animal research. The protocol for this review has been previously published and registered in the International Prospective Register of Systematic Reviews (CRD42020183689) on August 20th, 2020. A thorough search of three databases (PubMed, EMBASE, CENTRAL) was conducted in addition to a hand-search of the relevant literature and consultation with experts in pain-management. This review included double-blinded randomized controlled trials (RCTs) which compared nonopioid drug combinations to at least one of the combination's individual components and/or placebo for the treatment of cancer pain in adults. Two reviewers independently reviewed titles and abstracts for inclusion, resolving disagreements through consensus. The primary outcome was the proportion of participants reporting ≥30% pain reduction from baseline OR ≥moderate pain relief OR ≥moderate global improvement. Risk of bias was assessed independently by two authors using the guidelines established by the Cochrane Handbook for RCTs(4). One author completed data extraction for eligible studies; it was determined *a priori* that studies would only be analyzed in combination if they were sufficiently similar in order to avoid clinical heterogeneity.

**Results:** In total, 8134 citations were imported for review. Preliminary results of this systematic literature search have, thus far, identified three RCTs deemed suitable for inclusion. Matsuoka (2019) demonstrated the superiority of duloxetine vs. placebo in combination with pregabalin for cancer pain relief. Minotti (1998) found no significant difference in pain scores between imipramine, codeine and placebo in combination with diclofenac. Finally, Delanian (2019) found no benefit to pentoxifylline, tocopherol, clodronate combined vs. placebo with an 18-month follow up. Meta-analysis was not performed due to substantial between-study heterogeneity.

**Discussion:** Regimens of nonopioid agents have not been rigorously trialed in the setting of cancer pain, as illustrated by the low yield of RCTs reviewed in the present study. From the included trials, nonopioid combinations of antidepressant and anticonvulsant drugs remain promising for the treatment of neuropathic cancer pain, although the strength of available evidence is insufficient to derive recommendations for clinical practice. We conclude that this subject merits further study to improve pain management options for cancer patients.

## REFERENCES:

1. Kane CM, Mulvey MR, Wright S, Craigs C, Wright JM, Bennett MI. Opioids combined with antidepressants or antiepileptic drugs for cancer pain: Systematic review and meta-analysis. Palliative medicine. 2018 Jan;32(1):276-86.
2. van den Beuken-van Everdingen MH, Hochstenbach LM, Joosten EA, Tjan-Heijnen VC, Janssen DJ. Update on Prevalence of Pain in Patients With Cancer: Systematic Review and Meta-Analysis. J Pain Symptom Manage. 2016 Jun;51(6):1070-1090.e9. doi: 10.1016/j.jpainsymman.2015.12.340. Epub 2016 Apr 23. Review. PubMed PMID: 27112310.
3. Marieke et al. Update on prevalence of pain in patients with cancer: systematic review and meta-analysis. *Journal of Pain and Symptom Management.* 2016. 51:6 (1070-1090). Available from: https://doi.org/10.1016/j.jpainsymman.2015.12.340
4. Higgins JP, Altman DG, Gøtzsche PC, Jüni P, Moher D, Oxman AD, Savović J, Schulz KF, Weeks L, Sterne JA. The Cochrane Collaboration's tool for assessing risk of bias in randomised trials. Bmj. 2011 Oct 18;343:d5928.

## GRANT ACKNOWLEDGEMENT:

This work was supported, in part, by the Queen's University Department of Anesthesiology & Perioperative Medicine, and the Chronic Pain Network of the Canadian Institutes of Health Research Strategy on Patient-Oriented Research.

## Optimizing Prescription Sizes by Measuring Post-Discharge Opioid Analgesic Use After Common Ambulatory Orthopedic Surgeries: An Online Survey

Kristin McPhail[1], Ryan Amadeo[1], Scott Wolfe[1], Thomas Mutter[1]

1 Department of Anesthesiology, Pain and Perioperative Medicine, Max Rady College of Medicine, University of Manitoba, Winnipeg, Manitoba, Canada.

**Objective:** Postoperative opioid analgesic prescriptions are necessary to manage acute postoperative pain, but can convert opioid naïve patients into chronic users[1]. Optimizing opioid prescription sizes requires balancing interindividual variation in perceived needs with the societal obligation to reduce the amount of unnecessary opioids dispensed into the community[2]. To help inform the optimum prescription with actual data[3] instead of expert consensus[2], we surveyed patients to determine the oral morphine equivalents (OME) prescribed and used during their recovery.

**Methods:** Ethics approval was obtained from the local REB. This was a cross-sectional, self-administered, anonymous online survey of patients who had recently undergone ambulatory orthopedic surgery. It was conducted at a single outpatient surgical center attended by 13 surgeons. Serial postoperative phone calls were used to assess for eligibility, including internet access, English language facility, and discontinuation of postoperative opioids. Interested participants were sent a link to the survey by email. The authorship group developed the survey with attention to readability and input from non medical acquaintances. The primary outcome was OME used by opioid naïve patients. Patients reported the opioid prescribed, the number of pills remaining and initially prescribed (including refills), and the researchers converted the input to OME[4] for analysis. The goal was to construct histograms of OME used to qualitatively inform prescription size planning, with OME expressed in tablets (1tablet =5mg OME). Predictors of OME used were examined using negative binomial models with significance set at $p<0.05$.

**Results:** 388 (40.0%) of 971 eligible patients completed a survey between January and August 2020, and 330 (85.1%) filled an opioid prescription, median 47 tablets [interquartile range 30-75]. 26.8% of respondents were more than 60 years old, 47.8% were female and >85% received regional anesthesia or a combined technique. The most common surgeries were shoulder arthroscopy (29.9%), knee arthroscopy (16.2%), anterior cruciate ligament reconstruction (9.2%), and bunion/ hammer toe surgery (8.5%). Histograms of OME use tended to be right skewed (see Figure). In multivariable regressions adjusted for age, surgery/ anesthetic type, use of cold therapy, refills received, pain scores and use of non-opioid co-analgesics, the only significant predictor was OME prescribed ($p\leq0.002$). A 25mg OME (5 tablet) increase in prescription size was associated with an 11% (95% confidence interval (CI) 6%-18%) increase in tablets taken for knee surgery and a 5% (95% CI 2%-8%) increase in tablets taken for shoulder arthroscopy. Chronic preoperative opioid users (n=33) were excluded from histograms and models.

**Discussion:** Histograms of postoperative opioid use can be used to plan prescription sizes and anticipate the need for refills after common ambulatory orthopedic procedures, despite significant interindividual variation. Larger opioid prescription sizes were affirmed as a predictor of increased postoperative opioid use[5], and warrant continued investigation as a potential target for intervention.

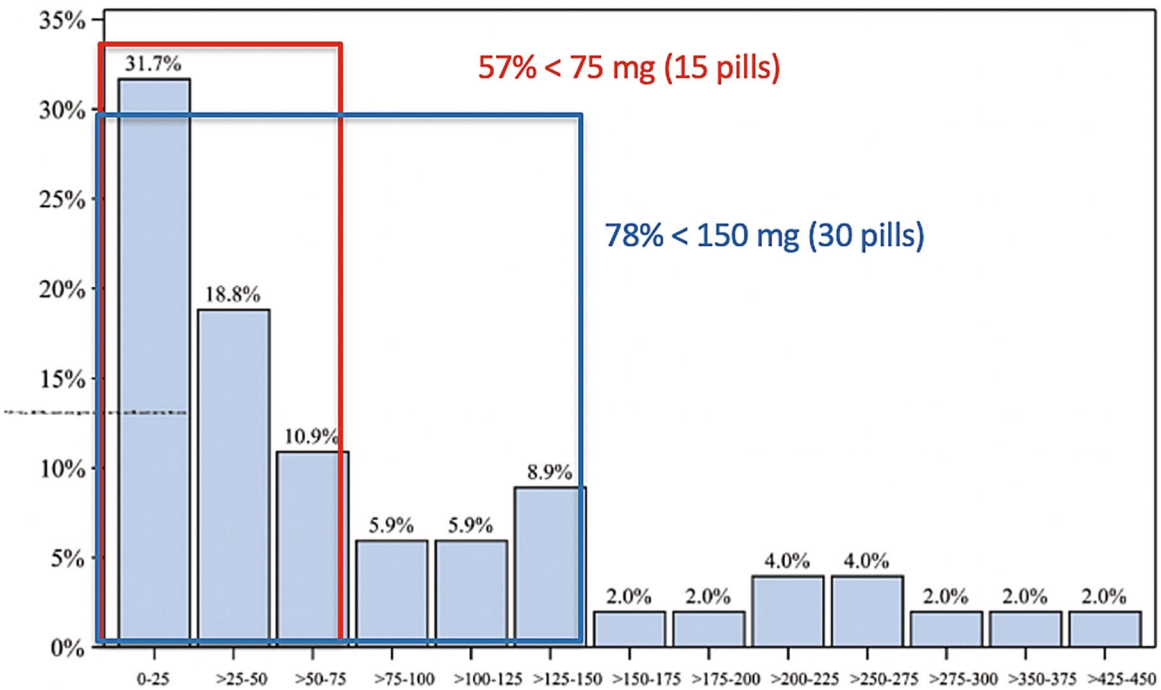
## REFERENCES:


1. Alam A, Gomes T, Zheng H, Mamdani MM, Juurlink DN, Bell CM. Long-term analgesic use after low-risk surgery: a retrospective cohort study. Arch Intern Med 2012; 172: 425e30
2. Overton HN, Hanna MN, Bruhn WE, Hutfless S, Bicket MC Makary MA. Opioid-Prescribing Guidelines for Common Surgical Procedures: An Expert Panel Consensus. J Am Coll Surg 2018 227(4): 411-18
3. Rodgers, J., Cunningham, K., Fitzgerald, K., & Finnerty, E. (2012). Opioid consumption following outpatient upper extremity surgery. Journal of Hand Surgery, 37(4), 645–650. https://doi.org/10.1016/j.jhsa.2012.01.035
4. Busse, J. (2017). The 2017 Canadian Guideline for Opioids for Chronic Non-Cancer Pain. 1–105, see page 68.
5. Gaddis, A., Dowlati, E., Apel, P. J., Bravo, C. J., Dancea, H. C., Hagan, H. J., Mierisch, C. M., Metzger, T. A., & Mierisch, C. (2019). Effect of Prescription Size on Opioid Use and Patient Satisfaction After Minor Hand Surgery: A Randomized Clinical Trial. Annals of surgery, 270(6), 976–982. https://doi-org.uml.idm.oclc.org/10.1097/SLA.0000000000003127


## GRANT ACKNOWLEDGEMENT:

Anesthesia Oversight Committee (Department of Anesthesiology, Pain and Perioperative Medicine, Max Rady College of Medicine, University of Manitoba).

Figure 1. Oral morphine equivalents used after knee arthroscopy (n=53)



# PEDIATRIC

## Incidence of Perioperative Respiratory Adverse Events in Pediatric Anesthesia

Wassila Ait Igrine[1], Davinia E. Withington[2]

1 Department of Anesthesia, McGill University, Montreal, Quebec, Canada.
2 Department of Anesthesia, Montreal Children's Hospital, McGill University, Montreal, Quebec, Canada.

**Introduction:** Respiratory events are responsible for the majority of the perioperative complications in pediatric anesthesia.[1] Unfortunately, little is known of the current pediatric anesthesia complication rates in Canada.[2,3] We aimed to identify the incidence of perioperative respiratory adverse events (PRAE) at our pediatric center and sought to identify associated patient, surgical and anesthetic risk factors.

**Methods:** Ethics approval was waived by local REB. We conducted a prospective audit of all children receiving anesthesia from December 2018 to June 2019 inclusively. Data was collected through anonymized surveys that were completed by the anesthetist and the recovery room nurse responsible for the patient. The primary outcome was the incidence of any PRAE either during anesthesia or in the recovery room. The events assessed were stridor, laryngospasm, bronchospasm, persistent coughing, airway obstruction, apnea and oxygen desaturation. Data on relevant patient risk factors as well as on anesthetic and surgical management were recorded.

**Results:** A total of 1903 forms were collected. Analysis was conducted using SPSS 24.0. Incidence of any PRAE was 14.3%. Incidence of any RAE in the OR was 7.8% where 8% of these were classified as severe. Incidence in the PACU was of 6.6%, with 1% of these being severe. Airway obstruction was the most common event and occurred mostly either on emergence or in the PACU. Three multivariate models based on significant patient, anesthetic and surgical factors were built to assess association with the primary outcome. Significant variables identified in each model were used to build a final integrated multivariate model. Variables significantly associated with the outcome were age groups 0-2 years (OR 2.88, 95% CI 1.42 -3.78, P 0.007) and 13-18 (OR 1.99, 95% CI 1.09-3.00, P 0.007), abnormal airway (OR 2.36, 95% CI 1.17-3.56, P 0.01), chronic pulmonary disease (OR 2.31, 95% CI 1.37-5.30 , P 0.004), OSA (OR 2.25 95% CI 1.48-4.00 , P 0.005), URTI (OR 2.1 95% CI 1.44-3.22 , P0.0002), history of PRAE (OR 3.59 95% CI 1.08/8.57 , P0.03), obesity (OR 2.60 95% CI 1.32-5.49 , P 0.006), native airway being protective (OR 0.48 95% CI 0.293-0.796, P 0.001), and urgent procedure (OR1.65 95% CI 1.00-2.71 , P 0.04).

**Discussion:** Incidence of PRAE at our center is comparable to rates identified in other studies.[4] Here again we observe the importance of patient factors.[5] Notable potentially modifiable risk factors include URTI and obesity. Of interest, while age was traditionally shown to be strictly inversely correlated with the risk of RAE, we found that children older than 13 years were at higher risk compared to the 7-13 years category. This could be a target for improvement. Finally, only one event resulted in unexpected ICU admission, highlighting the overall favorable prognosis of respiratory adverse events.

**REFERENCES:**


1. Habre, W., Disma, N., Virag, K., Becke, K., Hansen, T. G., Jöhr, M., ... & Didier, A. (2017). Incidence of severe critical events in paediatric anaesthesia (APRICOT): a prospective multicentre observational study in 261 hospitals in Europe. The Lancet Respiratory Medicine, 5(5), 412-425.
2. Rose, D. K., Cohen, M. M., Wigglesworth, D. F., & DeBoer, D. P. (1994). Critical respiratory events in the postanesthesia care unit: patient, surgical, and anesthetic factors. The Journal of the American Society of Anesthesiologists, 81(2), 410-418.
3. Cohen, M. M., Cameron, C. B., & Duncan, P. G. (1990). Pediatric anesthesia morbidity and mortality in the perioperative period. *Anesthesia & Analgesia*, *70*(2), 160-167.
4. von Ungern-Sternberg, B. S., Boda, K., Chambers, N. A., Rebmann, C., Johnson, C., Sly, P. D., & Habre, W. (2010). Risk assessment for respiratory complications in paediatric anaesthesia: a prospective cohort study. The Lancet, 376(9743), 773-783.
5. Regli, A., & von Ungern-Sternberg, B. S. (2015). Diagnosis and management of respiratory adverse events in the operating room. Current Anesthesiology Reports, 5(2), 156-167.

## Novel use of Continuous Erector Spinae Plane Blocks in Surgery for Adolescent Idiopathic Scoliosis

Allyson Farran[1], Michael Little[1], Florian Rudolph[1], Eric Huang[2], Kyle Stampe[2], Mancho Ng[1]

1 Department of Anesthesiology and Pain Medicine, University of Alberta, Edmonton, Canada.
2 Department of Surgery, University of Alberta, Edmonton, Alberta, Canada.

**Background:** Posterior spinal fusion (PSF) for adolescent idiopathic scoliosis (AIS) can cause severe post-operative pain[1]. These patients often have high systemic opioid requirements, which can result in a sequalae of unwanted opioid-related adverse effects[2]. The erector spinae plane (ESP) block is a novel regional anesthesia technique that blocks the dorsal and ventral rami of spinal nerve roots[3]. The utility of this block in pediatrics is relatively new[4], and its efficacy in managing pain following surgery for scoliosis has not yet been described. We sought to determine whether bilateral continuous ESP blocks, when compared to single-shot intrathecal morphine, reduces opioid consumption in the first 72 hours after PSF for AIS. We also compared the frequency of opioid-related adverse effects and numeric rating scale (NRS) pain scores.

**Methods:** Ethics approval was obtained from the local REB. This was a before-after cohort study that compared a historical group of 31 consecutive patients receiving single-shot intrathecal morphine (5mcg/kg) to a prospectively matched cohort of 25 patients receiving bilateral continuous ESP blocks (bupivacaine 0.1% infusion at 0.5-1ml/hr, bolus dose of 7ml every 90min). ESP block catheters were placed under direct visualization by the surgeons at the end of surgery, and remained in-situ for 72 hours. Both groups also received gabapentin (5mg/kg), ibuprofen (10mg/kg), and acetaminophen (15mg/kg), and either morphine or hydromorphone via patient-controlled analgesia.

**Results:** Patients receiving continuous erector spinae plane blocks used significantly less opioids compared to those receiving intrathecal morphine at 48 and 72 hours post-operatively (28.5mg ± 13.5 vs 43.6mg ± 20.2, $p = 0.007$ at 48h; 29.5mg ± 13.6 vs. 47.9mg ± 23.0 at 72h, $p = 0.002$), but not at 24 hours. There were no significant differences in numeric rating scale pain scores. The continuous erector spinae plane blocks also had a lower incidence of nausea and vomiting (68% vs 90%, $p < 0.05$), as well as pruritis (20% vs 52% $p < 0.05$).

**Discussion:** This study found that continuous bilateral ESP blocks in PSF for AIS resulted in significantly less opioid consumption at 48- and 72- hours compared to a retrospective cohort of intrathecal morphine. The continuous ESPBs also resulted in fewer opioid-related adverse effects, including PONV and pruritis. Interestingly, the reduction in opioid consumption did not translate to reduced NRS pain scores. This may simply reflect a compensatory increase in the use of PCA opioids by the ITM group to achieve similar levels of analgesia. Given that this is a relatively new technique in pediatrics, the optimal dose of local anesthetic has not yet been established. Further characterization of the ideal loading volume, infusion rate, and concentration of local anesthetic used for continuous ESP blocks would be a valuable next step.

**REFERENCES:**

1. Rullander AC, Jonsson H, Lundström M, Lindh V. Young people's experiences with scoliosis surgery: a survey of pain, nausea, and global satisfaction. *Orthop Nurs*. 2013;32(6):327-335.

2. Milbrandt TA, Singhal M, Minter C, et al. A comparison of three methods of pain control for posterior spinal fusions in adolescent idiopathic scoliosis. *Spine (Phila Pa 1976)*. 2009;34(14):1499-1503.
3. Forero M, Adhikary SD, Lopez H, Tsui C, Chin KJ. The Erector Spinae Plane Block: A Novel Analgesic Technique in Thoracic Neuropathic Pain. *Reg Anesth Pain Med*. 2016;41(5):621-627.
4. Holland EL, Bosenberg AT. Early experience with erector spinae plane blocks in children. *Paediatr Anaesth*. 2020;30(2):96-107.

## Point of Care Ultrasound (PoCUS) for Obstructive Sleep Apnoea Screening in the Pediatric Population – A Systematic Review

Donogh Burns[1], Aditya Trivedi[5], Vincent Chan[2], Mandeep Singh[2,3,4]

1 Department of Anesthesia and Pain Medicine, The Hospital for Sick Children, Toronto, Ontario, Canada.
2 Department of Anesthesiology and Pain Management, Toronto Western Hospital, University Health Network, University of Toronto, Toronto, Ontario, Canada.
3 Toronto Sleep and Pulmonary Centre, Toronto, Ontario, Canada.
4 Department of Anesthesiology and Pain Management, Women's College Hospital, Toronto, Ontario, Canada.
5 Department of Chemistry, McMaster University, Hamilton, Ontario, Canada.

**Introduction:** The diagnosis of obstructive sleep apnea (OSA) has important clinical significance in the pediatric perioperative context. The gold standard of polysomnography is a limited and expensive resource. A recent systematic review and meta-analysis in adults identified several parameters which correlate well with OSA diagnosis. The objective of this systematic review was to evaluate the usefulness of surface airway ultrasound as a perioperative point-of-care ultrasound (PoCUS) tool for OSA screening in the pediatric population and identify potential areas for future research.

**Methods:** Ethics approved was not applicable because the study did not involve human or animal research.

This systematic review was registered with Prospero ID: CRD42020216252. A search of major electronic databases including Medline, Embase, and others was conducted from inception to November 2020. Inclusion criteria were observational cohort studies and randomized controlled trials involving surface ultrasound (US) imaging directly relating to OSA or US imaging of upper airway structures with a known association with OSA in the pediatric population (0-18 years) . Article screening, and data extraction were conducted by two independent reviewers. Mean age, gender, BMI, study setting, US parameters (index test) and reference measures were collected. An evaluation was made of the correlation between US parameters and OSA diagnosis using sleep study (reference standard), other reference measures relating to severity of symptoms or measures validating US parameters.

**Results:** Of the initial 8,499 screened articles, 12 articles (8 airway, 4 non-airway) evaluating 1,237 patients were included.

Three studies examined correlation between US measurements and OSA diagnosis defined by Apnea Hypopnea Index (AHI) as measured by polysomnography. Lateral pharyngeal wall thickness (LPW) was positively correlated with either the severity or presence of OSA in all three of these studies and total neck thickness (TNT) with AHI in one of the studies.
Three studies examined the relationship between carotid intimal media thickness (cIMT) and AHI, with no significant correlation found. One study examined the relationship between cIMT and a clinical diagnosis of Adenotonsillar Hypertrophy and found a statistically significant association.

Four studies compared US measurements of tonsil volume preoperatively with the pathological specimens of resected tonsils with good correlations found between the measured volumes in each study.
One study examined the adenoid tonsils and found a strong correlation between the adenoid

thickness on US and the extent of adenoid-posterior nostril occlusion (EANC) based on electronic nasopharyngoscopy.

**Discussion:** The studies included in this review exhibit considerable heterogeneity in terms of the structures examined by US and the correlated parameters. There is insufficient data currently to recommend any specific US measurements to reliably diagnose pediatric patients with OSA. This is an area of increasing interest, with most of the included studies published in the past three years. This systematic review highlights areas for future larger scale studies to pursue.

**REFERENCES:**

1 Coté CJ, Posner KL, Domino KB. Death or neurologic injury after tonsillectomy in children with a focus on obstructive sleep apnea: Houston, we have a problem! *Anesthesia and Analgesia*. 2014;118(6):1276-1283. doi:10.1213/ANE.0b013e318294fc47
2 Pehora C, Faraoni D, Obara S, et al. Predicting Perioperative Respiratory Adverse Events in Children With Sleep-Disordered Breathing. Published online 2020. doi:10.1213/ANE.0000000000005195
3 Marcus CL, Brooks LJ, Draper KA, et al. Diagnosis and management of childhood obstructive sleep apnea syndrome. *Pediatrics*. 2012;130(3):576-584. doi:10.1542/peds.2012-1671
4 Singh M, Tuteja A, Wong DT, et al. Point-of-Care Ultrasound for Obstructive Sleep Apnea Screening: Are We There Yet? A Systematic Review and Meta-analysis. *Anesthesia and analgesia*. 2019;129(6):1673-1691. doi:10.1213/ANE.0000000000004350

## Retrospective Audit of Paediatric Spine Surgeries: A Quality Improvement Initiative

Cindos Barakat[1,2], Ushma Shah[1,2], Niveditha Karuppiah[1,2], Raju Poolacherla[1,2], Herman Sehmbi[1,2], Brynn Charron[2], Kathleen Lynch[3], Susan Carter[3], Abi Kandasamy[3]

1 Department of Anesthesia and Perioperative Medicine, London Health Science Centre, London, Ontario, Canada.
2 Schulich School of Medicine and Dentistry, London, Ontario, Canada.
3 London Health Sciences Centre, London, Ontario, Canada.

**Introduction/Background:** Chronic postsurgical pain (CPSP) is known to occur in 20% of children after major surgery. (1) CPSP is associated with prolongation of recovery, higher risk of postsurgical infection and psychological distress. (1) Pediatric spine surgeries are commonly associated with higher rates of chronic pain and longer post-operative recovery. (2) Protocoled peri-operative management, such as with ERAS, can improve perioperative care. (3,4) The purpose of this review is to audit the hospital stay of pediatric patients who underwent spine surgery at a children's hospital to evaluate the baseline function and assess for areas of improvement.

**Methods:** Ethics approval was waived by the local REB. This is a retrospective chart review of all paediatric spine cases at a children's hospital between Jan 1$^{st}$ 2018 to December 31$^{st}$ 2019. Data collected included 1) demographic profile, 2) medical comorbidities, 3) surgery, 4) post-operative pain scores & opioid consumption, 5) duration of hospital & ICU stay 6) adjuvant drugs, 7) physiotherapy goals and day achieved and 8) post-operative complications. This is the part 1 of a PDSA cycle.

**Results:** Total cases reviewed in this study were 67. Table 1 summaries the results. Average duration of hospital stay was 6.7 ± 2.1 days, with an average of 1.2 ± 0.83 days spent in ICU. Average opioid consumption was 0.50 ± 0.52 mg/kg on POD 0, 0.71 ± 0.67 mg/kg on POD 1, 0.31 ± 0.32 mg/kg on POD 2, and 0.13 ± 0.14 mg/kg on POD 3. For multimodal analgesia, all patients were prescribed acetaminophen (79% scheduled), 99% ibuprofen (53% scheduled) and 33% gabapentin. For rehabilitation goals, the average number of post-operative days to be able to sit at edge of bed was 1.3 ± 0.7, sitting for >20 min was 3.0 ± 1.4, ambulate ~10 m was 3.4 ± 1.3 and ascend/descend 3 steps was 4.5 ± 1.5. Analysis of the pain scores was complex due to variations in documentation style and frequency.

**Discussion:** Complex pediatric spine surgery needs a multidisciplinary approach to manage perioperative pain which in turn improves patient outcomes, while reducing hospital stay and costs. The hospital stay at our institution is 1-2 days greater than others. Institutions without ERAS protocol have a length of stay at 5.7 days, in comparison to our 6.7 days; additionally, those with ERAS protocols have lengths of stay at 4 days.(4) The barriers to early discharge have been identified as variable postoperative analgesic prescription, late mobilization and physiotherapy goal achievement. We would benefit from the development of standardized post-operative pain management protocol and early mobilization to facilitate recovery and early discharge. The next PDSA cycle will introduce postoperative spine care bundle which will target pain and symptom management and early physiotherapy.

## REFERENCES:


1. Rabbitts JA, Fisher E, Rosenbloom BN, Palermo TM. Prevalence and predictors of chronic postsurgical pain in children: a systematic review and meta-analysis. The journal of pain. 2017 Jun 1;18(6):605-14.
2. Williams G, Howard RF, Liossi C. Persistent postsurgical pain in children and young people: prediction, prevention, and management. Pain reports. 2017 Sep;2(5).
3. Dietz N, Sharma M, Adams S, Alhourani A, Ugiliweneza B, Wang D, Nuño M, Drazin D, Boakye M. Enhanced recovery after surgery (ERAS) for spine surgery: a systematic review. World neurosurgery. 2019 Oct 1;130:415-26.
4. Muhly WT, Sankar WN, Ryan K, Norton A, Maxwell LG, DiMaggio T, Farrell S, Hughes R, Gornitzky A, Keren R, McCloskey JJ. Rapid recovery pathway after spinal fusion for idiopathic scoliosis. Pediatrics. 2016 Apr 1;137(4).


Table 1. Results. Total cases reviewed were 67. *Outliers were removed due to extended duration of stay due to comorbidities not associated with spine surgery.

| **Gender** | | | | **Age** | | | |
|---|---|---|---|---|---|---|---|
| | **M** | **F** | | | **Years** | | |
| **Total** | 24 | 42 | | Average | 13± 3.1 | | |
| **Percent** | 35% | 64% | | | | | |
| **Most Responsible Diagnosis** | | | | | | | |
| | **Idiopathic Scoliosis** | **Neuromuscular disorder** | **Trauma** | **Tumor** | **Congenital Scoliosis** | **Spondylolisthesis** | **Neurofibromatosis** |
| **Total** | 40 | 8 | 7 | 3 | 3 | 3 | 3 |
| **Percent** | 61% | 12% | 11% | 4.5% | 4.5% | 4.5% | 4.55% |
| **ASA** | | | | | | **Surgical Levels** | |
| | **1** | **2** | **3** | **4** | | | Percent |
| **Total** | 1 | 14 | 39 | 13 | | **<4** | 16% |
| **Percent** | 2% | 21% | 58% | 19% | | **>3** | 84% |
| **Hospital Stay** | | | **ICU Stay** | **ICU Stay** | | **Remained Intubated** | |
| | **Days** | | | **Days** | | | |
| **Average** | 7.3 ± 5.4 | | **Average** | 1.9 ± 5.1 | | **Total** | 6 |
| **Average (outliers removed)*** | 6.7 ± 2.1 | | **Average (outliers removed)*** | 1.2 ± 0.83 | | **Percent** | 9% |
| **Opioid Consumption** | | | | | | | |
| | **POD 0** | **POD 1** | **POD 2** | **POD 3** | | | |
| **Morphine Equivalents in mg/kg** | 0.54 ± 0.62 | 0.81 ± 1.0 | 0.44 ± 1.2 | 0.27 ± 1.2 | | | |
| **Morphine Equivalents in mg/kg (outlier removed)** | 0.50 ± 0.52 | 0.71 ± 0.67 | 0.31 ± 0.32 | 0.13 ± 0.14 | | | |
| **Adjuvants** | | | | | | | |
| | **Acetaminophen** | **Ibuprofen** | **Gabapentin** | | | | |
| **Total** | 67 | 66 | 22 | | | | |
| **Scheduled** | 79% | 53% | 100% | | | | |
| **PRN** | 13% | 47% | | | | | |
| **Physiotherapy** | | | | | | | |
| | **Sitting at Edge of bed** | **Sitting >20 min** | **Ambulate ~10 m** | **Ascend/Descend 3 Steps** | | | |
| **Average Post Operative Day** | 1.3 ± 0.7 | 3.0 ± 1.4 | 3.4 ± 1.3 | 4.5 ± 1.5 | | | |

## Retrospective Review of Ambulatory Continuous Adductor Canal Catheters in Adolescents Undergoing Reconstructive Knee Surgery

Jennifer Dvorak[1,2], Adam Spencer[2,3], Andrew Walker[1], Lisa Phillips[4], Ryan Endersby[3], Kaleigh Peters[5]

1 Department of Anesthesia, Foothills Medical Centre, Calgary, Alberta, Canada.
2 Department of Anesthesia, Alberta Children's Hospital, Calgary, Alberta, Canada.
3 Department of Anesthesia, South Health Campus, Calgary, Alberta, Canada.
4 Department of Orthopedics, Alberta Children's Hospital, Calgary, Alberta, Canada.
5 Faculty of Nursing, University of Calgary, Calgary, Alberta, Canada.

**Introduction/Background:** Pediatric knee reconstruction is known to be a painful procedure requiring multimodal analgesia, including regional techniques to provide adequate postoperative pain control.[1] To provide prolonged postoperative analgesia pediatric anesthesiologists are inserting continuous peripheral nerve block (CPNB) catheters and using delivery systems such as electronic or elastomeric pumps to infuse local anesthetic over 24 to 72 hours.[2] Ambulatory continuous peripheral nerve block catheters (CPNBs) have proven to be feasible and safe for pediatric patients, however there is little data on ambulatory adductor canal blocks (ACBs) in this population.[3] We present a retrospective audit in pediatric patients to evaluate the efficacy of ambulatory continuous ACBs placed after reconstructive knee surgery using the catheter-over-needle technique (CON).

**Methods:** Ethics approval was obtained from the local REB**.** Retrospective data was collected on all pediatric patients who received an ambulatory continuous ACB after reconstructive knee surgery between March 2017 and May 2020 at a tertiary care pediatric hospital. Catheters were placed under ultrasound guidance using the CON technique as described here.[4] Catheters were intended to remain in place for up to three days. Data obtained included demographic information, duration of hospital stay, numerical pain scores (NRS) at rest, with movement and opioid use on postoperative days 1-3, complications related to the catheter, emergency department visits and hospital readmissions. Data was analyzed using descriptive statistics and presented as mean (standard deviation) or frequency (percentage) unless otherwise specified.

**Results:** Sixty-eight patients (age 13-17) were discharged home with a continuous ACB *in situ*; 80.9% on the day of surgery. 60.3% and 36.5% patients had their catheters in place until POD 2 and POD 3 respectively. Median NRS pain scores were ≤3 at rest and ≤5 with activity on postoperative days 1-3. Median opioid use was ≤5mg oral morphine equivalents per day with 31% of patients using no opioids from postoperative days 1-3. There were no serious complications such as LAST or long-term neurologic deficits. Readmission to hospital was limited to one patient for uncontrolled pain post-catheter removal.

**Discussion:** This study was designed as an initial retrospective audit on the use of postoperative ambulatory ACBs at our institution. We did not design our study to detect an *a priori* defined effect size. Despite our sample size, our audit suggests that in our cohort of pediatric reconstructive knee surgery patients the use of ambulatory ACBs is a feasible analgesic modality that resulted in clinically acceptable postoperative pain scores and minimal opioid use. Leakage around the catheter puncture site was limited to one patient supporting the use of the CON technique that utilizes a puncture hole of equivalent size to that of the catheter. Future appropriately powered clinical trials are warranted comparing the adductor canal block to the more commonly applied femoral approach in pediatric patients.

**REFERENCES:**


1. Parikh, H. B., Gagliardi, A. G., Howell, D. R., Albright, J. C., & Mandler, T. N. (2020). Femoral nerve catheters and limb strength asymmetry at 6 months after primary anterior cruciate ligament reconstruction in pediatric patients. *Paediatric anaesthesia*, *30*(10): 1109–1115.
2. Gurnaney H, Kraemer W, Maxwell L, Muhly WT, Schleelein L, Ganesh A. (2014). Ambulatory continuous peripheral nerve blocks in children and adolescent: a longitudinal 8-year single center study. *Anesthesia & Analgesia,* 118(3): 621-627.
3. Walker, B. J., Long, J. B., Sathyamoorthy, M., Birstler, J., Wolf, C., Bosenberg, A. T., Flack, S. H., Krane, E. J., Sethna, N. F., Suresh, S., Taenzer, A. H., Polaner, D. M., Martin, L., Anderson, C., Sunder, R., Adams, T., Martin, L., Pankovich, M., Sawardekar, A., Birmingham, P *et al.* Pediatric Regional Anesthesia Network Investigators (2018). Complications in Pediatric Regional Anesthesia: An Analysis of More than 100,000 Blocks from the Pediatric Regional Anesthesia Network. *Anesthesiology*, *129*(4): 721–732.
4. Spencer AO, Tsui BCH. (2014). Intermittent bolus via infraclavicular nerve catheter using a catheter-over-needle technique in a pediatric patient. *Canadian Journal of Anesthesia*; published online: May 6 2014. doi 10.1007/s12630-014-0172-3.

# PERIOPERATIVE

## A Systematic Review and Meta-Analysis of Preoperative Frailty Instruments Derived from Electronic Health Data

Jamal Alkadri[1], Dima Hage[2], Leigh H Nickerson[1], Lia R Scott[3], Julia F Shaw[4], Sylvie D Aucoin[1], Daniel I McIsaac[1,4,5]

1 Department of Anesthesiology & Pain Medicine, University of Ottawa, Ontario, Canada.
2 Faculty of Medicine, University of Ottawa, Ontario, Canada.
3 Department of General Surgery, Queen's University, Ontario, Canada.
4 School of Epidemiology and Public Health, University of Ottawa, Ontario, Canada.
5 Ottawa Hospital Research Institute, Ottawa, Ontario, Canada.

**Background:** Frailty is a multidimensional state related to accumulation of age- and disease-related deficits, acting as a strong predictor of adverse health outcomes in the perioperative period.[1,2] Given the increasing availability of electronic medical data, we performed a systematic review and meta-analysis with primary objectives of describing available frailty instruments applied to electronic data and synthesizing their prognostic value. Our secondary objectives were to assess the construct validity of frailty instruments that have been applied to perioperative electronic data and the feasibility of electronic frailty assessment.

**Methods:** Ethics approval was not applicable because the study did not involve human or animal research. Following protocol registration, a peer-reviewed search strategy was applied to Medline, Embase, Cochrane databases and the Comprehensive Index to Nursing and Allied Health literature from inception to December 31, 2019. All stages of the review were completed in duplicate. The primary outcome was mortality; secondary outcomes included non-home discharge, health care costs and length of stay. Effect estimates adjusted for baseline illness, sex, age, procedure and urgency were of primary interest; unadjusted and adjusted estimates were pooled using random-effects models where appropriate, or narratively synthesized. Risk of bias was assessed.

**Results:** Ninety studies were included; 83 contributed to the meta-analysis. Frailty was defined using 22 different instruments. In adjusted data, frailty identified from electronic data using any instrument was associated with a 3.57-fold increase in the odds of mortality (95%CI 2.68 to 4.75; P <0.001; $I^2$=97%, see Figure 1), increased odds of institutional discharge (OR 2.40, 95%CI 1.99 to 2.89, $I^2$=99%) and increased costs (incidence rate ratio 1.54, 95%CI 1.46 to 1.63, $I^2$=47%;). Most instruments were not multidimensional, head-to-head comparisons were lacking and no feasibility data was reported.

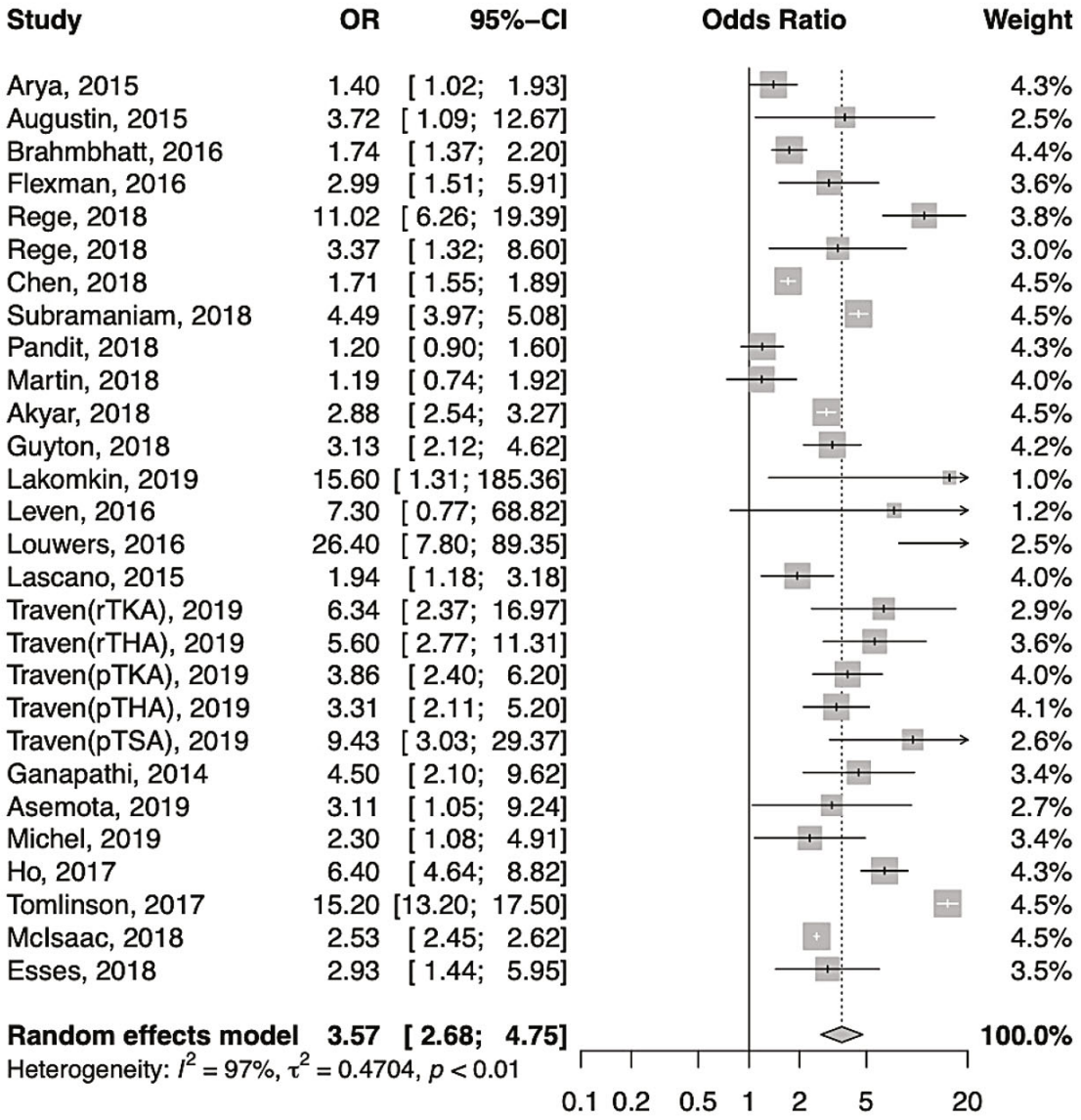
**Discussion**: Frailty status derived from electronic data provides prognostic value as it is associated with adverse outcomes, even after adjustment for typical risk factors. However, future research is required to evaluate multidimensional instruments, their head-to-head performance and to assess their feasibility and clinical impact.

### REFERENCES:

1. Rockwood K, Song X, MacKnight C, et al. A global clinical measure of fitness and frailty in elderly people. CMAJ. 2005;173(5):489-495. doi:10.1503/cmaj.050051

2. Fried LP, Ferrucci L, Darer J, Williamson JD, Anderson G. Untangling the concepts of disability, frailty, and comorbidity: implications for improved targeting and care. J Gerontol A Biol Sci Med Sci. 2004;59(3):255-263

Figure 1. Forest plot for adjusted pooled strength of association between frailty and mortality.



## Cognition-Cognizant Care: The Perioperative Brain Health Centre

Connor T.A. Brenna[1,2], Lilia Kaustov[2,3], Beverley A. Orser[2,3], Jane Huang[2,3], Stephen Choi[2,3]

1 Department of Medicine, University of Toronto, Toronto, Ontario, Canada.
2 Perioperative Brain Health Centre, Sunnybrook Research Institute, Toronto, Ontario, Canada.
3 Department of Anesthesia, Sunnybrook Health Sciences Centre, Toronto, Ontario, Canada.

**Background**: Postoperative neurocognitive disorder (P-NCD) is significant health issue with far-reaching socioeconomic implications, which can affect any patient undergoing surgery.[1,2] This multifactorial clinical phenomenon comprises a spectrum of perioperative cognitive changes,[3,4] which are commonly misdiagnosed as they often remain masked until long after surgery.[5] Unlike dementia, P-NCD has a clear starting point (i.e., surgery) and may represent an amenable target for intervention. Currently, however, there are no known preventative or therapeutic pharmacological approaches.

To address this, we established the multidisciplinary Perioperative Brain Health Centre (PBHC) at our quaternary referral center. The PBHC's objective is to develop innovative strategies to improve surgical patients' quality of life while reducing morbidity and economic burden. Our mission is three-fold: 1) investigate prospective diagnostic, preventative, and therapeutic tools for P-NCD; 2) care for patients in need; and 3) promote awareness and best practices among patients and providers, bolstering the safety of anesthesia and preserving cognitive health in the perioperative environment.

**Methods:** Ethics approval was obtained from the local REB. We employ multidisciplinary strategies highlighting perioperative cognition within the medical community and the broader public through patient education and outreach. The PBHC has several ongoing research arms focused on developing and validating techniques to recognize P-NCD, identifying perioperative cognitive risk factors, and testing potential preventative (repurposed and novel) interventions.

Given our focus on cognitive risks in surgical patients, we are undertaking several large RCTs exploring perioperative cognitive care. We are applying remotely-administered, computerized cognitive screening to assess the prevalence and risk factors of P-NCD in patients undergoing major surgical procedures (joint replacements and open-heart surgery). In parallel, we are investigating targeted interventions for P-NCD prevention in cardiac patients.

**Results:** The PBHC's development models the implementation of a large-scale perioperative cognition program to redesign the pathway to surgery. Partnering with the Seniors Friendly program, we have created a breadth of educational materials to inform and support patients and their families. Across several ongoing clinical projects, we have screened 4443 patients and randomized 1321 into intervention groups. Of these, 447 patients have completed long-term follow-up.

Our early observations include a striking incidence of preexisting cognitive impairment (Pre-CI), a seldom-recognized preoperative cognitive disorder (and an important predictor of P-NCD), among patients with cardiac disease. Our preliminary findings identified Pre-CI in approximately 31% of cardiac surgery patients, compared to approximately 1% of patients undergoing joint arthroplasty.

**Discussion:** The assessment of cognitive function is a critical priority in the perioperative setting, and emerging applications of remote cognitive assessment and P-NCD prediction will enable the implementation of focused pharmaceutical and psychosocial interventions. Our

experience designing the PBHC illustrates a robust and multifaceted approach to safeguarding cognitive health in the perioperative setting.

## REFERENCES:

1. Boone, M.D., Sites, B., von Recklinghausen, F.M., Mueller, A., Taenzer, A.H. and Shaefi, S., 2020. Economic burden of postoperative neurocognitive disorders among US medicare patients. *JAMA network open*, 3(7), pp.e208931-e208931.
2. Steinmetz, J., Christensen, K.B., Lund, T., Lohse, N., Rasmussen, L.S. and ISPOCD Group, 2009. Long-term consequences of postoperative cognitive dysfunction. *The Journal of the American Society of Anesthesiologists*, 110(3), pp.548-555.
3. Evered, L., Silbert, B., Knopman, D.S., Scott, D.A., DeKosky, S.T., Rasmussen, L.S., Oh, E.S., Crosby, G., Berger, M., Eckenhoff, R.G. and Nomenclature Consensus Working Group, 2018. Recommendations for the nomenclature of cognitive change associated with anaesthesia and surgery—2018. *Anesthesiology*, 129(5), pp.872-879.
4. Price, C.C., Garvan, C.W. and Monk, T.G., 2008. Type and severity of cognitive decline in older adults after noncardiac surgery. *The Journal of the American Society of Anesthesiologists*, 108(1), pp.8-17.
5. Deiner, S., Fleisher, L.A., Leung, J.M., Peden, C., Miller, T. and Neuman, M.D., 2020. Adherence to recommended practices for perioperative anesthesia care for older adults among US anesthesiologists: results from the ASA Committee on Geriatric Anesthesia-Perioperative Brain Health Initiative ASA member survey. *Perioperative Medicine*, 9(1), pp.1-8.

## GRANT ACKNOWLEDGEMENT:

The projects received funding from the Dana Foundation (17-13030) and the Sunnybrook AFP Association through the Innovation Fund of the Alternative Funding Plan from the Academic Health Sciences Centre of Ontario. BAO and SC receive funded academic time from the Sunnybrook Anesthesia Academic Partnership.

## Contributing Factors to Elevated Postoperative Troponin in High Cardiovascular Risk Patients Referred for Multimodal Prehabilitation: Preliminary Data

Stefan Saric[1,2], Amal Bessissow [2,3], Gabriele Baldini [2,4], Franco Carli[2,4]

1 Division of Experimental Medicine (MSc), McGill University, Montreal, Quebec, Canada.
2 Perioperative Program, Montreal General Hospital, Montreal, Quebec, Canada.
3 Department of Internal Medicine, McGill University Health Centre (MUHC), Montreal, Quebec, Canada.
4 Department of Anesthesia, McGill University Health Centre (MUHC), Montreal, Quebec, Canada.

**Introduction/Background:** Multimodal prehabilitation involves preoperative exercise, nutrition, and anxiety management interventions to improve postoperative patient recovery (1). Functional capacity and elevated serum brain natriuretic peptide (BNP) predict myocardial injury after non-cardiac surgery (2), but the role of prehabilitation in improving outcomes for high cardiovascular risk patients is unknown. Using preliminary data, we compared baseline BNP, baseline 6-minute walk test (6MWT), and adherence to prehabilitation between patients who experienced elevated postoperative serum troponin, and those who did not.

**Methods:** Ethics approval was obtained from the local REB. Data were audited from previous 4-6 week multimodal prehabilitation programs between 2018-21 at a single tertiary hospital. Using an elevated preoperative BNP (≥92pg/mL) (3), we identified 24 patients at high risk of adverse cardiovascular events perioperatively. Baseline BNP and 6MWT were examined. Postoperative myocardial infarction (MI), elevated serum troponin, stroke, death at 30 days, and hospital length of stay (LOS) were also recorded. Participants were deemed adherent to prehabilitation if they attended >75% of prescribed sessions.

**Results:** Data comprised 24 patients (67% male), aged 61-95 years (mean=76 years), ASA 3 (58%) with a revised cardiac risk index (RCRI) of 1 (54%), 2 (29%), or ≥3 (17%). Surgeries were predominantly for cancer (92%) and minimally-invasive (79%). Mean baseline BNP was 198pg/mL (*SD*=95) and mean baseline 6MWT was 389m (*SD*=113). Thirteen (54%) patients adhered (>75%) to the prehabilitation program.

Postoperative serum troponin was elevated in 6 patients (5 non-adherent to prehabilitation), and 1 patient had an MI postoperatively (also non-adherent). Baseline BNP in patients with elevated postoperative troponin (*mean* = 274pg/mL, *SD*=*97*) was significantly greater than in patients who did not have an elevated troponin (*mean* = 140pg/mL, *SD* =55; *p* = 0.022). Baseline 6MWT in patients with elevated postoperative troponin (*mean* = 294m, *SD*=71) was significantly lower than in patients who did not have an elevated troponin (*mean* = 422m, *SD*= 107m; *p*=0.005). Median (IQR) length of stay for patients with an elevated postoperative troponin was 8 (29) days, and 3 (3) days for patients who did not have an elevated troponin (*p*=0.116). No strokes or deaths were recorded.

**Discussion:** This exploration of preliminary data identified that high cardiovascular risk patients who went on to have an elevated troponin postoperatively had higher baseline BNP and lower baseline 6MWT. They were also less likely to be adherent to the prehabilitation program. All three of these factors may have contributed to increased incidence of elevated postoperative troponin. Future trials investigating the role of prehabilitation in high cardiovascular risk patients are required.

**REFERENCES:**

1. Minnella EM, Bousquet-Dion G, Awasthi R, Scheede-Bergdahl C, and Carli F. Multimodal prehabilitation improves functional capacity before and after colorectal surgery for cancer: a five-year research experience. *Acta Oncol.* 2017;56(2):295-300.
2. Rodseth RN, Biccard BM, Le Manach Y, Sessler DI, Lurati Buse GA, Thabane L, et al. The prognostic value of pre-operative and post-operative B-type natriuretic peptides in patients undergoing noncardiac surgery: B-type natriuretic peptide and N-terminal fragment of pro-B-type natriuretic peptide: a systematic review and individual patient data meta-analysis. *J Am Coll Cardiol.* 2014;63(2):170-80.
3. Duceppe E, Parlow J, MacDonald P, Lyons K, McMullen M, Srinathan S, et al. Canadian Cardiovascular Society Guidelines on Perioperative Cardiac Risk Assessment and Management for Patients Who Undergo Noncardiac Surgery. *Can J Cardiol.* 2017;33(1):17-32.

## Dexmedetomidine Is a Strong Predictor of Postoperative Hypotension in Hip and Knee Arthroplasties – Preliminary Results

Charles Gélinas[1], Edmund Yim[1], Mandy Li[2], Stephen Su Yang[1, 3]

1 Department of Anesthesia, McGill University, Montreal, Quebec, Canada.
2 Faculty of Medicine, McGill University, Montreal, Quebec, Canada.
3 Lady Davis Institute for Medical Research, Jewish General Hospital, Montreal, Quebec, Canada.

**Introduction/ Background:** The volume of total hip arthroplasties (THA) and total knee arthroplasties (TKA) is increasing in many developed countries, including Canada. Although there is no gold standard anesthetic technique for these procedures, observational data demonstrated better outcomes with neuraxial anesthesia(1). Based on evidence from randomized controlled trials, dexmedetomidine, a selective alpla-2 agonist often used as a sedative with neuraxial anesthesia, offers significant benefits in THAs and TKAs(2, 3). These include better pain control, reduced post-operative delirium and prolonged spinal analgesia. Despite its significant benefits, dexmedetomidine can have a potential risk, specifically hypotension. There is strong evidence showing that postoperative hypotension is linked to worse outcomes(4). With its elimination half-life of 2-3 hours, it is still unclear if dexmedetomidine is associated with postoperative hypotension. To our knowledge, no study has examined the incidence of postoperative hypotension with the use of dexmedetomidine in THAs and TKAs.

**Methods:** Ethics approval was obtained from the local REB. In this single-centre retrospective study, we will review 1600 patients who underwent an elective THA or TKA under neuraxial anesthesia between 2017 and 2019. Independent variables were selected based on biological plausibility and a literature review of known associated factors related to postoperative hypotension(5). The outcome of interest was the presence of postoperative hypotension in the post-anesthesia care unit (PACU), defined as a systolic BP <90 mm Hg. Secondary outcomes will include time spent in PACU and major adverse cardiovascular events (MACE) during admission.

**Results:** Preliminary data analyzed based on 400 patients. Median age was 71 (IQR 63-77) with 34.0% male patients. 22.9% of patients developed postoperative hypotension in the recovery room with a median systolic blood pressure of 83 mm Hg (IQR 76-87). 22.3% of patients received dexmedetomidine as an intraoperative intravenous sedation with an adjusted odds ratio for postoperative hypotension of 4.08 (95% confidence interval 2.17-7.67).

**Discussion:** Preliminary data demonstrate that dexmedetomidine is a significant predictor of postoperative hypotension in patients undergoing orthopaedic surgery. As we know, postoperative hypotension is associated with poor outcomes, especially in the elderly population requiring hip or knee arthroplasties. Our results indicate that despite its numerous advantages in this patient population, its hemodynamic effects should be seriously taken into consideration when choosing this agent. As more data will be collected and analyzed, we will be able to determine if these finding are associated with MACE during admission. Detailed analysis of other predictors and sedation agents will also be presented.

**REFERENCES:**

1. Memtsoudis SG, Sun X, Chiu YL, Stundner O, Liu SS, Banerjee S, et al. Perioperative comparative effectiveness of anesthetic technique in orthopedic patients. Anesthesiology. 2013;118(5):1046-58.
2. Chan IA, Maslany JG, Gorman KJ, O'Brien JM, McKay WP. Dexmedetomidine during total knee arthroplasty performed under spinal anesthesia decreases opioid use: a randomized-controlled trial. Can J Anaesth. 2016;63(5):569-76.
3. Mei B, Meng G, Xu G, Cheng X, Chen S, Zhang Y, et al. Intraoperative Sedation With Dexmedetomidine is Superior to Propofol for Elderly Patients Undergoing Hip Arthroplasty: A Prospective Randomized Controlled Study. Clin J Pain. 2018;34(9):811-7.
4. Group PS, Devereaux PJ, Yang H, Yusuf S, Guyatt G, Leslie K, et al. Effects of extended-release metoprolol succinate in patients undergoing non-cardiac surgery (POISE trial): a randomised controlled trial. Lancet. 2008;371(9627):1839-47.
5. Yang SS, Devereaux PJ. Predictors of postoperative hypotension. Perioperative Care Congress. Toronto, ON2019.

## Postoperative Vision Loss after Common Surgical Procedures: Effect of Longitudin115al Data on Incidence and Risk Factors in A Population Based, Administrative Database Cohort

Michael T Paille[1], Violet FY Luo[2], Cameron D Goldie[3], Frank Stockl[4], Dan Chateau[5,6], Thomas C Mutter[7]

1 Max Rady College of Medicine, University of Manitoba, Winnipeg, Manitoba, Canada.
2 Department of Anesthesiology, Perioperative and Pain Medicine, University of Calgary, Calgary, Alberta, Canada.
3 Department of Anesthesiology, Pharmacology, and Therapeutics, University of British Columbia, Vancouver, British Columbia, Canada.
4 Max Rady College of Medicine, Department of Ophthalmology, University of Manitoba, Winnipeg, Manitoba, Canada.
5 Rady Faculty of Health Sciences, Department of Community Health Sciences, Winnipeg, Manitoba, Canada.
6 Manitoba Centre for Health Policy, University of Manitoba, Winnipeg, Manitoba, Canada.
7 Max Rady College of Medicine, Department of Anesthesiology, Perioperative and Pain Medicine, University of Manitoba, Winnipeg, Manitoba, Canada.

**Background:** Postoperative vision loss (POVL) is most frequently described as immediate, irreversible and profound blindness due to retinal artery occlusion or ischemic optic neuropathy in one or both eyes after cardiac and major spine surgery. However, its epidemiology has been defined by clinical registries and *cross-sectional analyses* of hospital discharge abstracts restricted to these procedures.[1–4] We used *longitudinal data* to more reliably exclude patients with pre-existing vision loss, to explore the potential for late presentations of POVL after hospital discharge, and to compare the risk of POVL between a variety of higher and lower risk surgical procedures.

**Methods:** With local ethics approval, we performed a retrospective, unblinded analysis of administrative health data from a single Canadian province, spanning April 1, 1982 to March 31, 2019. Records of major spine procedures, cardiac surgery and other common major and minor procedures were included from patients who had at least five years of data before surgery. Records from patients with pre-existing ocular disease were excluded, as were those from patients who developed multiple sclerosis, intracranial or pituitary tumour anytime before or within 90 days after surgery.

We identified cases of POVL using the International Classification of Diseases-Clinical Modification 9$^{th}$ edition diagnosis codes for retinal arterial and venous occlusions, ischemic optic neuropathy and cortical blindness, visual disturbances, and blindness and low vision. Incident diagnoses recorded in hospital discharge abstracts and in physician visits during hospital admission and up to 14 days after hospital discharge were considered POVL.

**Results:** We identified 651,367 surgeries of interest between April 1,1987 and December 31, 2018. We excluded 409 diagnoses of POVL due to pre-existing ocular disease, leaving 599 incident POVL cases for analysis. 237 (39.6%) diagnoses were made after discharge including 147 (62.0%) made by ophthalmologists, neurologists or radiologists. In univariate regression analyses, patients with POVL were older, more likely to be male and have higher Charlson comorbidity index scores than patients without POVL (all $p < 0.01$). Incidence varied by type of surgery (Figure 1). In multivariable logistic regression analyses, with minor surgery as a reference, cardiac, major spine, colorectal, vascular and femoral fracture surgery were associated with increased risk of POVL (all $p \leq 0.003$).

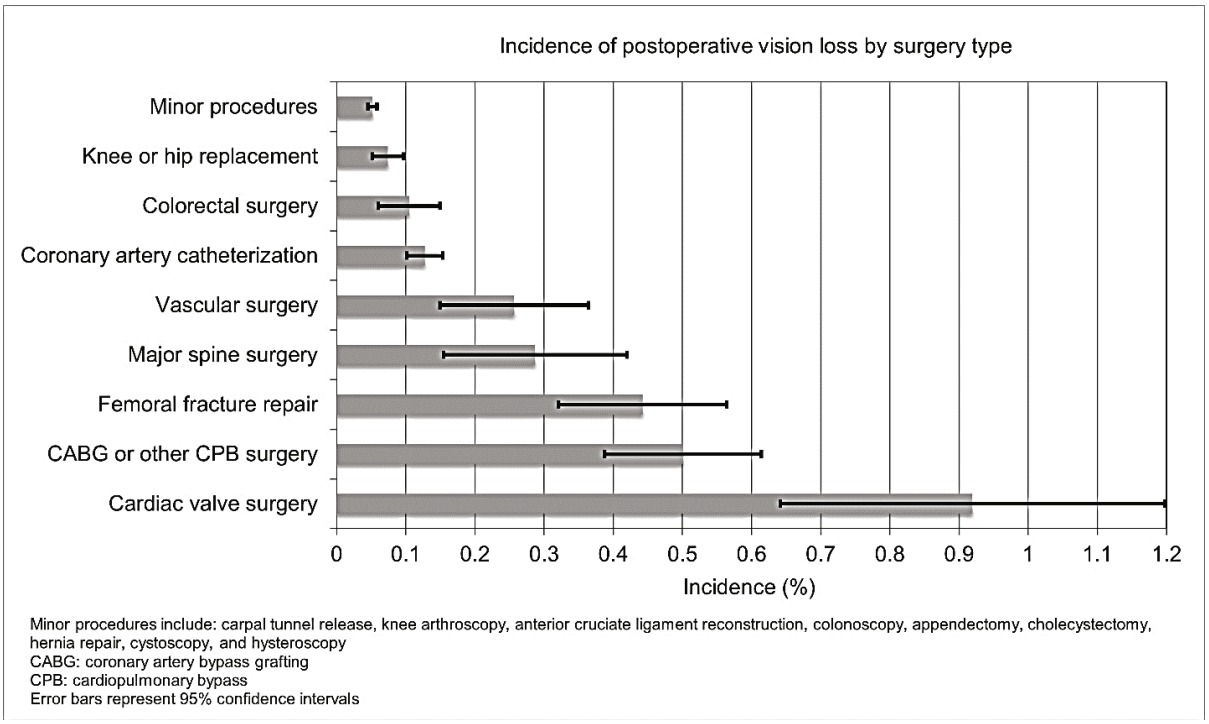
**Discussion:** Using longitudinal data including physician visit diagnoses, we found POVL may occur more frequently, across a wider variety of surgical procedures and with more varied timing of presentation than previously reported in cross sectional hospital discharge abstract analyses. Late presenting cases could represent anterior ischemic optic neuropathy and less severe vision loss. These findings mirror emerging evidence on perioperative stroke which may share a common pathophysiology with some POVL subtypes.[5] Clinical validation of this administrative health database work would expand our understanding of POVL epidemiology and better inform preventative strategies.

## REFERENCES:


1. Rubin DS, Matsumoto MM, Moss HE, Joslin CE, Tung A, Roth S. Ischemic optic neuropathy and cardiac surgery: incidence and risk factors in the United States from the National Inpatient Sample 1998 to 2013. *Anesthesiology*. 2017;126(5):810-821.
2. Rubin DS, Parakati I, Lee LA, Moss HE, Joslin CE, Roth S. Perioperative visual loss in spine fusion surgery: ischemic optic neuropathy in the United States from 1998 to 2012 in the Nationwide Inpatient Sample. *Anesthesiology*. 2016;125(3):457-464.
3. Nandyala S V., Marquez-Lara A, Fineberg SJ, Singh R, Singh K. Incidence and risk factors for perioperative visual loss after spinal fusion. *Spine J*. 2014;14(9):1866-1872. doi:10.1016/j.spinee.2013.10.026
4. Anesthesiologists Task Force on Perioperative Visual Loss. Practice advisory for perioperative visual loss associated with spine surgery. *Anesthesiology*. 2019;130(1):12-30. doi:10.1097/aln.0b013e31823c104d
5. Mrkobrada M, Chan MTV, Cowan D, et al. Perioperative covert stroke in patients undergoing non-cardiac surgery (NeuroVISION): a prospective cohort study. *Lancet*. 2019;394(10203):1022-1029. doi:10.1016/S0140-6736(19)31795-7


## GRANT ACKNOWLEDGEMENT:

This work was supported by the University of Manitoba Department of Anesthesiology, Perioperative and Pain Medicine Oversight and Advisory Committee, and the Office of the Dean, Max Rady College of Medicine.


Incidence of postoperative vision loss by surgery type
Minor procedures
Knee or hip replacement
Colorectal surgery
Coronary artery catheterization
Vascular surgery
Major spine surgery
Femoral fracture repair
CABG or other CPB surgery
Cardiac valve surgery
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
Incidence (%)
Minor procedures include: carpal tunnel release, knee arthroscopy, anterior cruciate ligament reconstruction, colonoscopy, appendectomy, cholecystectomy, hernia repair, cystoscopy, and hysteroscopy
CABG: coronary artery bypass grafting
CPB: cardiopulmonary bypass
Error bars represent 95% confidence intervals

## Preoperative Anxiety During the COVID 19 Pandemic

Claire Broe[1], Jaclyn Robinson[2], Anita Wadden[2], Claire Snyman[3], Kelly Mayson[4,5]

1 Dept. of Anesthesia & Perioperative Care, Vancouver General Hospital and UBC Hospital, Vancouver, British Columbia, Canada.
2 Dept. Nursing & Perioperative Care, Vancouver General Hospital and UBC Hospital, Vancouver, British Columbia, Canada.
3 Patient Voice Member, Canadian Medical Association, Ottawa, Ontario, Canada.
4 Clinical Professor, Dept. of Anesthesia & Perioperative Care, Vancouver General Hospital and UBC Hospital, Vancouver, British Columbia, Canada.
5 Chairperson, Vancouver Coastal Health Physician Led Quality Improvement Committee, Vancouver, British Columbia, Canada.

**Background:** The importance of patient psychology and experience during the perioperative period has been recognized since the early 1900s. (1) Every community now faces a period of great anxiety and fear caused by a global pandemic. Our goal was to gather information to identify anxiety triggers preoperatively, better inform our staff and aim to alleviate preventable stress factors caused by COVID-19.

**Methods:** Ethics approval was waived by the local research ethics board. Patients were presented with a questionnaire at the time of admission to the preoperative care unit. All patients were informed that the questionnaire was entirely voluntary and written consent was taken for a follow up phone call by nursing at or greater than14 days postoperatively. The questions were based on the Amsterdam Anxiety and Information Scale (APAIS) using a Likert scale and prior patient reported outcomes measures (PROMs) used at our institution. Additional questions and patient comments were reviewed with a multidisciplinary team, consisting of a patient representative, anesthesia, and Patient experience, Quality & Safety staff. Two tertiary care sites were sampled which varied in the time of sampling and the type of procedures and length of stay, and restrictions on visitors.

**Results:** 361 questionnaires were disseminated across two hospital sites from June to September 2020. One patient refused to take part, three patients passed away prior to the follow up telephone call and 30% of patients were not contactable for follow up. Almost two thirds of patients were female. 69% of cases had a length of stay of less than or equal to three days. The most prevalent concern expressed by patients related to receiving adequate information regarding their procedure and anesthesia (47% for surgery vs. 22% for anesthesia). Only a small percentage of patients expressed high levels of concern regarding COVID delays. Both our institutions scored highly for kindness and support from hospital staff.

**Discussion:** There was less anxiety in our patient population regarding COVID-19 in the preoperative period than anticipated. Our preadmission nurses screen patients for COVID symptoms 48-72 hours preoperatively and this may be of benefit for relieving some anxiety. Evaluation of comments by patients in the follow up interviews highlighted three main areas for quality improvement for patient management- 1) clarification of visiting guidelines and policies during COVID-19 for the post operative patient, 2) improving discharge and follow up instructions post operatively to avoid unnecessary stress regarding self management and 3) improved communication from surgical teams during their daily rounds.

**REFERENCES:**

1. Moerman. N, Frits S, Muller MJ, Oosting H " The Amsterdam preoperative anxiety and information scale (APAIS)" Anesthesia & Analgesia 82, vol.3 (1996):445-451

## The Outcome of a Pre-Operative Screening Process in Identifying and Triaging Patients Requiring Optimization: A Quality Improvement Study

Caroline Gardiner[1], Stella Harley[2], Geoff Schierbeck[3], Kelly Mayson[4]

1 University of British Columbia, Vancouver, British Columbia, Canada.
2 Quality and Patient Safety, Vancouver Coastal Health, Vancouver, British Columbia, Canada.
3 Specialist Services Committee, Doctors of B.C., Vancouver, British Columbia, Canada.
4 Department of Anesthesia and Perioperative Care, Vancouver General and UBC Hospitals, Vancouver, British Columbia, Canada.

**Introduction/Background:** It is well established that surgical prehabilitation improves patient outcomes and is economically efficacious for healthcare systems [1]. The surgical optimization program recently instituted at our tertiary care center provides educational materials and/or interventions to activate appropriate patients in modifiable health domains including anemia, smoking cessation, pre-existing pain, social supports, nutrition, physical activity, frailty, glycemic control, and sleep apnea. Patients should be screened a minimum of 21 days in advance for the feasibility of a referral/intervention, and 7 days in advance to receive educational material. Our study aims to assess the impact of a new screening process in identifying and triaging patients requiring optimization, as well as the subsequent effect of SARS-CoV-2 on its efficacy.

**Methods:** Ethics approval was waived by the local REB. A new patient questionnaire, pre-operative bloodwork guidelines, and standard operating procedures for triaging were instituted. A retrospective chart review was performed on all patients undergoing urology, gynecology and spine surgeries at our center from November 2019 to mid-March 2020 as cohort 1 (N=594), and following hospital-level changes in response to COIVD-19, from March 15 to June 2020 as cohort 2 (N=352). Analysis was completed using descriptive statistics.

**Results:** Only 27.1% of cohort 1 (161/594) and 25.9% of cohort 2 (91/352) were screened >21 days in advance of surgery with the proper paperwork to be triaged. Of these patients, 83.2% in cohort 1 (134/161) and 82.4% in cohort 2 (75/91) had indications for optimization on the basis of their questionnaire and/or bloodwork. Overall the most frequent referrals were made to the perioperative blood management program (71/252) and pain services (50/252), while the most frequently distributed educational materials were for pain management (104/252) and nutrition (72/252). Diabetic patients accounted for 11.1% of cases (28/252), and only 32.1% of these had optimal glycemic control with HgbA1c <7.1% (9/28). 5.2% of patients were smokers (13/252) and 4.4% of patients were identified as potentially frail (11/252). 41.2% of cohort 1 (245/594) were not triaged due to lack of new proper paperwork at the time of screening, versus 8.2% of cohort 2 (29/352). In cohort 2 triaging was hampered by insufficient screening time with only 28.4% of patients (100/352) screened >21 days in advance of surgery as compared to 48% of cohort 1 (285/594).

**Discussion:** The majority of patients undergoing surgery at our hospital had indications for optimization. Pre-operative pain and anemia represent pervasive issues amenable to prehabilitation. The main barrier to engaging eligible patients in optimization is screening far enough in advance for an intervention to be feasible. COVID-19 further impaired timely screening, likely as a result of slates being created on shorter notice and inadequate nursing resources to screen for both optimization and COVID-19.

**REFERENCES:**

1. Meka, Arjun P., Uchenna Okoro, et al. What Should Pre-operative Clinics Do to Optimize Patients for Major Surgery? *Michigan Journal of Medicine* 1.1 (2016): 78-87.

# PHARMACOLOGY

## Systematic Review of Neuropsychiatric Adverse Effects of Ketamine Compared to Other Anesthetic Regimens for Induction or Maintenance of General Anesthesia

Imayan Subramaniam,[1] Charlie Cochrane,[1] Peter T. Choi [2]

1 MD Undergraduate Program, The University of British Columbia, Vancouver, British Columbia, Canada.
2 Department of Anesthesiology, Pharmacology and Therapeutics, The University of British Columbia, Vancouver, British Columbia, Canada.

**Introduction:** Ketamine has been used since the 1960's and was initially developed to create a shorter-acting version of phencyclidine with reduced emergence delirium.[1] Despite favourable cardiorespiratory stability, alternative intravenous anesthetics are often preferred for general anesthesia given the notion that ketamine causes more neuropsychiatric adverse effects.[1] This review aimed to answer the question "What is the difference in incidence rates of neuropsychiatric adverse effects between ketamine and non-ketamine anesthetic regimens for patients undergoing general anesthesia?"

**Methods:** Ethics approval was not applicable because the study did not involve human or animal research. We independently searched MEDLINE® (1946 to April 2020), EMbase (1974 to April 2020), CINAHL® (1982 to April 2020), and PsycINFO (1597 to April 2020) databases. We included studies if they were clinical trials involving human participants of any ages, undergoing procedures requiring general anesthesia; contained a group receiving ketamine for induction or maintenance of general anesthesia and a group not receiving ketamine; and quantitatively documented neuropsychiatric effects. We excluded studies if ketamine was used: only as an analgesic; only postoperatively; for non-operative care or procedural sedation; or when English full text was unavailable. We assessed the validity of each study using the Centre for Evidence-Based Medicine critical appraisal worksheets for randomized controlled trials. We recorded neuropsychiatric adverse events of each study and calculated the risk differences where appropriate.

**Results**: From the 722 studies screened, we included 31 in the review. The study populations included pediatric and adult participants. Ketamine doses ranged from 0.3 to 3 $mg \cdot kg^{-1}$ intravenously for induction with some studies also using infusions and boluses as needed for maintenance. Premedication regimens used in the studies included benzodiazepines, anticholinergics, antipsychotics, opioids, and no premedication.

The primary outcomes were unpleasant dreams, agitation, hallucinations, and delirium. Fourteen studies reported unpleasant dreams with three reporting statistically significant risk differences (RD), suggesting ketamine groups had more unpleasant dreams: 6% (95% confidence interval [CI] 1-16%),[2] 23% (95% CI 3-38%),[3] and 36% (95% CI 22-50%).[4] All three studies involved adult women undergoing termination of pregnancy or cesarean section under general anesthetic with a variety of premedication and adjuvant anesthetics. Five studies reported agitation in children undergoing various procedures with one study reporting more agitation in the non-ketamine group (RD 26%; 95% CI 5 - 44%) than in the ketamine group.[5] Four studies reported delirium; none of these studies found statistically significant differences between groups. Six studies included hallucination as an outcome; none found any events in any study group.

**Discussion:** Overall, there is limited evidence in the published literature to suggest that ketamine has increased rates of neuropsychiatric adverse effects compared to non-ketamine general anesthetic regimens. Limitations of this review include the lack of patient level data and an inability pool incidence rates given significant heterogeneity between studies.

**REFERENCES:**

1. *Li L, Vlisides PE.* Ketamine: 50 years of modulating the mind. Front Hum Neurosci 2016; 10: 612.
2. *Jakobsson J, Oddby E, Rane K.* Patient evaluation of four different combinations of intravenous anaesthetics for short outpatient procedures. Anaesthesia 1993; 48: 1005-7.
3. *Krantz ML.* Ketamine in obstetrics: Comparison with methoxyflurane. Anesth Analg 1974; 53: 890-3.
4. *Krestow M.* The effect of post-anaesthetic dreaming on patient acceptance of ketamine anaesthesia: a comparison with thiopentone-nitrous oxide anaesthesia. Can Anaesth Soc J 1974; 21: 385-9.
5. *Jalili S, Esmaeeili A, Kamali K, Rashtchi V.* Comparison of effects of propofol and ketofol (Ketamine-Propofol mixture) on emergence agitation in children undergoing tonsillectomy. Afr Health Sci 2019; 19: 1736-44.

# REGIONAL AND ACUTE PAIN

## A Cohort Study on The Impact of the Covid-19 Pandemic on Surgical Practice for Breast Cancer Surgery: One More Step Towards Regional Anesthesia

Maxim Soucy-Proulx[1,2], Ariane Clairoux[1,2], Rami Issa[1,2], Annik Fortier[3], Philippe Richebé[1,2]

1 Department of Anesthesiology and Pain Medicine, University of Montreal, Maisonneuve-Rosemont Hospital, CEMTL, Montréal, Quebec, Canada.
2 Department of Anesthesiology and Pain Medicine, University of Montreal, Montreal, Quebec, Canada.
3 Montreal health Innovations Coordinating Center (MHICC), Department of Statistics, Montreal, Quebec, Canada.

**Background:** The Covid-19 pandemic has dramatically increased the oncologic surgery delays. It is now recommended to avoid general anesthesia and promote regional anesthesia whenever possible. This retrospective observational cohort study evaluates whether performing oncologic breast surgery under paravertebral blocks as sole anesthetic technique would improve the time to discharge from the Ambulatory Surgery Unit as well as reduce the incidence of postoperative nausea and vomiting (PONV) and the need for postoperative analgesia.

**Methods**: Institutional ethics review board approval was obtained to retrospectively review the files of 106 consecutive patients who underwent an oncologic breast surgery between March and June 2020 (intra-pandemic group) and of 104 consecutive patients moving backwards from February 2020 to December 2019 (pre-pandemic group). The primary outcome was the time from the end of surgery to discharge from hospital. The secondary outcomes included the incidence of PONV, the need for postoperative analgesia and the duration in post-anesthesia care unit (PACU).

**Results**: The time to discharge was significantly lower in the patients who had their surgery done under paravertebral blocks in the intra-pandemic group (139 (58) vs 202 (60) minutes; $p < 0.001$). The incidence of PONV was significantly lower in the intra-pandemic group (11% vs 3% $p=0.03$). The need for postoperative analgesia was similar in the 2 groups. The PACU durations were significantly lower in the intra-pandemic group (46 (37,63) vs 29 (21,39) minutes, $p < 0.001$).

**Conclusions**: Patients who had their breast oncologic surgery done under paravertebral blocks left the hospital 63 minutes earlier. They also spent less time in the PACU and has less PONV. With growing surgical waiting lists, concerns to reduce aerosol generating procedures and official recommendations to avoid GA when feasible, paravertebral blocks as sole anesthetic for oncologic breast surgery offer greater benefits for patients and medical teams.

**REFERENCES:**

1. Singleton MN, Soffin EM. Daring discourse: are we ready to recommend neuraxial anesthesia and peripheral nerve blocks during the COVID-19 pandemic? A pro-con. Reg Anesth Pain Med 2020.
2. FitzGerald S, Odor PM, Barron A, Pawa A. Breast surgery and regional anaesthesia. Best Pract Res Clin Anaesthesiol 2019;33:95–110.

3. Weltz CR, Greengrass RA, Lyerly HK. Ambulatory surgical management of breast carcinoma using paravertebral block. Ann Surg 1995;222:19–26.
4. Pusch F, Freitag H, Weinstabl C, Obwegeser R, Huber E, Wildling E. Single-injection paravertebral block compared to general anaesthesia in breast surgery. Acta Anaesthesiol Scand 1999;43:770–4.
5. Santonastaso DP, de Chiara A, Piccioni F, Tognù A, Agnoletti V. Awake mastectomy under ultrasound guided thoracic paravertebral block in elderly patients. J Clin Anesth 2018;47:50–1.

Table 1. Postoperative data

| | **Pre-pandemicGroup (n=106)** | **Intra-pandemicGroup (n=104)** | ***p* value** |
|---|---|---|---|
| **PACU stay (yes)** | 106 (100%) | 97 (93%) | **0.007** |
| **Time spent in PACU (min)** | 46 (37, 63) | 29 (21, 39) | **<0.001** |
| **Opioid dose in PACU (morphine equivalent PO mg)** | 2.0 (5.0) | 1.2 (2.9) | 0.14 |
| **PONV in PACU** | 6 (6%) | 2 (2%) | 0.188 |
| **Opioid Dose in Ambulatory Surgery (morphine equivalent PO mg)** | 0.5 (1.7) | 0.5 (2.0) | 0.14 |
| **PONV in Ambulatory Surgery** | **11 (11%)** | **3 (3%)** | **0.029** |
| **Total time spent in hospital (min) – between end of surgery and hospital discharge** (including ALL patients) | 202 (60) | 157 (73) | **<0.001** |
| **Total time spent in hospital (min) – between end of surgery and hospital discharge** (excluding patients under GA in intra-pandemic group) | 202 (60) | 139 (58) | **<0.001** |
| **Hospitalisation** | 4 (4%) | 4 (4%) | 0.967 |

PACU, postanesthesia care unit; PO, per os; PONV, postoperative nausea and vomiting; GA, general anesthesia

## A Survey Assessing the Need for Spinal Chloroprocaine to Provide Subarachnoid Neuraxial Anesthesia for Short Duration Surgeries in Canada

Jennifer Szerb[1], Syed Abbass[2], Jillian Banfield[1], Vishal Uppal[1]

1 Dept Department of Anesthesia, Perioperative Medicine and Pain Management, Dalhousie University and Nova Scotia Health Authority, Halifax, Nova Scotia, Canada.
2 Department of Anesthesiology and Pain Medicine, University of Toronto and St. Joseph's Health Centre, Toronto, Ontario, Canada.

**Introduction:** The ability to access chloroprocaine (CP) in Canada for subarachnoid blockade (SAB) and epidural use ceased in 2012.1 Its fast onset, intense nerve blockade, reliable anesthetic time, and quick offset make it ideal for short-duration surgery.2,3 Current recommendations during the COVID-19 pandemic favor regional anesthesia to avoid aerosol-generating medical procedures.4,5 This survey of Canadian anesthesiologists sought to assess the need for CP to provide spinal anesthesia for short duration surgeries.

**Methods:** Ethics approval was obtained from the local REB. An electronic survey link was sent to 2218 members of the Canadian Anesthesia Society (CAS), and 1720 members of the Ontario Anesthesia Section (OAS). The survey questions were developed using focused discussion (Appendix) and tested with-in the authorship team. The survey was conducted from December 1st, 2020 to January 4th, 2021 using the REDCap (Research Electronic Data Capture) platform. Descriptive statistics were performed on all the collected variables. Categorical variables were reported using counts and percentages.

**Results:** The CAS and OAS survey response rates were 379/2218 (17%) and 81/1720 (4.7%) respectively, giving a total of 460 who consented to be part of the survey.
Two hundred and twenty-seven participants had experience using CP. The participants worked in a variety of work settings. Prior to the COVID-19 pandemic, 73% of respondents estimated the number of short surgical procedures amenable to SAB to be at least 3 or more per week. Fifty-seven percent provide SAB for short surgical procedures sometimes often or always. If CP was available, 92% would provide SAB sometimes, often or always. The choice of local anesthetic for SAB for short surgical procedures was bupivacaine 64.5%, lidocaine 18%, mepivacaine 15.5% and other 2%. The main barriers to SAB provision were prolonged time for spinal anesthesia regression, 86%, and lack of reliable short-acting local anesthetic without risk of transient neurological symptoms, 72%. Sixty-nine percent of Canadian anesthesiologists responded that access to spinal CP for SAB in short duration surgeries would be of 'considerable help' or 'extremely helpful'. Eighty-eight percent were more likely to provide SAB for short surgical procedures during the COVID-19 pandemic compared to their pre-pandemic practice.

**Discussion:** The responders of the survey of two major Canadian anesthesiologists' societies have identified the lack of a reliable short-acting local anesthetic without risk of transient neurological symptoms as a main barrier to use of spinal anesthetic for short procedures. The Canadian health organization should work collaboratively to ensure the availability of CP in Canada not only to provide requisite patient care options, patient satisfaction and safety, but also to mitigate risk and protect peri-operative staff from aerosolized particles during a general anesthetic.

**REFERENCES:**

1. Szerb JJ. Reviving older drugs to deal with anesthesia drug shortages. Can J Anaesth. 2015; 62: 1042-4.
2. Teunkens A, Vermeulen K, Van Gerven et al. Comparison of 2-Chloroprocaine, Bupivacaine, and Lidocaine for Spinal Anesthesia in Patients Undergoing Knee Arthroscopy in an Outpatient Setting: A Double-Blind Randomized Controlled Trial. Reg Anesth Pain Med. 2016; 41: 576-83.
3. Saporito A, Ceppi M, Perren A, et al. Does spinal chloroprocaine pharmacokinetic profile actually translate into a clinical advantage in terms of clinical outcomes when compared to low-dose spinal bupivacaine? A systematic review and meta-analysis. J Clin Anesth 2019; 52: 99-104.
4. Uppal V, Sondekoppam RV, Landau R, et al. Neuraxial anaesthesia and peripheral nerve blocks during the COVID-19 pandemic: a literature review and practice recommendations. Anaesthesia 2020; 75: 1350-1363.
5. Uppal V, Sondekoppam RV, Lobo CA, et al. Practice Recommendations on Neuraxial Anesthesia and Peripheral Blocks during the COVID-19 Pandemic. www.asra.com/covid-19/raguidance.

**GRANT ACKNOWLEDGEMENT:**

Department of Anesthesia, Pain Management and Peri-operative Medicine, Dalhousie University Internal Grant.

Table 1. Barriers to Performance of SAB in Order of Frequency

| | Freq | % |
|---|---|---|
| Prolonged time for spinal anesthesia regression causing delayed discharge readiness | 372 | 86 |
| Lack of reliable short-acting local anesthetic without risk of TNS. | 311 | 72 |
| Patients' fears of spinal anesthesia and being "awake" | 140 | 32 |
| Surgeons' or post-anesthesia nurses' preference for general anesthesia | 105 | 24 |
| Lack of space such as block room to provide parallel processing | 68 | 16 |
| Insufficient time to provide SAB due to rapid operating room turn-over | 62 | 14 |
| Lack of personnel to assist in the performance of SAB | 19 | 4 |

## Assessing the Effectiveness of Thoracic Epidurals for Post-Operative Pain Control. A Quality Improvement Project

Yuan Yi (Ryan) Dong[1], Ekta Khemani[1], Tasnim Zaman[2], John Shin[3], Mohamed Nassef[1]

1 Department of Anesthesiology, McMaster University, Hamilton, Ontario, Canada.
2 McMaster Medical School, McMaster University, Hamilton, Ontario, Canada.
3 Department of Family Medicine, McMaster University, Hamilton, Ontario, Canada.

**Introduction:** Thoracic epidural analgesia (TEA) is routinely used for post-operative pain control in patients undergoing various surgical procedures and has been shown to improve patient outcomes (1). Their failure can lead to patient dissatisfaction, clinician frustration, increased resource usage, and loss of operating room time used for performing the procedure. At our institution, improving the success rate of TEA has been identified as a key target for quality improvement (QI). The goal of our project is to establish the baseline failure rate of TEA at our institution and elucidate the causes of failed thoracic epidurals.

**Methods:** Ethics approval was obtained from the local REB. We performed a retrospective chart review for all patients over 18 years old who received TEA as a part of their post-operative analgesia regimen between January and February 2019. A “successful TEA” is defined as an epidural continued in the post-operative period until no further need. We further stratified “failed TEA” into primary failure (ineffective epidural removed in PACU), and secondary failure (effective epidural that is subsequently and prematurely discontinued). We also collected information on the reasons for failed epidurals, epidural technical information, epidural safety information, patient demographics, surgical information, and PACU quality indicators.

**Results:** Data was collected from 41 patients who met our inclusion criteria and received a thoracic epidural. There were 12 mid-thoracic (T5-T9) epidurals and 29 lower thoracic (T9-T12) epidurals. 24.4% (10/41) of patients had a failed thoracic epidural. Out of these, 20% (2/10) were primary failures and 80% (8/10) were secondary failures. Reasons for failure include hypotension (4), ineffective analgesia (4), neurological deficit (1), and unknown/not documented (1). The average PACU admission pain score for these patients was 2.4 ± 3.4 out of 10. On average, it took 44.3 ± 15.7 minutes for induction of anesthesia which includes time needed to insert the epidural. Patients stayed in the PACU for 146.2 ± 65.4 minutes and they stayed in the hospital for a median of 6 days.

**Discussion:** Thoracic epidurals are crucial in improving patient outcomes postoperatively. However, multidisciplinary support is required to maximize their effectiveness. Our data shows there is an opportunity to improve the success rates of thoracic epidurals performed at our institution. A vast majority of our TEA failures were secondary failures where an epidural was deemed effective in the PACU then subsequently removed on the ward. This suggests improvements can be made in the management of TEA after a patient leaves the PACU. Possible QI interventions include multidisciplinary education, auditing and enlisting the help of a dedicated pain service nurse. Our findings establish the baseline failure rates of TEA at our institution and provide specific targets for future QI in TEA to improve patient outcomes.

**REFERENCES:**

1. Freise H, Van Aken HK. Risks and benefits of thoracic epidural anaesthesia. British journal of anaesthesia. 2011 Dec 1;107(6):859-68.

## Assessment of Hemi-diaphragm Dysfunction after Upper Extremity Nerve Blocks Using an Oscillometry Device to Measure Lung Mechanics

Janine Van Veghel[1], Sean Donald[2], Jon Bailey[2], Kwesie Kwofie[2], Vishal Uppal[2], Geoffrey Maksym[3], Andrew Milne[2,3]

1 Dalhousie Medical School, Halifax, Nova Scotia, Canada.
2 Department of Anesthesia, Pain Management and Perioperative Medicine, Dalhousie University, Halifax, Nova Scotia, Canada.
3 School of Biomedical Engineering, Dalhousie University, Halifax, Nova Scotia, Canada.

**Background:** Respiratory mechanics can be measured using an effort independent technique known as oscillometry (Osc). An Osc device is held in the patient's mouth and small pressure waveforms are superimposed on normal tidal volume breaths to measure respiratory system resistance (R) and reactance (X, a measure of compliance and inertia properties) over a frequency range of 5-37 Hz. Osc has been useful for assessing changes in lung mechanics in many conditions including asthma (1,2), COPD (1) and after mechanical ventilation (3,4). The objective of this prospective observational study was to determine if Osc was sensitive to lung function changes secondary to phrenic nerve and hemi-diaphragm dysfunction (HDD) caused by an Interscalene (ISB) or Supraclavicular brachial plexus nerve block (SCB).

**Methods:** Ethics approval was obtained from the local REB. Consenting patients undergoing routine ISB or SCB were recruited. Patient age, sex, smoking history, bronchodilator use and BMI were recorded. Osc was performed using a handheld oscillometry device (Tremoflo, Thorasys, Montreal) before the nerve block and after the block, once HDD was confirmed by chest ultrasonography (< 20% inspiratory diaphragm thickening). Three serial 30 second tests of Osc measurements were recorded at both time points for each patient. Osc testing was done in a standardized head-up bed position used for nerve blocks. Self-reported dyspnea was recorded every 5 minutes after ISB/SCB nerve block. R at 5 Hz (R5) quantified total respiratory system resistance, and the difference from R at 19 Hz, (R5-19) assessed any heterogeneity from narrowing in the small airways. X values at 5 Hz (X5) and area under the reactance curve AX indicated respiratory system stiffness. R and X values (cmH2O.s/L) were statistically compared using paired t-tests or Wilcoxon signed rank tests.

**Results:** A total of 16 patients with ultrasound confirmed HDD were included in the study (5 ISB/11 SCB, 9 male/7 female, mean age 58 years, mean BMI 28 kg/m^2, 10/16 lifetime non-smokers). After HDD, significant changes were seen in the resistance, R5 (mean increase 12.7%, p=0.0057) and reactance, X5 (median decrease 79.5%, p=0.039). There also was a significant increase in the R5-19 parameter (median increase 45.7%, p<0.001) and AX (median increase 69.16%, p=0.016).

**Discussion:** The overall pattern of changes in mechanics measured after HDD were indicative of increased heterogeneity in the small airways, causing impaired flow to the periphery of the lung. The change in X indicated increased stiffness likely due to small airway obstruction, and potentially from altered thoracic volume and shape changes with hemidiaphragm elevation. Previous Osc studies have reported similar patterns of post-operative changes after mechanical ventilation (3,4). Based on our data, Oscillomety can detect changes in lung mechanics after HDD and has potential for clinical use in future studies of HDD.

**REFERENCES:**

1. Kanda S, Fujimoto K, Komatsu Y, et al (2010) Evaluation of respiratory impedance in asthma and COPD by an impulse oscillation system. Intern Med 49:23–30.
2. Cavalcanti J V., Lopes AJ, Jansen JM, Melo PL (2006) Detection of changes in respiratory mechanics due to increasing degrees of airway obstruction in asthma by the forced oscillation technique. Respir Med 100:2207–2219.
3. Kuzukawa Y, Nakahira J, Sawai T, Minami T (2015) A Perioperative Evaluation of Respiratory Mechanics Using the Forced Oscillation Technique. Anesth Analg 121:1202–1206
4. Nakano S, Nakahira J, Sawai T, et al (2016) Perioperative evaluation of respiratory impedance using the forced oscillation technique: A prospective observational study. BMC Anesthesiol 16:2–7.

## Association of Anesthesia Technique with Graft Patency Rates After Open Lower Limb Revascularization: A Retrospective Population Cohort Study

Xue Chen (Janny) Ke[1,2], Alana Flexman[1,3], Stephen Schwarz[1,3], Shaun MacDonald[1,4], Christopher Prabhakar[1,3]

1 Department of Anesthesia, St. Paul's Hospital, Vancouver, British Columbia, Canada.
2 Department of Anesthesia, Pain Management & Perioperative Medicine, Dalhousie University, Halifax, Nova Scotia, Canada.
3 Department of Anesthesiology, Pharmacology & Therapeutics, University of British Columbia, Vancouver, British Columbia, Canada.
4 Department of Surgery, St. Paul's Hospital and Vancouver General Hospital, University of British Columbia, Vancouver, British Columbia, Canada.

**Background:** Lower limb revascularization is performed for patients with blood flow occlusion, with the goals of improving pain and function (1). Graft patency is associated with higher quality of life scores (2). Our primary objective was to determine, for patients undergoing elective open lower limb revascularization, whether the use of regional anesthesia (RA) only (spinal, epidural, and peripheral nerve block), compared to general anesthesia (GA) only, is associated with higher rates of patent graft within 30 days postoperatively.

**Methods:** After REB approval, we analyzed the multicenter National Surgical Quality Improvement Program (ACS NSQIP®) dataset from 2014-2019. All elective cases within the NSQIP Lower Extremity Open procedure-targeted dataset (LEO) were included and linked with the main NSQIP dataset. Patients with age<18, urgent and emergent surgery, local anesthesia only or unknown anesthesia type, and international normalized ratio (INR)>=1.5 on day of surgery were excluded. Patients who had both GA and RA were excluded from primary analysis.

The primary outcome was graft patency, derived from the LEO variable "Most Severe Procedural Outcome" and "Untreated Loss of Patency". The group of patients with non-patent grafts included patients who died. Secondary outcomes included major reintervention, amputation, venous thromboembolism (VTE), myocardial infarction (MI) or stroke, pneumonia, discharge to new facility, postoperative length of stay, readmission rate, and death, all within 30 days postoperatively. Complete case analysis was performed with no imputation. Multivariate logistic regression was performed adjusting for potential confounders: age, bleeding diathesis (including medication causes), severe chronic obstructive pulmonary disease, total operating time, renal failure, functional status, diabetes, and year of surgery.

**Results:** The cohort included 8893 patients, with 7.7% (688) patients receiving RA only, 90.4% (8039) GA only, and 1.9% (166) both GA and RA. The mean age in the RA only group was 71(10) years, compared to 67(11) years in the GA only group. Compared to patients in the GA only group, patients in the RA only group had higher frequencies of bleeding diathesis, high risk physiologic factors as defined by NSQIP, and severe COPD. The RA group also had lower frequencies of high-risk anatomic features and current smoking status, and shorter surgery time. The frequency of missing data for patency was 13.0% (1155/8893). The patency rate was 93.2% (573/615) for RA only, and 91.5% (6390/6983) for GA only (P = 0.15). Multivariate logistic regression showed that the use of RA only, compared to GA only, was not associated with a higher rate of patency (adjusted odds ratio 1.16, 95% confidence interval 0.83 to 1.63, P = 0.378).

**Interpretation:** The rate of patency 30 days after elective lower limb revascularization is high; compared to GA only, the use of RA only was not associated with a significant increase in patency rate. Further studies could explore the impact of RA with a longer-term follow up.

**REFERENCES:**

1. Barbosa FT, Jucá MJ, Castro AA, Cavalcante JC. Neuraxial anaesthesia for lower-limb revascularization. Cochrane Database Syst Rev. 2013 Jul 29;(7):CD007083.
2. Nguyen LL, Moneta GL, Conte MS, Bandyk DF, Clowes AW, Seely BL. Prospective multicenter study of quality of life before and after lower extremity vein bypass in 1404 patients with critical limb ischemia. J Vasc Surg Off Publ Soc Vasc Surg Int Soc Cardiovasc Surg North Am Chapter. 2006 Nov;44(5):977–84.
3. Grip O, Wanhainen A, Michaëlsson K, Lindhagen L, Björck M. Open or endovascular revascularization in the treatment of acute lower limb ischaemia. Br J Surg. 2018;105(12):1598–606.

## Erector Spinae Plane Block When Neuraxial Analgesia is Contraindicated by Clotting Abnormalities in Trauma and Surgical Patients

Glenio B. Mizubuti[1], Daenis Camiré[1], Anthony M.-H. Ho[1], Sophie Bretton[1], Gregory Klar[1]

1 Department of Anesthesiology and Perioperative Medicine, Queen's University, Kingston, Ontario, Canada.

**Introduction/Background:** Erector spinae plane (ESP) block is technically simple, has a low risk profile, and provides an excellent analgesic alternative in the presence of coagulopathy – an absolute contraindication to epidural/paravertebral blocks. Four patients with ongoing coagulopathies received an ESP block to manage severe thoracic pain with respiratory impairment. Tracheal intubation was avoided in two cases, and extubation facilitated in the other two.

**Case Presentation:** Case 1: 54-year-old morbidly obese man with recurrent lung abscesses/empyema had a right thoracotomy for middle lobe wedge resection, decortication, and pleurectomy. Suspected sepsis precluded preoperative epidural insertion. Two chest drains were placed and he was sent to intensive care where severe pain hindered weaning from the ventilator. Because INR was 1.6 (secondary to massive intraoperative blood loss and underlying liver cirrhosis), a single-shot ESP block was performed allowing subsequent tracheal extubation.

Case 2: A 39-year-old male post motorcycle accident sustained polytraumatic injuries. Thoracic pathology included left-sided rib fractures 6-12 with flail chest, hemo/pneumothorax and suspected esophageal tear precluding oral co-analgesics. Severe pain, ongoing oxycodone/marijuana abuse and behavioural challenges impeded weaning from mechanical ventilation. Due to rapid downtrending consumptive thrombocytopenia, a single-shot ESP was performed allowing tracheal extubation.

Case 3: A 93-yr-old man was admitted with 5 right-sided rib fractures and bilateral lower lobe atelectasis/consolidation after a fall 10 hours prior. He had significant cardiorespiratory comorbidities (on therapeutic doses of apixaban for atrial fibrillation) presenting in acute respiratory distress requiring high flow oxygen. Upon institution of thoracic ESP infusion of local anesthetic, he was weaned from supplementary oxygen and discharged home 2 days later.

Case 4: 69-year-old moderately obese man post motorcycle accident with 1-7 right-sided rib fractures, small hemothorax, pulmonary contusion and suspected sleep apnea. He was on ticagrelor for coronary stents and prophylactic dalteparin. Despite conventional multimodal analgesia, he was unable to cough or breathe deeply. Following a single-shot ESP block, he was weaned from oxygen and discharged home 2 days later.

Ethics approval and written consent were obtained.

**Conclusion:** Satisfactory analgesia without central nervous depression can positively affect trauma and perioperative outcomes. In the elderly, mortality is ~5% for every rib fractured and in the young approximately ~2.5%.[1] Coagulopathies often preclude neuraxial/paravertebral analgesia. The risk of spinal hematoma after ESP block is considered low.[2] To date, it has been used in the setting of von Willebrand features,[3] thrombocytopenia,[4] and coagulopathy,[5] and no clinically significant spinal hematoma has been reported. This safety profile is attributed to the absence of major blood vessels in the ESP, the greater distance between the ESP and the spine, the superficial nature of the block (allowing for external pressure to control bleeding

should it occur), and the larger spaces where blood can be accommodated without compressing vital structures.

**REFERENCES:**

1. Ho AMH, Ho AK, Mizubuti GB, et al. Regional analgesia for patients with multiple rib fractures – A narrative review. J Trauma Acute Care Surg 2020;88:e22-e30.
2. Tsui BCH, Kirkham K, Kwofie MK, et al. Practice advisory on the bleeding risks for peripheral nerve and interfascial plane blockade: evidence review and expert consensus. Can J Anesth 2019; 66:1356-1384.
3. Wyatt K, Elattary T. The erector spinae plane block in a high-risk Ehlers-Danlos syndrome pediatric patient for vascular ring repair. J Clin Anesth 2019; 54:39-40.
4. De Cassai A, Iepparielllo G, Ori C. Erector spinae plane block and dual antiplatelet therapy. Minerva Anestesiol 2018; 84:1230-1.
5. Adhikary SD, Prasad A, Soleimani B, Chin KJ. Continuous erector spinae plane block as an effective analgesic option in anticoagulated patients after left ventricular assist device implantation: a case series. J Cardiothorac Vasc Anesth 2019; 33:1063-7.

## Postoperative Neurologic Symptoms in the Operative Arm After Shoulder Surgery with Interscalene Block: A Systematic Review

Gabrielle S Logan[1], Sam Neily[1], Scott Richardson[1], Nicole Askin[2], Ahmed Abou-Setta[3], Thomas Mutter[1]

1 Department of Anesthesiology, Perioperative and Pain Medicine, Rady Faculty of Health Sciences, University of Manitoba, Winnipeg, Manitoba, Canada.
2 Neil John Maclean Health Sciences Library, Rady Faculty of Health Sciences, University of Manitoba, Winnipeg, Manitoba, Canada.
3 George and Faye Yee Centre for Healthcare Innovation, Rady Faculty of Health Sciences, University of Manitoba, Winnipeg, Manitoba, Canada.

**Background:** Nerve injury, anesthesia (1,2). Interscalene block (ISB) provides reliable anesthesia and analgesia for shoulder surgery (3) but has been associated with PONS in observational case series (1,4). However, unmeasured confounders may have biased these older, nonrandomized studies that also predated the development of newer alternative regional techniques and the widespread use of adjuvant agents to extend block duration. This systematic review of randomized trials aimed to compare the risk of PONS between ISB and other techniques and the relative safety of different agents used in ISB.

**Methods:** The review followed the methods of Cochrane review, and institutional ethics approval was not required. A search strategy was developed with a methodological expert and applied to MEDLINE, EMBASE, and CENTRAL from database inception to June 2020. All screening and data extraction was done independently and in duplicate with disputes resolved by a third author. We included randomized, or quasi-randomized trials of patients (>5 years old) undergoing any shoulder surgery with any ISB technique as an intervention, and a comparison group that received any other non-regional or regional technique, or ISB of alternate composition or technique. PONS, however defined and measured a minimum of 1 week after surgery, was the outcome of interest.

**Results:** 568 full text articles were assessed from 1,611 records. 422 of 568 (74%) were excluded due to lack of PONS outcome and 91 (16%) for other reasons. The remaining 55 studies (10%), totaling 6236 participants (median sample size 69; range 30-910) were included for full text review. PONS was assessed by telephone report (n=26, 47%), physical exam (n=21, 38%) or unclear methods (n=8, 15%) and frequently assessed at more than one time point. 44 (80%), 7 (13%), 9 (16%) and 10 (18%) studies assessed PONS between 1 week and <1 month, 1 and <3 months, 3 months and <6 months, and at 6 months to 1 year, respectively. Meta-analysis was not attempted due to low PONS counts and heterogeneity in comparator groups, time period of PONS assessment and PONS diagnostic criteria (Table 1). The most commonly applied diagnostic criteria for PONS were the presence of one or more of paresthesia, sensory deficit or motor deficit, used in 16 studies (29%).

**Conclusion:** The relative risk of PONS between different ISB agents and compared to other regional anesthesia techniques could not be quantified from meta-analysis of relevant randomized trials. This was due to PONS being infrequently measured as an outcome and definitions varying markedly between studies. Standardization of a PONS outcome definition and regularly reporting its occurrence would improve patient safety by increasing our understanding of PONS epidemiology.

**REFERENCES:**


1. Sites BD, Taenzer AH, Herrick MD, et al (2012) Incidence of local anesthetic systemic toxicity and postoperative neurologic symptoms associated with 12,668 ultrasound-guided nerve blocks: an analysis from a prospective clinical registry. Reg Anesth Pain Med 37:478–482.
2. Dwyer T, Henry PD, Cholvisudhi P, et al (2015) Neurological Complications Related to Elective Orthopedic Surgery: Part 1: Common Shoulder and Elbow Procedures. Reg Anesth Pain Med 40:431–442.
3. Toma O, Persoons B, Pogatzki-Zahn E, et al (2019) PROSPECT guideline for rotator cuff repair surgery: systematic review and procedure-specific postoperative pain management recommendations. Anaesthesia 74:1320–1331.
4. Liu SS, Gordon MA, Shaw PM, et al (2010) A prospective clinical registry of ultrasound-guided regional anesthesia for ambulatory shoulder surgery. Anesth Analg 111:617–623.


Table 1. Frequency of specific diagnostic criteria used in the definition of postoperative neurologic symptoms among the 55 included studies.

| Diagnostic criteria | Frequency among included studies |
|---|---|
| Paresthesia/Tingling/Abnormal sensations | 30 (55%) |
| Numbness/sensory deficits | 22 (40%) |
| Dysesthesia | 4 (7%) |
| Motor deficit/motor dysfunction/weakness | 27 (49%) |
| Pain[1] | 10 (18%) |
| Non-specific definition[2] | 14 (25%) |
| Other | 5 (9%) |

1. Pain includes neuropathic pain, new onset pain, radiating pain in brachial plexus distribution, pain in forearm or hand.
2. Non-specific definitions include neurologic symptoms, dysfunction, deficits or complications, neuropathy, nerve injury or palsy; abnormal neurologic evaluation; or persistent motor or sensory dysfunction

## Video Conferencing as a Tool for Improving Access to Regional Anesthesia in a Remote Community Hospital

Justine Denomme[1], Kirk McCarroll[2], Chris Prabhakar[1], Steve Petrar[1]

1 Department of Anesthesia, St Paul's Hospital, Vancouver, British Columbia, Canada.
2 Department of Anesthesia, Queen Victoria Hospital, Revelsoke, British Columbia, Canada.

**Introduction:** The COVID-19 pandemic has led to an increase in the amount of video conferencing and telemedicine practiced worldwide. User-friendly applications for video conferencing have facilitated the implementation of telemedicine in anesthesia in areas such as remote obstetric anesthesia and trauma care at remote centres[1,2]. With this easily accessible technology, we present a novel strategy for providing real-time mentoring for the performance of regional anesthesia in a community hospital 569km away from the nearest centre with an advanced regional anesthesia program.

**Case Presentation:** Patient consent was obtained for publication of this case. As this case report is devoid of patient identifiable information, it is exempt from REB review requirements.

Family practice anesthetists (FPAs) approached our regional anesthesia group for support in performing adductor canal blocks for knee surgery. The FPA group already had some experience with the technique, but felt that real-time expert feedback would be helpful to refine their approach. A webinar was organized and given by the regional anesthesia fellow and a staff specialist in regional anesthesia prior to block performance. The session included a review of relevant anatomy and sonoanatomy, details regarding how to safely perform the block, videos demonstrating appropriate technique, and provided opportunity for questions and discussion.

Subsequently, a video conferencing session was arranged to provide guidance from the regional anesthesia specialists during performance of an adductor canal block. The remote site provided real-time audio and visual feed of the room where the nerve block was performed, and could share the ultrasound images through the video conferencing platform. The FPA performing the block had assisted in adductor canal blocks previously, but this was the first she performed independently. The patient and the FPA performing the block were easily visualized with simultaneous, live video feed from the ultrasound machine in two different windows. As a result, advice could be provided in real-time regarding probe placement, needling technique, and identification of appropriate local anesthetic spread in the adductor canal and subsequent identification of the saphenous nerve.

**Discussion:** Through video conferencing and the ability to view ultrasound images, real-time mentoring facilitated the use of regional anesthesia in a remote community. This strategy has not yet been reported in the literature, although video conferencing in the context of simulation in regional anesthesia has been documented[3]. In a recent survey of anesthesiologists working at academic and community sites in southwestern Ontario, 72% of anesthesiologists reported they would like to receive additional training in the use of ultrasound and all respondents felt they would benefit from E-learning modules[4]. The use of video conferencing provides the opportunity not only for E-learning but also for feedback, which improves skill acquisition[5]. Through this technology, knowledge-sharing and mentorship could potentially facilitate learning and maintenance of competency in regional anesthesia, and improve perioperative care for patients in rural and remote locations.

**REFERENCES:**

1. Iyengar K, Vaish A, Toh E, Vaishya R. COVID-19 and remote consulting strategies in managing trauma and orthopaedics. Postgrad Med J. 2020 Jul;96(1137):438-439.
2. Duarte SS, Nguyen TT, Koch C, Williams K, Murphy JD. Remote Obstetric Anesthesia: Leveraging Telemedicine to Improve Fetal and Maternal Outcomes. Telemed J E Health. 2020 Aug;26(8):967-972. doi: 10.1089/tmj.2019.0174. Epub 2019 Nov 11.
3. Burckett-St Laurent DA, Niazi AU, Cunningham MS, Jaeger M, Abbas S, McVicar J, Chan VW. A valid and reliable assessment tool for remote simulation-based ultrasound-guided regional anesthesia. Reg Anesth Pain Med. 2014 Nov-Dec;39(6):496-501.
4. Chui J, Lavi R, Hegazy AF, Jones PM, Arellano R, Yang H, Bainbridge D. Identifying barriers to the use of ultrasound in the perioperative period: a survey of southwestern Ontario anesthesiologists. BMC Health Serv Res. 2019 Apr 4;19(1):214.
5. Niazi AU, Peng PW, Ho M, Tiwari A, Chan VW. The future of regional anesthesia education: lessons learned from the surgical specialty. Can J Anaesth. 2016 Aug;63(8):966-72.

# RESIDENTS' ORAL COMPETITION

## Emergency Airway Management in a Tertiary Trauma Centre: A 1-Year Prospective Longitudinal Study

Thomas Hall[1], Murdoch Leeies[2,3], Carmen Hrymak[2,3], Duane Funk[1,3], Faisal Siddiqui[1,3], Brenden Dufault[1], Stephen Kowalski[1,3]

1 Department of Anesthesiology, Perioperative and Pain Medicine, University of Manitoba, Max Rady College of Medicine, Winnipeg, Manitoba, Canada.
2 Department of Emergency Medicine, University of Manitoba, Max Rady College of Medicine, Winnipeg, Manitoba, Canada.
3 Department of Internal Medicine, Section of Critical Care, University of Manitoba, Max Rady College of Medicine, Winnipeg, Manitoba, Canada.

**Introduction:** Emergency airway management can be associated with difficulties that can result in complications ranging from transient adverse events to long term neurological injury, need for surgical airway and death. (1) A series of Canadian multi-centre studies showed that adverse events are common in emergency airway management and that that they are associated with poor patient outcomes. (2,3) Multiple attempts at laryngoscopy are associated with increased complications. (1,2,3) At the study site, a tertiary care trauma centre, there is a paucity of data regarding emergency airway management. The objectives of this study are:

1. To enumerate the number of emergent intubations that occur annually
2. To quantify the incidence of first pass success
3. To quantify the incidence of adverse events associated with emergency airway management
4. To identify predictors of successful first pass intubation
5. To identify predictors of adverse events

**Methods:** Ethics approval was obtained from the local REB. We performed a single centre, prospective, observational study, including all adult patients (>17 years old) intubated in the Emergency Department, Intensive Care Units (ICU), in-patient wards or a diagnostic imaging suite. The Respiratory Therapy Department assists at all intubations, as such, the Respiratory Therapist (RT) liased with the physician responsible for the intubation to complete the data collection sheet. We collected additional data via chart review retrospectively. Data collection was shortened to 7-months due to the COVID-19 pandemic.

**Results:** In a 7-month period, there were 416 emergency intubations and a first pass success rate of 73.08%. First pass success rates varied widely between locations; ward intubations were the lowest with 57.5% completed successfully, followed by 66.1% in the ICU's and 84.3% in the Emergency Department. Hypotension and hypoxemia occurred in 57 (13.7%) and 48 (11.5%) patients, respectively. Direct laryngoscopy (DL) was used as the primary technique in 199 patients (47.8%) but varied significantly by location; Emergency Room (35.0%) compared to on the ward (89.4%). Failure of first pass intubation was associated with inexperienced operator (OR: 2.06, CI: 1.30 – 3.24), use of paralysis (OR: 0.36, CI: 0.23 – 0.56), direct laryngscopy (OR: 1.74, CI: 1.12 – 2.70), physiologic difficult airways (OR: 2.04, CI: 1.25 – 3.32) and location (any vs. ER). Paralysis was used in 260 (62.5%) of patients and was not associated with hypoxia (OR: 1.15, CI: 0.60 – 2.20) or hypotension (OR: 0.99, CI: 0.54 – 1.81).

**Discussion**: Emergency intubation is a frequently performed life-saving procedure. First pass

success is associated with a number of modifiable factors and the rate of success varies significantly between locations at the study hospital. Operator experience, choice of medications, and equipment used are associated with first pass success and are potential targets for efforts to improve rates of successful first pass emergency airway management.

**REFERENCES:**

1. Cook TM, Woodall N, Harper J, Benger J. Major complications of airway management in the UK: Results of the Fourth National Audit Project of the Royal College of Anaesthetists and the Difficult Airway Society. Part 2: Intensive care and emergency departments. *Br J Anaesth*. 2011;106(5):632-642. doi:10.1093/bja/aer059
2. Green RS, Turgeon AF, McIntyre LA, et al. Postintubation hypotension in intensive care unit patients: A multicenter cohort study. *J Crit Care*. 2015;30(5):1055-1060. doi:10.1016/j.jcrc.2015.06.007
3. Green R, Hutton B, Lorette J, Bleskie D, Mcintyre L, Fergusson D. Incidence of postintubation hemodynamic instability associated with emergent intubations performed outside the operating room: A systematic review. *Can J Emerg Med*. 2014;16(1):69-79. doi:10.2310/8000.2013.131004

## Front of Neck Access (FONA): A Survey of Teaching Curriculums Among Canadian Anesthesiology Residency Programs

Steven L. Long[1], Daniel Cordovani[1]

1 Department of Anesthesiology, McMaster University, Hamilton, Ontario, Canada.

**Introduction:** Front of Neck Access (FONA) is an emergency procedure that involves securing an airway through the anterior neck to facilitate alveolar oxygenation [1]. It is a last resort intervention in the cannot intubate, cannot oxygenate (CICO) scenario. The way FONA is taught during residency training is important, especially given that education and training have been implicated as significant causal factors in major airway complications [2].

Among various FONA techniques, scalpel-bougie-tube is the preferred method described in the most recent Difficult Airway Society guidelines. However, Canadian anesthesiologists have demonstrated a preference for needle techniques [3], despite its proven lower success rate [4, 5]. Given this discrepancy, we sought to determine if Canadian anesthesia residents are taught FONA techniques based on the most recent guidelines or anesthesiologist preference.

**Methods:** An 11-item questionnaire was developed to survey Canadian anesthesiology residency curriculums based on two domains: (1) preferred techniques of FONA taught to residents in adult and pediatric anesthesia, and (2) the duration, timing, and methods of teaching. Local ethics board approval was obtained.

Program directors of all 17 Canadian residency programs were contacted to inquire about survey completion. Surveys were distributed via email link and completed voluntarily by program director or residency curricular leads from January - June 2020. Three reminder emails were sent encouraging survey completion. Results were analyzed descriptively, using counts and percentages.

**Results:** Of 17 surveys distributed to Canadian anesthesia residency programs, 14 (82%) were returned.

In adult anesthesia, cricothyroidotomy by scalpel-bougie method was most commonly selected (n=10, 71%) as the preferred method of FONA taught to residents for the CICO scenario; cricorthyroidotomy by scalpel open-surgical methods (n=3, 21%) and wire-guided (seldinger) method (n=1, 7%) were also selected. In pediatric anesthesia, deferring to tracheostomy by surgeon was most commonly selected as the preferred method for FONA (n=6, 43%); cricothyroidotomy by a variety of other techniques were also selected.

**Discussion:** Based on a nationwide survey from 2014, Canadian anesthesiologists have previously demonstrated a preference for intravenous catheter and wire-guided techniques for FONA [3]. In contrast, the results of this survey demonstrate that most Canadian residency programs in anesthesiology (13/14, 93% of respondents) prefer to teach open surgical methods including scalpel-bougie technique for adult FONA.

It is notable and perhaps reassuring that the majority of residency programs are favouring scalpel techniques, given its superior speed and success rate in the emergency setting [1,4,5]. Nevertheless, this preference is not unanimous, with one program selecting a preference for wire-guided methods. This finding may speak to the known preference for non-surgical techniques among Canadian anesthesiologists that still permeates to teaching at the resident level. Alternatively, it may speak to the ongoing debate that still remains regarding optimal

FONA technique [1].

In pediatric FONA, the results of our survey were more varied, which may parallel the equivocal evidence in the literature.

**REFERENCES:**

[1] Price TM, et al. Emergency front of neck access in airway management. BJA Education. 2019 June;19(8):246-253
[2] Baker PA, et al. Education in airway management. Anaesthesia. 2011 Nov;66(s2):101-111
[3] Wong DT, et al. A survey of Canadian anesthesiologists' preferences in difficult intubation and "cannot intubate, cannot ventilate" situations. Can J Anaesth. 2014 Aug;61(8):717-26
[4] 4th National Audit Project of The Royal College of Anaesthetists and The Difficult Airway Society. Major complications of airway management in the United Kingdom. Mar 2011.
[5] Lockey D, et al. Observational study of the success rates of intubation and failed intubation airway rescue techniques in 7256 attempted intubations of trauma patients by pre-hospital physicians. Br J Anaesth. 2014 Aug;113(2):220-5

## Introduction of the Serratus Anterior Plane Catheter with Programmed Intermittent Bolus for Minimally Invasive Cardiac Surgery: A Retrospective Study

Russell Christie[1,2], Peter Rose[3,4], Daniel Law[2], Reva Ramlogan[1,2], Donna Nicholson[2,3], Diem Tran[2,3]

1 Department of Anesthesiology and Pain Medicine, The Ottawa Hospital, Ottawa, Canada
2 University of Ottawa Faculty of Medicine, Ottawa, Ontario, Canada.
3 Department of Anesthesiology and Perioperatve Care, Vancouver Acute (Vancouver General and UBC Hospitals), Vancouver, British Columbia, Canada.
4 University of British Columbia Faculty of Medicine, Vancouver, British Columbia, Canada.
5 University of Ottawa Heart Institute, Ottawa, Ontario, Canada.

**Introduction/Background:** Minimally invasive heart surgery (MIHS) is rapidly progressing with proposed benefits over sternotomy including reduced recovery time, inflammatory response and transfusion requirements[1-3]. In addition to the surgical ports, MIHS requires a mini-thoracotomy in the 4-5$^{th}$ intercostal space resulting in significant postoperative pain for which regional anesthetic techniques may be used. One such technique is the serratus anterior plane (SAP) block, which has been described previously for thoracic surgery and MIHS[4-9]. The objective of this study was to compare postoperative analgesia efficacy and opioid consumption, as well as clinical outcomes between patients that did and did not receive SAP catheters.

**Methods:** REB approval was obtained from the local REB for this retrospective cohort study comparing analgesic control and patient outcomes from May 2017 until May 2020 in patients undergoing MIHS at a single cardiac surgery center. Clinical use of the SAP block and catheters was started in November 2018. Patients were excluded if they were less than 18 years of age, had incomplete documentation of anesthetic technique, conversion from MIHS to open or a surgical procedure within 72 hrs of the index surgery. Continuous data are expressed as means and standard deviations for variables with normal distribution and as medians and interquartile ranges (IQR) otherwise. Groups were compared using unadjusted t-tests and logistic regression models (adjusted for age, sex and BMI) or fisher's exact tests as appropriate. A value $p \leq 0.05$ was considered significant for differences between the two groups.

**Results:** There were 115 patients that met inclusion during the study period (41 in the SAP catheter group and 74 in the control group). Demographic data were balanced between the two groups. After adjusting for age, sex and body mass index, there was no difference in opioid consumption (OR: 0.995, 95% CI: 0.990 - 1.000) , pain score at extubation (OR: 0.93, 95% CI: 0.789 – 1.098) average pain score in the first 24 hours after surgery (OR: 0.869, 95% CI: 0.702 – 1.077), Intensive Care Unit length of stay (OR: 0.990, 95% CI: 0.773 0 1.268) or hospital length of stay (OR: 0.998, 95% CI 0.904 – 1.101) between groups. There was a significant decrease in opioid related side effects in the SAP group (OR: 2.702, 95% CI: 0.773- 1.268). As well, the duration of post-operative intubation was 218 minutes shorter in the SAP group compared to the usual care group (OR: 0.998, 95% CI: 0.904 – 0.999).

**Discussion:** We have shown that patients undergoing MIHS who have a SAP catheter placed for post-operative analgesia do not have a decrease in opioid consumption, pain at extubation or pain scores. They do experience less time intubated and have less opioid related adverse effects.

**REFERENCES:**


1. Whellan DJ, McCarey MM, Taylor BS, et al. Trends in robotic-assisted coronary artery bypass grafts: A study of The Society of Thoracic Surgeons Adult Cardiac Surgery Database, 2006 to 2012. Ann Thorac Surg 2016;102:140–6.
2. Bonaros N, Schachner T, Wiedemann D, et al. Quality of life improvement after robotically assisted coronary artery bypass grafting. Cardiology 2009;114:59–66.
3. Bonatti J, Ramahi J, Hasan F,et al. Long-term results after robotically assisted coronary bypass surgery. Ann Cardiothorac Surg 2016;5:556–62.
4. Berthoud V, Ellouze O, Nguyen M, Konstantinou M, Aho S, Malapert G, Girard C, Guinot P, Bouchot O and Bouhemad B. Serratus anterior plane block for minimally invasive heart surgery. BMC Anesthesiology. 2018; 18: 144-150.
5. Ökmen K, Metin Ökmen B. Evaluation of the effect of serratus anterior plane block for pain treatment after video-assisted thoracoscopic surgery. Anaesth Crit Care Pain Med 2017; https://doi.org/10.1016/j.accpm.2017.09.005.

## PreWarming to Prevent Perioperative Hypothermia in Short Duration Outpatient Surgery Under General Anesthesia: a Randomized Comparison Study

Marie-Eve Belanger[1,2], Amelie Sergent[1], Philippe Richebé[1,2], Julie Blain[3], Issam Tanoubia[1,2]

1 Department of Anesthesiology and Pain Medicine, University of Montreal, Montreal, Quebec, Canada.
2 Department of Anesthesiology and Pain Medicine, Maisonneuve-Rosemont Hospital CEMTL, Montreal, Quebec, Canada.
3 Department of Respiratory Therapy and Anesthesia Division, Maisonneuve-Rosemont Hospital CEMTL, Montreal, Quebec, Canada.

**Introduction:** Prevention of perioperative hypothermia is a major challenge as hypothermia leads to adverse outcomes such as wound infections, coagulopathy, delayed recovery and cardiac events (1,2). The heat redistribution from central to peripheral compartment is the main mechanism of early heat loss under general anesthesia (GA), and a 30-minutes forced-air prewarming (PW) minimizes this phenomenon (3,4). The actual trend for fast-tracking surgery demands an aggressive perioperative temperature control. Therefore, as intraoperative active warming is limited during short duration outpatient surgeries, it seems pertinent to evaluate the impact of PW. The goal of this study was to evaluate, in short duration outpatient surgeries and compared to standard care, if the use of PW will impact patients' core temperature at the end of surgery.

**Methods:** After ethic approval, 60 adult patients scheduled for outpatient, short surgery (30-120min) under GA were randomized to PW Group (PWG) using a forced-air warming system (Flex gown, BairPaw system, 3M$^{TM}$) for at least 30 minutes preoperatively, or to control group (CG, standard care). CG received passive isolation with warm blankets. Intraoperative forced-air warming blankets (BairHugger, 3M$^{TM}$) were used for both groups. Perioperative temperatures were measured using the SpotOn 3M$^{TM}$ system. The primary outcome was the patients' temperature at the end of the surgery ($T_{end}$). Secondary outcomes included: intraoperative temperature drop from OR entry ($T_0$) to the lowest intraoperative temperature ($T_{nadir}$), incidence of hypothermia (< 36°C), patient comfort level, length of stay (LOS) in PACU, and incidence of postoperative shivering.

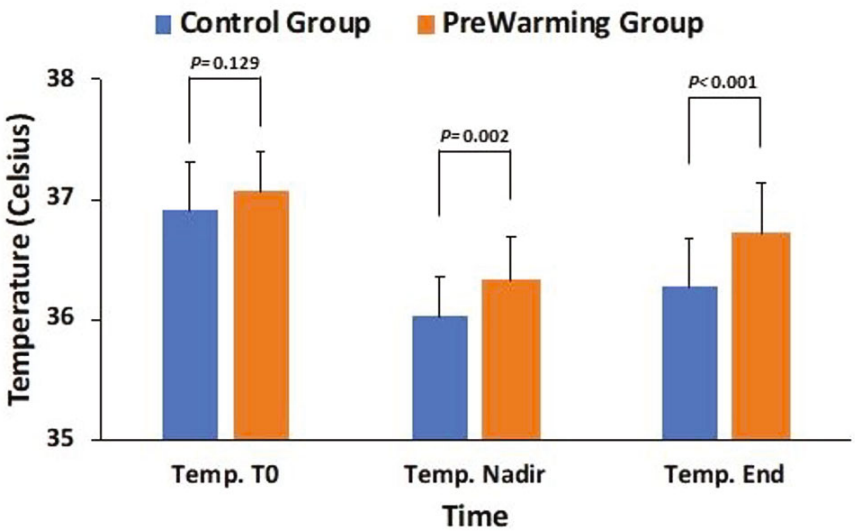
**Results:** 57 patients were analyzed (29 PWG; 28 CG). Demographic data and patients' basal temperature ($T_{basal}$) were similar. The $T_0$ were comparable between PWG and CG (*37.1°(0.3) vs 36.9°(0.4) respectively; p=0.129*). PWG showed a higher $T_{end}$ compared to CG patients *(36.7°(0.4) vs 36.3°(0.4); p<0.001)*. The temperature drop was less in PWG compared to CG *(-0.7°(0.3) vs -0.9°(0.3); p=0.044)*. The incidence of intraoperative hypothermia was not different *(PWG: 21% vs CG: 43%; p=0.072)*. The patients' comfort level on a 0-10 Likert scale was higher in PWG compared to CG (*10 [8-10] vs 7.5 [6.25-9] respectively; p=0.0005*). There was no difference in LOS nor in the incidence of shivering in PACU.

**Discussion:** Compared to standard care, a minimum of 30-minutes continuous forced-air PW was effective in maintaining higher core temperature by the end of a short duration outpatient surgery. National Institute for Care and Health Excellence defined as clinically relevant a perioperative difference of 0.5°C in core temperature over 36°C (5). Thus, the present 0.4°C gain, when using PW, is relevant in short surgery, as intraoperative warming is limited. Moreover, PW increases patients' comfort and slightly reduces the incidence of hypothermia. Not surprisingly, the incidence of shivering and the length of stay in PACU were unchanged for

this type of short surgery.

**REFERENCES:**


1. Madrid E, Urrútia G, Roqué i Figuls M, Pardo-Hernandez H, Campos JM, Paniagua P, et al. Active body surface warming systems for preventing complications caused by inadvertent perioperative hypothermia in adults. Cochrane Database of Syst Rev. 2016 Apr, Issue 4. DOI: 10.1002/14651858.CD009016.pub2.
2. Boet S., Patey A, Braon J, Mohamed K, Pigford AA, Bryson GL, et al. Factors that influence effective perioperative temperature management by anesthesiologists : A qualitative study using the Theoretical Domains Framework. Can J Anesth. 2017 June; 64(6) :581-596
3. Sessler DI. Perioperative thermoregulation and heat balance. Lancet. 2016 Jun 25;387(10038):2655-2664. doi: 10.1016/S0140-6736(15)00981-2. Epub 2016 Jan 8. PMID: 26775126.
4. Lau A, Lowlaavar N, Cooke EM, West N., German A., Morse DJ., et al. Effect of preoperative warming on intraoperative hypothermia : a randomized-controlled trial. Can J Anesth. 2018 Sep, 65(9); 1029-1040
5. National Institute for Health and Care Excellence (NICE). Hypothermia : prevention and management in adults having surgery. Guidelines 2008, updated 14 dec 2016

## The Impact of Shared Familial Chronic Pain Experiences on Healthcare Utilization

Alicia Ling[1], Jordana L. Sommer[1,2] , Dr. Renée El-Gabalawy[1,2,3,4]

1 Department of Anesthesiology, Perioperative and Pain Medicine, Max Rady College of Medicine, University of Manitoba, Winnipeg, Manitoba, Canada.
2 Department of Psychology, Faculty of Arts, University of Manitoba, Winnipeg, Manitoba, Canada.
3 Department of Psychiatry, Max Rady College of Medicine, University of Manitoba, Winnipeg, Manitoba, Canada.
4 Department of Clinical Health Psychology, Max Rady College of Medicine, University of Manitoba, Winnipeg, Manitoba, Canada.

**Introduction:** Chronic pain is highly prevalent across Canada and a large proportion of chronic pain patients do not suffer in isolation. There is a significant amount of research examining the impact of chronic pain on family members, when a sole member has a chronic pain condition. However, little research has examined the impacts of having multiple family members with a chronic pain condition. We first aimed to examine pain-related and mental health characteristics among chronic pain patients with a family member with chronic pain (spouse, child, sibling, or other relative) compared to those without. We further aimed to examine associations between having a family member with chronic pain on pain-related healthcare utilization.

**Methods:** Ethics approval was obtained from the local REB to gain access to self-reported data from a comprehensive Patient Intake Questionnaire (PIQ) completed by outpatients entering the Chronic Pain Clinic at a tertiary hospital between January 20, 2015 and February 12, 2018. Patients self-reported whether they had a family member with a chronic pain condition and completed validated self-report measures on indicators of chronic pain status (pain severity, pain interference), mental health (depressive features, pain catastrophizing), and healthcare utilization (medication use, healthcare encounters, specialists, imaging and tests). The primary analysis included multivariable logistic and linear regression models controlling for sociodemographic characteristics (age, sex, highest level of education completed) and duration of the chronic pain condition.

**Results:** 367 chronic pain patients were retrospectively identified and 339 were included in analyses, with 44% having a family member with chronic pain. Pain severity, pain interference, pain catastrophizing, and depression scores did not significantly differ between those with and without a family member with chronic pain, and there were no significant differences according to type of family member. There were differences amongst the subgroups in the type of specialists seen (Chi-square value = 9.51, $p < 0.05$) with the highest proportion of those seeking alternative therapies among those who have a child or other family with chronic pain. Having a family member with chronic pain, particularly close members (e.g. child or spouse), was also associated with increased hospital admissions for that individual ($H(4) = 11.184$, $p < 0.05$).

**Discussion:** Having shared chronic pain experiences with a family member may influence pain-related healthcare utilization (e.g. medication use, seeking alternative specialists and therapies, hospital admissions). Based on the trends observed, the type of familial relationship may play a key role. Determining the impact that various familial relationships have on healthcare utilization will allow for the development of targeted interventions catered towards families and will ascertain whether differences in use translate to differences in healthcare services satisfaction and/or treatment outcomes.

## REFERENCES:


1. Cardol M, van den Bosch WJHM, Spreeuwenberg P, Groenewegen PP, van Dijk L, de Bakker DH: All in the Family: Headaches and Abdominal Pain as Indicators for Consultation Patterns in Families. Annals of Family Medicine 4(6):506-511, 2006
2. Che X, Cash R, Ng SK, Fitzgerald P, Fitzgibbon BM: A Systematic Review of the Processes Underlying the Main and the Buffering Effect of Social Support on the Experience of Pain. Clinical Journal of Pain 34(11):1061-1076, 2018
3. Kraljevic S, Banozic A, Maric A, Cosic A, Sapunar D, Puljak L: Parents' pain catastrophizing is related to pain catastrophizing of their adult children. International Journal of Behavioural Medicine 19(1):115-119, 2012
4. Mann EG, Johnson A, VanDenKerkhof EG: Frequency and characteristics of healthcare visits associated with chronic pain: results from a population-based Canadian study. Can J Anaesth 63(4):411-41, 2016
5. Meyler D, Stimpson JP, Peek MK: Health concordance within couples: A systematic review. Social Science & Medicine 64(11):2297-2310, 2007


Table 1. Sample characteristics

| | Family member with CP | No family member with CP | Spouse with CP | Child with CP | Sibling with CP | Other family member |
|---|---|---|---|---|---|---|
| *n* (%) of total sample | 149 (44.0%) | 190 (56.0%) | 17 (5.1%) | 17 (5.1%) | 36 (10.7%) | 75 (22.4%) |
| Age (*M, SD*) | 52.97 (14.61) | 55.41 (14.48) | 62.29 (8.84) | 67.4 (10.40) | 59.03 (11.66) | 44.34 (12.31) |
| Sex | | | | | | |
| Male | 54 (36.2%) | 82 (43.2%) | 9 (52.9%) | 5 (29.4%) | 9 (25.0%) | 31 (41.3%) |
| Female | 95 (63.8%) | 108 (56.8%) | 8 (47.1%) | 12 (70.6%) | 27 (75.0%) | 44 (58.7%) |
| Education | | | | | | |
| High school or less | 82 (55.8%) | 99 (53.2%) | 12 (70.6%) | 11 (64.7%) | 20 (55.6%) | 38 (52.1%) |
| Some college or higher | 65 (44.2%) | 87 (46.8%) | 5 (29.4%) | 6 (35.3%) | 16 (44.4%) | 35 (47.9%) |
| Employment status | | | | | | |
| Employed | 68 (45.6%) | 54 (28.6%) | 10 (58.8%) | 15 (88.2%) | 22 (61.1%) | 32 (42.7%) |
| Unemployed | 81 (54.4%) | 135 (71.4%) | 7 (41.2%) | 2 (11.8%) | 14 (38.9%) | 43 (57.3%) |
| Marital status | | | | | | |
| Single | 26 (17.8%) | 32 (17.4%) | 0 (0%) | 1 (5.9%) | 3 (8.3%) | 22 (30.1%) |
| Married/common-law | 93 (63.7%) | 117 (63.6%) | 15 (93.8%) | 12 (70.6%) | 18 (50.0%) | 45 (61.6%) |
| Widowed/separated/ divorced | 27 (18.5%) | 35 (19.0%) | 1 (6.3%) | 4 (23.5%) | 15 (41.7%) | 6 (8.2%) |

Note. Values represent *n* (%); *M* = mean, *SD* = standard deviation; CP = chronic pain.
Continuous variables are represented as means and standard deviations and categorical groups as percentages.

# RICHARD KNILL RESEARCH ORAL COMPETITION

## "The Airwayve Podcast": A Novel Anesthesia Educational Tool for Medical Students

Puru Panchal[1], Alexa Caldwell[1], Grace Martin[1], Sean Xia[1,2], Nicholas Timmerman[1,2], Jordan Albaum[1,2], Gwen Lovsted[1], Anushka Nair[1], Amy Ajay[1], Daniel Cordovani[2]

1 Michael G. DeGroote School of Medicine, McMaster University, Hamilton, Ontario, Canada. 2 Department of Anesthesia, McMaster University, Hamilton, Ontario, Canada.

**Introduction/Background:** Medical students remain underexposed to anesthesiology before clerkship.(1) Few accessible introductory-level materials in anesthesia exist, and the COVID-19 pandemic has compounded this issue by restricting clinical access to the specialty.(2) We developed "The Airwayve Podcast" to provide fundamental teaching in anesthesia using succinct, student-generated episodes reviewed by senior students, residents and faculty. Episodes explore core topics in anesthesia, tips for learners and feature guest speakers to facilitate career exploration. For episodes and summaries, visit www.airwayvepodcast.com.

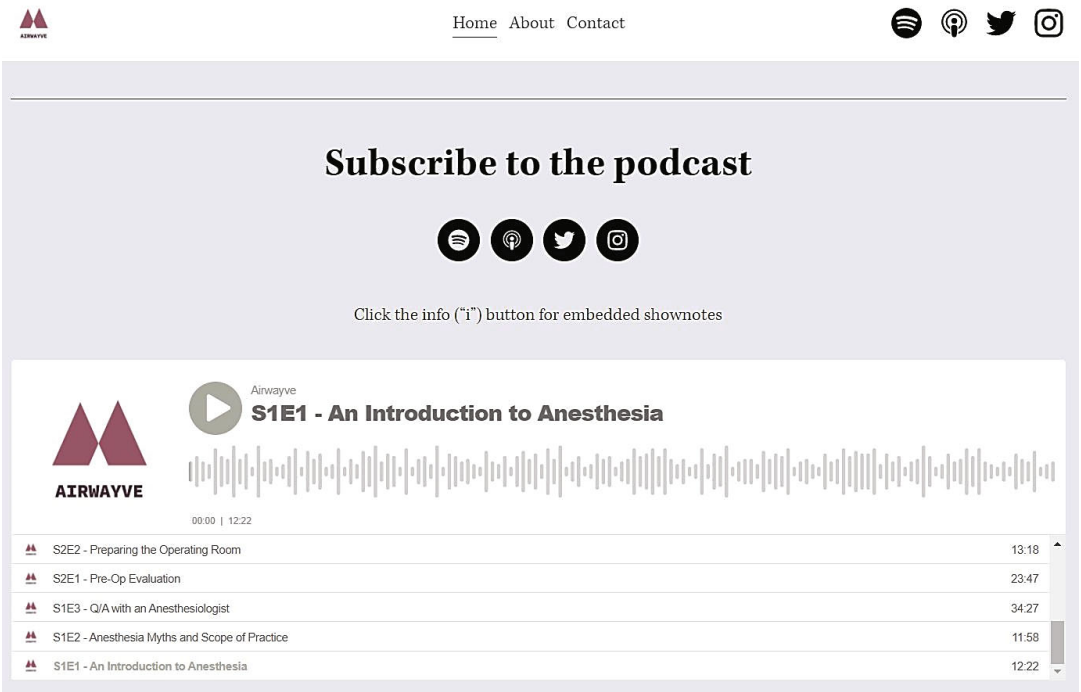
**Methods:** Ethics approval was not applicable because the study did not involve human or animal research. Six medical students, three residents and one faculty anesthesiologist have collaborated on the podcast. Each episode undergoes a three-step editorial process prior to recording and distribution via podcast apps. We administered a survey to capture students' perspectives regarding: preferences for the podcast as a learning and career exploration tool, podcast content, barriers to listening and preferences for future directions. Data were gathered via Likert-based assessments and multiple-choice options, which were represented as means and percentages.

**Results:** Thirteen episodes published across two series ("Introduction to Anesthesia" and "General Anesthesia") have received over 1100 downloads worldwide since September 2020. Data from the podcast hosting software indicates that 73% of listeners access episodes from mobile devices and listeners most commonly access episodes via the free online player on the podcast website (20%) and Spotify (19%). The Airwayve Podcast has been faculty-endorsed and shared nationally across medical schools. Survey data from 21 participants indicate that the podcast has helped students explore anesthesiology as a career path (mean 4.5/5), exposed students to anesthesia for the first time (mean 4.1/5), was perceived as effective in teaching fundamental anesthesia concepts (mean 4.4/5), was perceived as an accessible learning tool (mean 4.7/5), and helped students understand the skills and content to be successful in anesthesia (mean 4.2/5). Clerks (self-identified; n=11) indicated that the podcast was useful for clinical anesthesia rotations (mean 4.2/5). The top three requested topics for future episodes were: episodes about general anesthesia (76.2%), episodes about career advice (71.4%), and episodes featuring guest speakers (66.7%). Nine participants (42.9%) indicated that a lack of time to listen to episodes was a barrier to using the podcast as a learning tool; however, the majority of respondents (n=11; 52.4%) did not identify any barriers to listening to the podcast.

**Discussion:** The Airwayve Podcast is the first faculty-endorsed anesthesia podcast geared towards medical students. Preliminary results suggest strong approval of the podcast as a learning and career exploration tool. Listeners' feedback may be leveraged to optimize the content of this educational tool to ultimately support medical students' learning in the current distance-learning environment posed by the COVID-19 pandemic.

**REFERENCES:**

1. Adudu OP, Le NH, Devito I, Campbell FA, Levine MF. Medical student impressions of anesthesiology and anesthesiologists. Can J Anaesth. 2010 Aug;57(8):792-3. doi: 10.1007/s12630-010-9334-0. Epub 2010 Jun 4. PMID: 20524102.
2. Niburski, K., Nguyen, DD., Ingelmo, P. et al. Impact of COVID-19 on Canadian anesthesia resident matching: challenges and opportunities for applicants. Can J Anesth/J Can Anesth (2020). https://doi.org/10.1007/s12630-020-01878-z



## Development and Implementation of a Resident Assessment Dashboard for Competency-Based Medical Education in Anesthesiology: A Mixed Methods Study

Rebecca Dubé[1], Alayne Kealey[2,3], Celia Cassiani[4], Lisa Bahrey[2,5], Clyde Matava[2,6]

1 Département d'anesthésie, Centre hospitalier universitaire Sainte Justine, Montréal, Quebec, Canada; Département d'anesthésiologie et de médecine de la douleur, Université de Montréal, Montréal, Quebec, Canada.
2 Department of Anesthesiology and Pain Medicine, Temerty Faculty of Medicine, University of Toronto, Toronto, Ontario, Canada.
3 Department of Anesthesiology and Pain Medicine, Sunnybrook Health Sciences Centre, Toronto, Ontario, Canada.
4 Child Health Evaluative Sciences, Hospital for Sick Children, Toronto, Ontario, Canada.
5 Department of Anesthesia and Pain Medicine, University Hospital Network, Toronto General Hospital, Toronto, Ontario, Canada.
6 Department of Anesthesia and Pain Medicine, SickKids Hospital, Toronto, Ontario, Canada.

**Introduction**: Competency-based medical education (CBME) demands frequent assessment of resident performance.[1,2] Challenges in accessing the high volume of assessments in CBME may impede resident use of self-regulated learning (SRL) skills,[3,4] including self-assessment and goal setting. We describe the use of an iterative design-based framework to create a resident assessment dashboard (RAD) whereby residents access results of multiple assessments on a consolidated platform. We incorporated faculty and resident stakeholder perspectives into the development of the RAD. Our aims were to enhance resident access to assessment data, and understand the potential utility of a RAD in the context of SRL theory.

**Methods**: Ethics approval was obtained from the local REB. We employed a mixed-methods approach to gain an in-depth understanding of resident and educator perspectives on the elements of the dashboard that facilitate the use of assessment information for performance improvement, and the anticipated uses of the RAD in the context of SRL theory. We first used an anonymous survey to investigate elements faculty and residents felt were important for a RAD. We then performed resident and faculty focus groups to deepen survey findings, and probe stakeholder perspectives on the utility of an RAD in SRL. Thematic analysis using a grounded theory approach was used to analyse focus group transcripts.

**Results**: The RAD design proceeded iteratively, incorporating the results of each analysis into subsequent versions. Quantitative survey analysis revealed that 92% (24/26) of residents and 92% (17/19) of faculty felt that timely access to assessment results was important, and 77% (20/26) of residents felt that comparing their performance to anonymized peer assessment data was an important RAD feature. Thematic analysis of focus groups revealed that residents and faculty viewed the RAD as a tool to help residents accurately assess their performance, target their learning efforts, plan their learning strategy, and monitor for progress. Faculty and resident perspectives diverged on issues relating to confidentiality. Where residents were concerned that use of the RAD could threaten assessor anonymity resulting in reduced faculty engagement with assessment, faculty expressed concern that it could compromise peer assessment information privacy for trainees. Access to anonymized peer assessment data for comparison was viewed as important by a subset of residents to help them accurately self-assess. Although the RAD displayed a mix of summative and formative assessment data, in line with SRL theory, residents viewed the RAD primarily as a formative assessment tool.

**Discussion**: In our study, resident and faculty stakeholder co-development of a RAD permitted the inclusion of varied viewpoints in the iterative design and development of a tool to improve

resident engagement with assessment. The anticipated uses of the RAD overlapped with processes inherent to SRL. Use of a RAD may enhance resident engagement with learning and assessment.

## REFERENCES:

1. Iobst WF, Sherbino J, Cate OT, et al. Competency-based medical education in postgraduate medical education. Med Teach 2010; 32: 651-6.
2. Lockyer J, Carraccio C, Chan MK, et al. Core principles of assessment in competency-based medical education. Med Teach 2017; 39: 609-16.
3. van Houten-Schat MA, Berkhout JJ, van Dijk N, et al. Self-regulated learning in the clinical context: a systematic review. Med Educ 2018; 52: 1008-15.
4. Zimmerman BJ. Self-efficacy: an essential motive to learn. Contemp Educ Psychol 2000; 25: 82-91.

## GRANT ACKNOWLEDGEMENT:

This work was supported by an Education Research Scholarship Grant from Sunnybrook Health Sciences Centre.

## Does Leniency Bias Persist in Workplace-Based Assessments that Use Entrustment-Supervision Scales?

Alayne Kealey[1,2], Fahad Alam[1,2,8], Graham McCreath[3], Clyde T. Matava[2,3,4], Lisa A. Bahrey[2,5], Catharine M. Walsh[3,6,7,8]

1 Department of Anesthesia, Sunnybrook Health Sciences Centre, Toronto, Ontario, Canada.
2 Department of Anesthesiology and Pain Medicine, Temerty Faculty of Medicine, University of Toronto, Toronto, Ontario, Canada.
3 SickKids Research Institute, Hospital for Sick Children, Toronto, Ontario, Canada.
4 Department of Anesthesia and Pain Medicine, Hospital for Sick Children, Toronto, Ontario, Canada.
5 Department of Anesthesia and Pain Management, University Health Network-Toronto General Hospital, Toronto, Ontario, Canada.
6 Division of Gastroenterology, Hepatology and Nutrition, Hospital for Sick Children, University of Toronto; Department of Paediatrics, Toronto, Ontario, Canada.
7 SickKids Learning Institute, Hospital for Sick Children, Toronto, Ontario, Canada.
8 The Wilson Centre, Faculty of Medicine, University of Toronto, Toronto, Ontario, Canada.

**Introduction/Background:** Workplace-based assessments (WBA) play a crucial role in the assessment system of competency-based medical education programs. Entrustment-supervision scales frame assessors' decisions around the degree of supervision a trainee requires for safe patient care, reflecting the trainee's progression toward independent practice.[1] Basing WBAs on entrustment-supervision scales may encourage assessors to use the entire scale and to overcome the central tendency and leniency biases associated with proficiency scales.[2] We aimed to examine whether entrustment-supervision scales resolved leniency bias in a WBA used for postgraduate anesthesiology training.

**Methods:** Ethics approval was obtained from our local REB.
One of our program's WBAs for perioperative care, the Anesthesia Clinical Encounter Assessment (ACEA), includes a global rating scale (GRS) assessing 8 clinical competencies and overall independence. Supervisors rate residents on a 5-point entrustment-supervision scale, with descriptive anchors for each point (i.e., from '*Intervention*': required frequent direction or significant involvement from staff for this case; to '*Consultancy level*': could teach or supervise others for this case). We extracted ACEA data for anesthesia residents from July 2017 to January 2020. We analyzed data from assessors who completed at least ten assessments, for the frequency of low scores (i.e., '*Intervention*' or '*Direction*') and high scores (i.e., '*Autonomous*' or '*Consultancy level*') on the GRS items and the overall independence rating.

**Results:** We analyzed 7871 assessments for 137 residents, completed by 214 assessors. Across all residents, 10.75% (23/214) of assessors never assigned low scores for any GRS items and 27.10% (58/214) for the overall independence rating. In their first year of training, residents received a mean of 38.86 (±13.85) assessments. On at least one ACEA, 94.64% (53/57) of first year residents were rated as '*Autonomous*' or '*Consultancy level*' for overall independence, and 24.79% (±15.35) of overall independence ratings for PGY1s were assigned as '*Autonomous*' or '*Consultancy level*.' Additionally, 2.63% (2/76) assessors never assigned low scores to PGY1s for any GRS items and 11.84% (9/76) for the overall independence rating.

**Discussion:** As entrustment-supervision scales reference the level of supervision required for safe and high-quality care, it would be expected that a first-year resident's readiness to be trusted with clinical responsibility would start off requiring '*Intervention*' (i.e., frequent direction

and/or staff involvement). Nevertheless, assessors rated junior residents in our anesthesiology program as ready for independent practice nearly 25% of the time, which suggests that leniency bias in resident assessment persists even with entrustment-supervision scales. Leniency bias can impede tracking of a resident's progress, preclude identification of learners in difficulty, and restrict the coaching and corrective feedback that trainees receive.[3] These findings highlight the need for further research to determine the promoters of leniency bias with entrustment-supervision scales and approaches to mitigate its consequences in a competency-based assessment system.

## REFERENCES:

1. ten Cate O, Schwartz A, Chen HC. Assessing Trainees and Making Entrustment Decisions: On the Nature and Use of Entrustment-Supervision Scales. *Acad Med*. 2020;95(11):1662-1669.
2. Rekman J, Gofton W, Dudek N, Gofton T, Hamstra SJ. Entrustability Scales: Outlining Their Usefulness for Competency-Based Clinical Assessment. *Acad Med*. 2016;91(2):186-190.
3. Weller JM, Jones A, Merry AF, Jolly B, Saunders D. Investigation of trainee and specialist reactions to the mini-Clinical Evaluation Exercise in anaesthesia: implications for implementation. *Br J Anaesth*. 2009;103(4):524-530. doi:10.1093/bja/aep211

## GRANT ACKNOWLEDGEMENTS:

1. This project was supported by an Education and Research Scholarship Grant from the Sunnybrook Education advisory Council (SEAC) and Education Research Unit (ERU).
2. CMW holds an Early Researcher Award from the Ontario Ministry of Research and Innovation.

## First-Pass Success Rate of Endotracheal Intubation in Anesthetized Adults Comparing Video Laryngoscopy Using a Standard Blade to Direct Laryngoscopy - A Multicentre, Randomized Controlled Clinical Trial

Rüdiger R. Noppens[1], Jason Chui[1], Suzanne Flier[1], Sonja Payne[1], Timothy Turkstra[1], Marc Kriege[2] on behalf of the EMMA study group

1 Department of Anesthesia & Perioperative Medicine, Western University, Ontario, Canada.
2 Department of Anesthesiology, University Medical Center of the Johannes Gutenberg-University, Mainz, Germany.

**Introduction/Background:** First-pass intubation success has long been an important goal, with multiple attempts at laryngoscopy associated with airway trauma and potential morbidity[1]. The COVID-19 pandemic has reinforced the importance of first-pass success (FPS) to increase patient and healthcare worker safety[2]. Video laryngoscopy (VL) has been reported to reduce the incidence of failed intubations. However, the impact of VL on FPS remains unclear[3]. We hypothesized that using the McGrath MAC VL (McG; Medtronic®, Dublin, Ireland) for routine intubation in the operating room would result in a higher FPS compared to conventional direct laryngoscopy (DL).

**Methods[4]:** Ethics committees of participating centres approved this international multicentre randomized controlled trial prior to patient recruitment. Adults for elective surgery under general anesthesia requiring endotracheal intubation, without predictors of difficulty, were consented and randomized to either DL or McG. The primary outcome was FPS; secondary endpoints were the influence of the provider experience, time to ventilation, and adverse events (e.g., hypoxia or soft tissue injury). Multiple logistic regression analysis of subgroup factors allowed assessing factors affecting successful first-time intubation comparing McG to DL. A chi-squared test was used to compare FPS between the two groups. Data are expressed as median (interquartile range [IQR]). $p < 0.05$ was considered to be statistically significant.

**Results:** A total of 3323 patients were assessed for eligibility. 2047 consented and were enrolled in the trial (McG n=1021; DL n=1026). FPS was higher with the McG (955/1021, 93.5%), compared with DL (839/1026, 82%; p<0.0001). Overall, 1011/1021 (99%) of the McG and 983/1026 (96%) of DL attempts were successful after two attempts. Years of anesthesia experience had a positive effect on the probability of FPS (p<0.001). Lack of experience had a stronger effect on failure when using DL (OR = 0.889, 95% CI = [0.859; 0.940]), compared to McG (OR=0.992, 95%CI=[0.951;1.034]). Time to ventilation was shorter with DL (34 s, IQR [26-45]), compared to McG (36 s, [26-48]; p<0.01). Overall, no differences in intubation-associated adverse events between groups were observed (p=0.19). However, soft tissue lesions were more frequent with DL (25/1026, 2%) than McG (12/1021, 1%; p=0.03).

**Discussion:** In this large randomized multicenter trial, using a video laryngoscope with a Macintosh blade improved the intubation first-pass success rate in adults under routine general anesthesia. Less experienced anesthesiologists were more likely to be successful with the McG, compared to DL. Intubation time was slightly shorter using DL, but this was not clinically relevant. Based on these results, video laryngoscopy using a Macintosh-shaped blade can be recommended as a first-choice instrument to improve FPS in patients without predictors for difficult airway management. These findings are highly relevant during the ongoing COVID-19 pandemic.

**REFERENCES:**

1. Law JA, Broemling N, Cooper RM, Drolet P, Duggan LV, Griesdale DE, et al. The difficult airway with recommendations for management – Part 1 – Difficult tracheal intubation encountered in an unconscious/induced patient. Can J Anesth Can Anesth. 2013 Nov 1;60(11):1089–118.
2. Cook TM, El-Boghdadly K, McGuire B, McNarry AF, Patel A, Higgs A. Consensus guidelines for managing the airway in patients with COVID-19. Anaesthesia 2020; 75(6): 785-99.
3. Lewis SR et al. Videolaryngoscopy versus direct laryngoscopy for adult patients requiring tracheal intubation. Cochrane Database Syst Rev 2016 11(11): CD011136.
4. Kriege M, Alflen C, Tzanova I, Schmidtmann I, Piepho T, Noppens RR. Evaluation of the McGrath MAC and Macintosh laryngoscope for tracheal intubation in 2000 patients undergoing general anaesthesia: the randomised multicentre EMMA trial study protocol. BMJ Open. 2017;7:e016907. doi:10.1136/bmjopen-2017-016907

## Intrathecal Morphine Does Not Increase Pour in Joint Arthroplasty Surgeries. A Double Blind RCT

Naveed Siddiqui[1], Muhammad Imran Khan[1], Yehoshua Gleicher[1], Shiva Khandadashpoor[1], David Backstein[2], Ashok Kumar Jayaraj[1]

1 Department of Anesthesia, University of Toronto, Mount Sinai Hospital, Toronto, Ontario, Canada.
2 Department of Surgery, University of Toronto, Mount Sinai Hospital, Toronto, Ontario, Canada.

**Introduction:** The changing health economy has driven the need for greater patient throughput, rapid turnover, and shorter hospital stays whilst retaining high quality medical care. Use of intrathecal opioids has become a widely accepted technique for providing effective postoperative pain relief in joint arthroplasty surgeries[1]. However, intrathecal morphine (ITM) has its own adverse effects including urinary retention, and delayed respiratory depression[2]. Post-operative urinary retention (POUR) is one of the main reasons for the delayed discharge following hip and knee arthroplasties. Early removal is important, as a risk of UTI is reported to rise 5% for each day a urinary catheter remains in situ[3]. Avoiding intrathecal morphine would benefit patients by decreasing complications associated with prolonged catheterization such as urinary tract infection and improve cost effectiveness through early discharge of patients[4]. Our aim was to evaluate, whether removing the ITM would facilitate early removal of urinary catheter and earlier discharge from hospital.

**Methods:** Ethics approval was obtained from the local REB. A prospective, double-blind, RCT of 134 patients who are 18 to 85 years old, with BMI 18 to 40 and undergoing elective primary as well as revision knee and hip arthroplasty under regional anesthesia was conducted. Patients were excluded if they had language barrier, prior history of urinary retention or BPH. Intra-operatively, patients received ITM 100 mcg (group A) or saline (group B) in addition to the standard dose of bupivacaine and 15 mcg of fentanyl. None of these patients were catheterized. If they were unable to urinate, an in and out was performed according to preset ultrasound bladder residual volumes. Post-operatively, data collection includes the time of in and out catheterization, Post-op pain, opioids side effects and hospital length of stay.

**Results:** 112 out of 134 patients were recruited, with 99 completing the study, which 66 underwent knee surgery and 33 underwent hip surgery. Both groups; A (ITM) and B (Non-ITM) were similar at baseline. The use of ITM was found to significantly reduce the length of hospital stay at 48 hours post-operatively (with the Difference (95%CI) in the median of -15.3 (-29.9, -0.71) and p-value of 0.04). There was no significant difference in the incidence of opioid side effects, duration of bladder catheterization and requirement for In & Out catheterizations, pain score and patient satisfaction between the two groups.

**Discussion:** The results of our study show that traditional use of ITM in joint arthroplasties significantly reduces hospital length of stay. It does not increase the incidence of opioid side effects, duration of bladder catheterization and requirement for In & Out, patient satisfaction and pain score at rest and movement. The use of ITM in the context of Fast Track Knee and Hip Arthroplasty is still a useful modality.

**REFERENCES:**

1. Factors influencing urinary tract retention after elective open cholecystectomy. 174, 497–500, 1992.
2. Optimizing the dose of intrathecal morphine in older patients undergoing hip arthroplasty. 97, 1709–15, 2003.
3. Catheter-associated bacteriuria. 13,735–747, 1986.
4. High rates of postoperative urinary retention following primary total hip replacement performed under combined general and spinal anaesthesia with intrathecal opiate. 12, S157-S160, 2015.