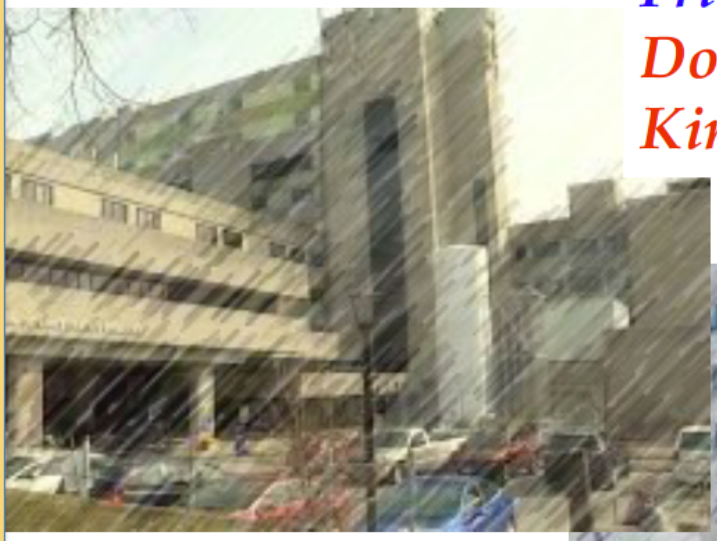
Queen's University

44th Annual Anesthesiology Research Day

Friday April 21, 2023
Donald Gordon Centre
Kingston, Ontario



Supported by the Galway Visiting Lectureship

Queen's University
44th Annual Anesthesiology Research Day

Scientific Program Director and Residency Research Coordinator:
Ian Gilron, MD, MSc, FRCPC
Research Day Co-moderators:
Glenio Mizubuti, MD, MSc **Jordan Leitch,** MD, MSc, FRCPC
Queen's Judges:
Scott Duggan, MD, MSc, FRCPC **Amanda Jasudavisius**, MD, FRCPC
The Galway Visiting Lecturer: **C. David Mazer,** MD, FRCPC

Department Head:
Ramiro Arellano, MD, MSc, FRCPC

Research Committee Chair:
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Research Coordinator:
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Research Coordinator:
Sylvia Robb, RN, CCRP

Institutional support:
• Queen's University • Kingston Health Sciences Centre (KGH & HDH Sites) • Providence Care

Held on April 21, 2023 – Donald Gordon Centre, Kingston, Ontario, Canada.

Funded by Educational Support from:

The Galway Visiting
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SCIENTIFIC PROGRAM OUTLINE

0800 – 0805 **Opening Remarks**

– Dr. Ramiro Arellano

0805 – 0815 **Research Day Introduction**

– Dr. Ian Gilron

Oral presentations – order of presentations to be announced

0815 – 0945 **Oral presentations (6)**

0945 – 1015 **Wellness break**

1015 – 1130 **Oral presentations (5)**

1130 – 1230 **Lunch on site**

1230 – 1400 **Oral presentations (5)**

1400 – 1430 **Wellness break**

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

The Queen's Judges will be:

***Dr. Scott Duggan*,** Queen's Dept of Anesthesiology & Perioperative Medicine

***Dr. Amanda Jasudavisius*,** Queen's Dept of Anesthesiology & Perioperative Medicine

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1430 – 1530 ***Dr. David Mazer*,** Professor, Department of Anesthesia, University of Toronto

* Guest Lecture *

"Lessons learned from TRICS III about transfusion and the conflict between evidence and practice"

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

<u>Oral Presentations</u> (alphabetical order)

Aurélie BRÉCIER, PhD (Queen's DBMS)
Contribution of circadian rhythms to sensory neuron activity *in vitro* and *ex vivo* (update)

Jesse CHEN, PGY-3
The role of pre-labour education in epidural understanding, satisfaction, and use. (udpate)

Stephanie CHEVRIER, PGY-1
Development, Implementation and Assessment of a Real-Time Remote Method for Teaching and Learning Regional Anesthesia Techniques (proposal)

Taryn DAVIDSON, PGY-2
Comparison of BNP & NT-ProBNP in adult patients undergoing preoperative cardiac risk prediction testing (Update)

Derek DIONNE, PGY-2
Fatigue Risk Management In Anesthesia Residency: Taking Stock And Quality Improvement (update)

Sawmmiya KIRUPAHARAN, MD Candidate (Queen's)
Changes in pain following repetitive transcranial magnetic stimulation for depression: Preliminary results of a retrospective data review (proposal)

MacKenzie KOSAK, PGY-2
Confirmation of caudal cannula placement in children using epidural waveform analysis: A prospective analysis (proposal)

Noah LETOFSKY, PGY-1
What complications relevant to emergent airway management have been reported in patients with achalasia in the literature? (proposal)

Francis NGUYEN-DO, PGY-4
Central Line Tutor: Computer Vision-Based Learning System for Practicing Central Venous Catheterization (update)

Sergiy SHATENKO, PGY-4
Development and validation of competency-based assessment tools for point-of-care ultrasound (POCUS) in perioperative anesthesia (update)

Devin STIRLING, PGY-2
Can a quick reference learning tool improve regional anesthesia block efficiency and documentation? (proposal)

Doriana TACCARDI, PhD student at Queen's DBMS (BSc, MSc, MBPsS)
Chronic Pain: Investigating circadian dysfunction in bio-psychosocial outcomes (proposal)

Michael TAYLOR, PGY-1
The effect of perineural dexmedetomidine on length of stay in the post-anesthetic care unit (proposal)

Theunis VAN ZYL, PGY-4
Improving Rib Fracture Analgesia: Implementation of a QI Standardized Protocol (update)

Kendall VERHULST, PGY-1
IV Dexmedetomidine in Cesarean Sections: Impact on patient experience (proposal)

Amanda ZACHARIAS, PhD Student, Queen's DBMS (BScH, MBI)
Analyzing transcriptomics to discover circadian pathways and networks in the naïve mouse's brain (proposal)

Poster Presentations

Hailey Gowdy	**A Canada-wide Epidemiological Study of the Circadian Control of Chronic Pain: The CircaPain Project**

Contribution of circadian rhythms to sensory neuron activity *in vitro* and *ex vivo*

Aurélie Brécier & Nader Ghasemlou (supervisor)

Introduction: Recent studies have unraveled a daily rhythm of thermal and mechanical sensitivity in humans [1, 2] and mice [3], suggesting a circadian control of nociception. However, the mechanisms underlying this phenomenon remain unclear. At the molecular level, circadian rhythms operate in each mammalian cell owing to core clock genes. The anti-correlated expression of *Bmal1*, the master clock gene, and *Nr1d1*, one of its principal repressors, participate in the molecular clock establishment and maintenance that further regulates the rhythmic expression of approximately 40% of the genome [4]. While nociceptive information is primarily transduced by the sensory neurons of the dorsal root ganglia (DRG), a link between the activity of DRG neurons and the circadian regulation of nociception has never been established. We propose that circadian rhythms control the excitability of DRG sensory neurons. To test this hypothesis, activity and clock genes expression of DRG sensory neurons were evaluated *in vitro* and *ex vivo* throughout the day.

Methods: DRGs from C57BL/6 adult male mice were extracted at ZT2 (9 a.m.), acutely dissociated, and cultured at 37°C for *in vitro* experiments. Cultures were treated or not with 200nM dexamethasone, a circadian clock synchronizer, 24h after plating. The activity of DRG neurons was assessed by whole-cell recordings 12h and 24h post-treatment. For *ex vivo* experiments, L3-L4 DRGs were collected at ZT2 (9 a.m.) and ZT14 (9 p.m.). Sensory neurons activity from whole-mount DRG was recorded in the whole-cell configuration 1-5 hours after collection. Clock genes expression of DRG tissues as well as treated and non-treated neuronal cultures was assessed by RT-qPCR every 6 hours for 48h in the *in vitro* experiments and 24h in the *ex vivo* experiments.

Results: RT-qPCR analysis revealed abnormal expression over time of the two main clock genes *Bmal1* and *Nr1d1* in the non-treated cultured DRG neurons compared to DRG tissues, suggesting a disruption of the circadian clock *in vitro.* In contrast, dexamethasone-treated cultures successfully expressed *Bmal1* and *Nr1d1* in an anti-correlated manner. Interestingly, the excitability of dexamethasone-synchronized neurons remains identical 12h and 24h post-treatment, while recordings from whole-mount DRGs revealed a decreased excitability of sensory neurons at ZT14 compared to ZT2.

Discussion: Our study first revealed that cultured DRG neurons present an altered molecular clock. Secondly, despite the molecular clock restoration in neuronal cultures with dexamethasone, the circadian fluctuation of sensory neuron activity is absent. Overall, we suggest that *in vitro* experiments are not a good model for studying circadian rhythm in DRG sensory neurons. More importantly, our study uncovered a daily fluctuation in the excitability level of sensory neurons *ex vivo* in healthy mice.

References

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Study Title: The role of pre-labour education in epidural understanding, satisfaction, and use.

Co-Investigator(s): Dr Jesse Chen* (MD, PGY3) *Presenter, Ms Maegan Chen (MD Candidate), Rachel Phelan (Clinical Research Facilitator) Department of Anesthesiology and Perioperative Medicine, Queen's University

Principal Investigator: Jessica Burjorjee (MD, FRCPC) Department of Anesthesiology and Perioperative Medicine, Queen's University

BACKGROUND: In 2007, Public Health Canada published a survey called the 'Maternal Experiences Survey' and found that 57.3% of all women with a vaginal birth had an epidural[1]. Although it is a safe method of labour analgesia, many women who decline epidurals may be doing so based on inaccurate understandings of the risks of the procedure[2,3]. Prior studies in Kingston have found that women wanted to know all risks of epidural analgesia prior to proceeding and that they prefer to know these risks in advance of the onset of labour[4,5]. Therefore, it becomes imperative to provide evidence-based information to parturients regarding the risks and benefits of epidural analgesia. There exists a variety of information for patients on the internet. However, they are not consistent nor accessible to all patients[6]. There exists an opportunity to supply patients with reliable evidence-based information in advance of labour to improve understanding of, and satisfaction with epidurals. It may also improve our current consent process and affect the rate of epidural use.

HYPOTHESIS: A Consolidated epidural education material of reputable sources prior to labour onset will improve patients' understanding of, and satisfaction with future epidural use. It will secondarily affect epidural use rate.

STUDY DESIGN: This was a single centre prospective cohort study. An epidural education pamphlet was delivered to parturients in the KHSC prenatal clinic in the third trimester. A postpartum survey was conducted on all labouring women at KHSC. The survey was used to evaluate the epidural experiences of patients who have reviewed the pamphlet and those who have not to compare findings.

PROGRESS: Queen's REB approval was on obtained on June 13, 2022. We then designed an evidence-based pamphlet after surveying a small sample of postpartum women on the labour and delivery floor to inquire the type of information they would find helpful in a pamphlet. We then distributed the pamphlet to the KHSC prenatal clinic. Then, we recruited 121 study participants to complete our comprehensive postpartum survey –63 did not review the pamphlet and 58 did review the pamphlet. Our preliminary results indicate that the pamphlet was a highly valued and important source of information to our parturients. It significantly improved parturients' knowledge of epidural complications overall ($p<0.001$) with specific improvement in knowledge of infection, death/permanent paralysis, hypotension, pruritus, urinary retention and decreased ability to push. Our results also implicate the pamphlet as a source of information just as important to parturients as the anesthesiologist conversation prior to epidural placement.

NEXT STEPS: Our next steps will be to continue to examine and perform statistical analyses of the comprehensive survey data. The plan will be to look for differences between the experiences of the pamphlet group versus the control group. We plan to also distribute the pamphlet to other prenatal clinics in the Kingston area with possible recruitment of more study patients.

References

1. Public Health Agency of Canada. What Mothers Say: The Canadian Maternity Experiences Survey. Ottawa, 2009.
2. Ituk U, Wong CA. Epidural labor analgesia: Whence come our patients' misconceptions?. J Clin Anesth. 2017;42:84-85. doi:10.1016/j.jclinane.2017.07.012, 10.1016/j.jclinane.2017.07.012
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Development, Implementation and Assessment of a Real-Time Remote Method for Teaching and Learning Regional Anesthesia Techniques

Stephanie Chevrier, Glenio Mizubuti, Gregory Klar

Background: Ultrasound-guided regional analgesia techniques have become increasingly popular. They can reduce and at times eliminate the need for opiate analgesics, thereby improving patient safety, reducing length of hospital stay and associated medical costs, and increasing patient satisfaction. However, a major barrier to the mainstream uptake of such regional anesthesia techniques pertains to training physicians; these techniques require acquisition of new skills under expert guidance, which is often challenging given the daily time-sensitive and competing demands placed upon anesthesiologists. With staff shortages and increasing demands amid the COVID-19 pandemic, expert availability for one-on-one guidance has become even more limited. As a result, many opportunities for providing regional analgesia to patients who would likely benefit from it may be missed, and nerve blocks may be performed in the absence of expert guidance.

Study Purpose: Implementation of a real-time remote teaching and learning method in which trainees will be supervised during the performance of standard-of-care nerve blocks by expert mentors, using an ultrasound probe which wirelessly connects to a monitor in a remote location. These nerve blocks will be performed in the peri-operative or emergency department settings.

Research Question: What are the opinions of attending physicians and residents (in the departments of anesthesiology and emergency medicine) regarding the use of remote supervision for the performance of ultrasound-guided regional anesthesia techniques?

Design and Methods: This is a qualitative and descriptive study. Participants will include mentors (staff anesthesiologists who are experts in ultrasound-guided regional anesthesia techniques), trainees (PGY-3 to PGY-5 anesthesia and emergency medicine residents, and emergency medicine staff physicians) and patients (individuals scheduled for surgery amenable to regional anesthesia techniques at Hotel Dieu Hospital *or* presenting to the Hotel Dieu Hospital or Kingston General Hospital emergency departments with traumatic injuries amenable to regional analgesia techniques). Nerve blocks will be performed using Clarius wireless linear scanners, which are Health Canada-approved ultrasound probes that connect to iPads or iPhones to provide a live feed to the expert mentor supervising the nerve block remotely.

Basic data will be collected following each nerve block, and assessment of block success will be documented. Trainees and mentors will be asked to rate their experience with the novel teaching method by completing a questionnaire, and voluntary focus group sessions will be held to obtain feedback from participants. Data will be collected via Qualtrics and exported to SPSS for descriptive analysis. Mean and standard deviations will be calculated for ordinal questions, categorical analyses will be performed for close-ended questions, and qualitative thematic analyses will be completed for the data obtained from voluntary focus group sessions.

References:

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Comparison of BNP & NT-ProBNP in adult patients undergoing preoperative cardiac risk prediction testing

AUTHORS: Davidson, Taryn[1]; Parlow, Joel[1]; King, Ben[1]; DuMerton, Deborah[1]; Roshanov, Pavel S[2,3]; Devereaux, Philip J[3,4]; Leitch, Jordan (Supervisor)[1]

AFFILIATIONS:
[1]Anesthesiology and perioperative Medicine, Queen's University, Kingston, Canada; [2]Division of Nephrology, Department of Medicine, Western University, London, Canada; [3]Population Health Research Institute, Hamilton, Canada; [4]Department of Medicine, McMaster University, Hamilton, Canada

INTRODUCTION: Myocardial injury after noncardiac surgery (MINS) is a strong and independent predictor of 30-day mortality[1]. B-type natriuretic peptide (BNP) and N-terminal pro B-type natriuretic peptide (NT-proBNP) have predictive value in identifying patients at increased risk of developing MINS and other perioperative vascular events. Although incremental threshold values of NT-ProBNP have been correlated with increasing degree of risk of perioperative cardiac events, a similar relationship with BNP values has not been established. As many hospitals provide BNP assays rather than NT-ProBNP, the primary objective of this study was to examine the relationship between BNP and NT-ProBNP in a group of adult patients undergoing elective non-cardiac surgery.

METHODS: This was a single-centre correlational study in 456 patients undergoing elective noncardiac surgery. This study was approved by the Research Ethics Board (REB) and all participants gave informed consent for enrollment in the study. Eligibility criteria included patients >65 years old, Revised Cardiac Risk Index ≥1, or patients >45 years old with significant cardiovascular disease. To allow simultaneous serum sampling of BNP and NT-ProBNP, patients at preoperative pre-surgical screening (PSS) who met local guidelines for preoperative BNP testing (lab-based BNP Abbott analysis) also had an additional 5mL of blood drawn for measurement of NT-ProBNP (point-of-care NT-ProBNP Roche analysis). The Abbott test and point-of-care Roche test are immunoassays for the quantitative determination of BNP and NT-proBNP in venous blood, respectively. A log transformed linear regression model was used to quantify the relationship between BNP and NT-ProBNP.

RESULTS: Among 456 adult patients (mean age 67 years, SD= 12; 50.4% male) who underwent preoperative BNP and NT-proBNP measurement, median (IQR) BNP was 36 pg/mL (73 - 15) and median (IQR) NT-ProBNP was 166 pg/mL (348.25 - 78). A linear regression model revealed a strong linear correlation between logBNP and logNT-ProBNP values, with a correlation coefficient (Pearson's r) of 0.89 and a coefficient of determination (r^2) of 0.79 ($F(1,454) = 1724.70$, $p < 0.001$).

DISCUSSION: BNP was significantly associated with NT-ProBNP in 456 adult patients undergoing preoperative cardiac risk prediction testing, with an explained variance ($R^2 = 0.79$) comparable to that previously reported in the literature ($R^2 = 0.81$)[2]. Although these observations suggest a strong correlation between BNP and NT-ProBNP, several studies demonstrate that consideration of certain patient factors, including age, body mass index, renal function, anemia, and atrial fibrillation, may improve the accuracy of formulas used to convert BNP to NT-ProBNP[3]. We plan future studies to examine the ability of these conversion formulas to validate BNP thresholds to predict perioperative cardiac risk using outcome data.

REFERENCES:

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FATIGUE RISK MANAGEMENT IN ANESTHESIA RESIDENCY: TAKING STOCK AND QUALITY IMPROVEMENT

Derek Dionne, Marta Cenkowski & Chris Haley

BACKGROUND

Studies investigating the effects of fatigue on health care worker performance indicate that fatigue increases risk of medical error, compromises patient safety, increases the risk to personal safety and wellbeing (1). The multiple causes of fatigue have been described in dimensions including physical, emotional and social/cultural. The impact of shift work on wellbeing include increased occupational accidents, fatal car accidents, increased risk of obesity, type 2 diabetes, coronary artery disease, breast prostate and colorectal cancer (2). As the knowledge of the fatigue risks have grown, as have the various strategies for risk management, general standards of accreditation of Canadian residency programs now require education of fatigue risks and individual as well as team-based strategies to manage these risks.

Fatigue risk management strategies cannot be implemented with a 'one-size fits all' strategy as there are many regional factors that can have large impacts on fatigue risks. Thus we propose a study to evaluate the Queen's specific factors contributing to fatigue risk by determining the level of fatigue and burnout within our anesthesia residency program and assessing the level of improvement with local strategies.

STUDY DESIGN

1) Fatigue risk assessment of anesthesia department and residents:
    a. Assess level of resident fatigue using tool (KSS or FSS +/- Sleep/work diary)
    b. Resident focus groups exploring fatigue experience
2) Summary of results
3) Draft & implement local strategies for mitigating fatigue
4) Repeat fatigue assessments to evaluate impact of QI strategies

PRELIMINARY RESULTS

We found that 79% of residents experience significant sleepiness while on call at least most shifts and all the residents find themselves to be self aware with regards to their fatigue. By the end of their call shifts on average residents rate their sleepiness as '8'. However, only 64% would feel comfortable sharing this awareness with certain staff and 29% are not comfortable disclosing their fatigue regardless of staff. All the residents, unsurprisingly, find there to be poor access to food options overnight while on call. Completion of the Maslach Burnout Inventory Medical Professional questionnaire (n=14) found that within the program there are 57% of resident respondents who experience a high level of emotional exhaustion burnout and another 14% moderate in this category. Within the depersonalization subscale 29% and 36% of residents experience a moderate and high level of burnout respectively. In contrast, within the personal accomplishment subscale only 7 % of residents experienced a moderate level of this type of burnout.

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Changes in pain following repetitive transcranial magnetic stimulation for depression: Preliminary results of a retrospective data review

Sawmmiya Kirupaharan[1], Dr. Roumen Milev[2], Dr. Scott Duggan[3], Dr. Felicia Iftene[2], Dr. Tim Salomons[4], Wilma Hopman[5], Joanne Bresee[6], Sonya Kelso[6], Dr. Ian Gilron[3*]

[1]Faculty of Health Sciences, Queen's University, [2]Department of Psychiatry, Queen's University, [3]Department of Anesthesiology and Perioperative Medicine, Queen's University, [4] Department of Psychology, Queen's University, [5]Department of Public Health Sciences, Queen's University, [6]Providence Care Hospital; *Research Supervisor

Purpose: Achieving adequate pain control in patients with chronic pain and comorbid depression is challenging, yet pain management in this population remains understudied. There is early evidence that suggests repetitive transcranial magnetic stimulation (rTMS) of the dorsolateral prefrontal cortex (DLPFC), most commonly used to treat medication-resistant depression, may concurrently reduce pain[1]. This study aims to describe changes in pain intensity and symptoms of anxiety and depression throughout rTMS treatment of the DLPFC.

Methods: Following institutional ethics approval, a retrospective chart review was conducted of adult patients who underwent their first acute series (25-30 treatments) of rTMS of the DLPFC at the Providence Care Hospital between 2020 and 2023. Data were collected on depression, anxiety and pain reported at baseline, weekly throughout rTMS therapy and immediately after completion of the treatment series. Depressive symptoms were self-reported using a 0-100 visual analogue scale (VAS) and the Beck Depression Inventory-II. Anxiety and pain were self-reported using 0-100 VAS scores. Data are described using descriptive statistics and pre- and post-treatment scores are compared using Wilcoxon signed rank tests. Exploratory correlational analyses are currently being planned. Continuous non-normally distributed data were summarized as medians with interquartile ranges and categorical variables were reported as frequencies. Wilcoxon signed rank tests are reported as Z statistics and p values. A p-value <0.05 was considered significant.

Results: Of the 137 patients identified, 65 (47.4%) reported moderate pain (VAS score ≥40) and 69 (50.4%) reported pain >30 at baseline. Of the 38 (20.4%) patients who volunteered a chronic pain diagnosis, 6 (4.4%) reported suffering from fibromyalgia, 6 (4.4%) chronic back pain, 1 (0.7%) chronic migraines, 1 (0.7%) chronic neuropathic pain and 14 (10.2%) unspecified chronic pain syndromes. For those with complete pre/post-treatment data available, patients reported an average pre-treatment pain score of 40.0 [IQR 10.0-70.0] and a post-treatment pain score of 22.5 [IQR 6.0-50.0] ($Z= -2.86$, $p=0.04$). BDI scores decreased from 38.0 [28.8-44.0] to 24.5 [10.8-35.6] from pre- to post-treatment ($Z= -5.31$, $p<0.01$). In patients who had a pain score ≥40 at baseline, pain scores decreased from 65.0 [IQR 54.0-75.0] at pre-treatment assessment to 40.0 [IQR 15.0-61.0] post-treatment ($Z= -3.74$, $p<0.01$). Ten of 48 patients (20.8%) with available pre- and post-treatment scores experienced ≥30% reduction in pain scores.

Conclusion: Patients undergoing their first acute series of rTMS treatments reported lower pain scores following treatment. While preliminary findings suggest that rTMS for depression also improves coexisting pain, rigorously conducted prospective studies are required to confirm these findings, and to further understand treatment mechanisms in this complex group of patients.

References:

1. Avery et al, Transcranial magnetic stimulation reduces pain in patients with major depression: a sham-controlled study. J Nerv Ment Dis. 2007 May;195(5):378-81.

Confirmation of caudal cannula placement in children using epidural waveform analysis: A prospective analysis

Kosak, Mackenzie (presenter); Ho, Anthony (supervisor); Phelan, Rachel; Mizubuti, Glenio; Klar, Gregory

Introduction: Single-shot caudal epidural injection of local anesthetic is one of the most common techniques for providing postoperative analgesia for children undergoing abdominal, pelvic, or lower limb surgery. As is common with blind procedures, the landmark technique for ascertaining correct placement of the catheter in the caudal epidural space is subjective, and its rate of success is variable (75-92%[1]). Adjuncts, including ultrasound, stethoscope, and nerve stimulation are objective but have the potential to increase procedural risks and extend procedure duration. Transducing an arterial pressure waveform from an epidural catheter is validated in the adult literature[2] in terms of confirming placement of lumbar epidurals for labour analgesia and thoracic epidurals for surgical anesthesia, and its feasibility has been demonstrated in the pediatric population[3]. We will aim to determine the sensitivity, specificity, predictive value, and inter-rater reliability of epidural waveform analysis for successful epidural placement of caudal blocks in pediatric patients.

Methodology: This is a single-center prospective analysis. Inclusion criteria is eligible children under 10 years of age undergoing abdominal, pelvic, or lower limb surgery of less than three hours for which a caudal block is planned for analgesia. Recruitment will be via parental consent. We will target a sample size of 85 patient, based on an adult study of similar design. An anesthesia resident will attempt the caudal block and confirmation with EWA, and a separate observer will make video record of the waveform transduced. Three blinded expert collaborators will review the video to evaluate whether an arterial waveform was successfully transduced. Procedural success will be evaluated by the absence of an increase in heart rate of >10% with surgical incision. FLACC pain scores and post-operative analgesia requirements will be utilized as a secondary measures of block success.

References:

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What complications relevant to emergent airway management have been reported in patients with achalasia in the literature?

Noah Letofsky and Anthony Ho (supervisor)

Related area of Clinical Need:

Achalasia is an uncommon primary esophageal motor disorder, with an incidence estimated at 1.63/100,000 and prevalence of 10.82/100,000 in Canada[1]. Given the treatment of this disorder often involves surgical and/or endoscopic myotomy or dilatations[2], these patients are likely to be encountered by the anesthesiologist. It understood that achalasia is associated with respiratory symptoms such as cough, dyspnea, and puts patients at risk of pulmonary aspiration of esophageal contents. While a narrative review in anesthesia and analgesia[3] discusses anesthetic considerations for elective patients undergoing POEM procedures, touching on the rare associated complications of megaesophagus, it does not comment on emergency airway management in these patients experiencing respiratory distress.

Current knowledge gaps in this area:

Many case studies exist describing respiratory distress due to megaesophagus in achalasia[4-8]. However, to our knowledge, there has only been one summary of these case reports in the literature[9], focusing on plausible mechanistic explanations of the phenomenon, and not considerations pertinent to the anesthesiologist, such as hemodynamic changes from thoracic inlet obstruction[8] and potential for compression associated reccurent laryngeal nerve palsy[7].

Proposed study design:

This will be a narrative review summarizing available reports of tracheal distortion with achalasia. A literature search, utilizing the OVID interface to access the Medline, Embase, and Web of Science databases, will be performed. With the guidance and consultation of a librarian, appropriate keywords and MeSH headings will be utilized, and articles will be screened for relevancy. Only English-language case-reports describing a case of airway distortion secondary to achalasia will be considered for inclusion.

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Central Line Tutor: Computer Vision-Based Learning System for Practicing Central Venous Catheterization

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Background: Simulation-based tools are being increasingly incorporated into medical training. Simulation models allow for the repetitive practice of invasive medical procedures without direct risk to patients. A common resource limitation in simulation teaching is the requirement for expert clinicians to teach and supervise learners practicing their skills. Central venous catheterization (CVC) is a commonly performed invasive procedure often taught to medical learners through simulation models. Computer vision-based systems can potentially analyze and recognize the steps involved in simulation procedures [1, 2].

Purpose: This study aims to assess a novel computer vision-based system, *Central Line Tutor,* as an independent CVC practice system that does not require an expert supervisor. The system uses video-based workflow recognition, 2D ultrasound, electromagnetic tracking and 3D modelling to provide learners with real-time instruction and feedback.

Hypothesis: Participants who practice CVC insertion with the tutor system will achieve CVC insertion competency.

Study design: Undergraduate medical students and residents from Queen's University will be recruited. Consented participants will be randomized to either use the full tutor system with active feedback and 3D modelling, or conventional system with only ultrasound and non-interactive checklist. All participants will receive an educational video on performing internal jugular venous cannulation and a copy of the procedural checklist prior to performing 11 trials. Recordings will be obtained from trial 1, 6, 11 for both groups using ultrasound and conventional checklist only. Performance of CVC will be assessed in each group by blinded expert evaluators using previously validated scoring systems [3]. Participants will complete a questionnaire documenting their level of training, previous experience and feedback on the simulator.

Progress: 56 medical students and 6 residents have been recruited as of April 2023. Target number of participants: 40 medical students, 10 residents.

Next Steps: Further recruitment, evaluation of recordings by blinded experts, data analysis.

Challenges: Durability of the mannequin has been a significant challenge, especially with skin degradation, accidental introduction of air and damaged wires. Estimated amount of recorded content to review is significant and maybe resource intensive.

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Development and validation of competency-based assessment tools for point-of-care ultrasound (POCUS) in perioperative anesthesia

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Collaborators: Dr. Ramiro Arellano, Dr. Sarah Maxwell, Rachel Phelan, Dr. Faizal Haji, Dr. Adam Szulewski, Dr. Hailey Hobbs, Dr. Rene Allard, Dr. Robert Tanzola, Dr. Anthony Ho, Dr. Klodiana Kolomitro, Dr. Nancy Dalgarno, Dr. Heather Braund

Point-of-care ultrasound (POCUS) is a tool that allows for rapid bedside clinical assessment, diagnosis and guidance of resuscitation across a variety of clinical presentations. As POCUS becomes ubiquitous, the importance of appropriate training has recently gained significant interest among medical authorities. As a result, POCUS training is being increasingly integrated as a mandatory field into the core curriculum of several Royal College-recognized specialties, including anesthesiology.[1] Unfortunately, however, there is no consensus on how to best teach POCUS and evaluate POCUS competencies in anesthesiology training. The lack of validated tool(s) to evaluate POCUS competencies, especially in the context of the current competence by design curriculum constitutes a barrier to effective POCUS training in anesthesiology in Canada and prevents adequate training standardization. This study therefore aims to establish and validate POCUS competencies and will be divided into 3 phases: (i) the creation of competencies through a Delphi process involving POCUS experts from all Anesthesiology programs across the country (ii) development of standardized POCUS assessment tool(s); and subsequently (iii) validation of this assessment tool through high-fidelity simulation as well as real-life patient settings. This project has been funded by the 2020 SEAMO Endowed Education Grant and approved by the Queen's University Health Sciences & Affiliated Teaching Hospitals Research Ethics Board. Presently, consensus has been reached using a Delphi process involving POCUS experts from every anesthesiology program across Canada and a manuscript is being prepared for publication in the Canadian Journal of Anesthesia.

[1]Royal College of Physicians and Surgeons 2020 National Curriculum for Canadian Anesthesiology Residency. Available at URL: https://www.royalcollege.ca/rcsite/documents/ibd/anesthesiology-national-curriculum-e.pdf. Chapter 25: Point-of-care Ultrasound (POCUS), pages 145-148.

Can a quick reference learning tool improve regional anesthesia block efficiency and documentation?

By Dr. Devin Stirling Supervised by Dr. Gregory Klar Collaborator: Dr. Glenio Mizubuti

Inadequate documentation practices have been linked to medicolegal risks in many areas of medicine including with regional anesthesia (1). Recently a multinational group of experts in the field collaborated to define international standards for documentation of regional anesthesia (2). These standards included documentation of specific risks discussed whenever a regional anesthetic procedure is preformed. Zarnegar et al. have also highlighted the importance of documenting specific risks as patients do not have good recall of regional anesthetic risks. They found that while 95% of patients recalled a risk discussion for a shoulder surgery only 68% recalled the risk discussion for the corresponding regional anesthetic. Similarly, 52% of patients could recall at least 2 risks of the surgery while only 20% could recall at least 2 risks of the regional technique (3).

A preliminary review of 21 charts at our institution was conducted showing only 64% listed specific risks when a regional block was preformed. On further follow-up totaling 80 patients only 55% of charts listed specific risks while 78% stated risks were discussed.

Lorenzetti et al. analyzed many methods to improve medical documentation finding that using reminders seemed to be an effective way to achieve this goal (4). We therefore decided to use a learning tool for regional anesthesia that would incorporate documentation reminders for our first PDSA cycle aimed at improving risk documentation. A secondary goal was to improve the efficiency of reviewing blocks before conducting them. While this review time can be important to ensure safety and effectiveness of blocks, it can also cause delays if it is not done efficiently. Therefore, by having an easily available summary of multiple nerve blocks we aimed to reduce the review time as well.

Upon completion of the first PDSA cycle we achieved 65% of charts listing specific risks, and 78% stating risks were discussed, which were not statistically significant improvements from the baseline ($p=0.38$ and $p=0.94$, respectively). To further our goal of increasing the documentation compliance a teaching session was conducted for incoming residents in hopes of setting good documentation habits early. Following this additional intervention specific risks were listed on 19/27 (70%) charts ($p=0.316$), while a statement that risks were discussed was present on 26/27 (96%) of charts ($p=0.085$).

Block review times before and after the catalogue introduction was also studied. The proportion of surveys with review times under 5 minutes went from 12/20 (60%) to 16/20 (80%). This exceeded our original goal of 70%, though it was not a significant improvement ($p=0.168$) as there was difficulty getting an adequate number of survey responses.

Efforts to improve documentation, while sometimes effective, are not guaranteed to be met with success. It is ultimately the individual responsibility of the anesthesia provider to ensure proper documentation of risk discussions is recorded in the chart, though supporting staff in doing so is encouraged.

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CircaHealth: An epidemiological study of the circadian control of biopsychosocial outcomes in chronic pain.

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Approximately 20% of the Canadian population lives with chronic pain. 24-hour circadian rhythms regulate the function of our nervous and immune systems, which are both involved in the experience of pain. Being able to address pain rhythmicity on a molecular and psychosocial level might help in the treatment/management of chronic pain conditions. Our study CircaHealth uses an online survey to study the circadian control of chronic pain in the Canadian and international population. Preliminary research within a cohort of people living with chronic low back pain in Kingston suggests that circadian rhythmicity, on a molecular and biopsychosocial level, influences pain intensity and opioid use. These findings will be expanded upon with CircaHealth.

Methods: Following a baseline questionnaire, blood samples are collected from participants two times a day within 12 hours to identify expression of specific clock genes and inflammatory cytokines throughout the day. Participants also complete a series of electronic symptom-tracking diaries (ecological momentary assessment), in which they rate their pain intensity, negative affect, and fatigue on a 0-10 scale at 3 timepoints (8:00AM, 2:00PM, 8:00PM) each day for 10 days.

Results: Our initial launch of CircaHealth - CircaPain in Canada (sample size N=822 c. Feb. 2023) revealed distinct patterns of pain rhythmicity (e.g., constant, increasing, or decreasing throughout the day). Further analysis determined associations between these pain rhythmicity patterns and other variables, such as pain condition, anxious and depressive symptoms, exercise, and sleep habits.

Discussion: We are now recruiting participants from across Canada and setting up multi-site collaborations nationally and internationally to collect samples and create a biobank. This work will deepen our understanding of 24-hour pain fluctuations by uncovering distinct pain rhythmicity patterns and potential predictors for their occurrence. This may help to develop new treatments for different chronic pain conditions tailored to circadian rhythmicity, such as light therapy/chronotherapy for chronic pain.

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The effect of perineural dexmedetomidine on length of stay in the post-anesthetic care unit

Michael Taylor, PGY 1; Supervisor: Glenio Mizubuti, MD, FRCPC

Regional anesthesia is increasingly used as a component of multimodal analgesia and ERAS guidelines, particularly in orthopedic surgery.[1] As an adjunct to regional techniques, perineural dexmedetomidine consistently increases length of analgesic block and reduces overall opioid use,[2] more so than parenteral administration.[3] While dexmedetomidine, a highly selective alpha-2 adrenergic agonist, works centrally to produce analgesia and sedation, it is thought to act as an immunomodulator when used perineurally, specifically reducing perioperative stress responses through its effect on catecholamines and inflammatory cytokines.[4] When used as an adjunct to perineural infiltration of ropivacaine or bupivacaine, dexmedetomidine reduces NF-kB, iNOS and mast cell degranulation, prolonging analgesia.[5] Unfortunately, *intravenous* dexmedetomidine has been shown to extend post-anesthetic care unit (PACU) stay,[6] particularly due to increased incidence of bradycardia, hypotension, and sedation,[7] leading to concerns of its use as an adjunct to rescue blocks in PACU. One cannot assume, however, that using dexmedetomidine as a regional adjunct will also result in prolonged PACU length of stay (LOS), given the pharmacologic differences depending on route of administration. We therefore aim to address the following question: What effect does the addition of perineural dexmedetomidine to rescue analgesia blocks have on the PACU LOS?

Adductor canal blocks (ACBs) are a frequently performed regional technique in the PACU as a rescue analgesic modality for total knee arthroplasty and offer an opportune vehicle to evaluate the effects of perineural adjunct agents. We are proposing to perform a prospective, double-blinded randomized control study that compares the effect of a standardized ACB with or without the addition of dexmedetomidine as an adjunct in patients receiving rescue analgesia after elective unilateral total knee arthroplasty. *Specifically, we aim to evaluate our hypothesis that the use of dexmedetomidine as an adjunct to local anesthetic for post-operative ACBs* ***does not*** *increase the PACU LOS in ambulatory total knee arthroplasty patients.* Our primary outcome will be PACU LOS, based on Aldrete criteria, with assessment of total opioid requirements in PACU as a secondary outcome. We aim to demonstrate that the addition of dexmedetomidine to ACBs can offer the benefits of prolonged analgesia without negatively impacting surgical efficiency through increased PACU LOS.

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Implementation of a standardized, multidisciplinary rib fracture analgesia protocol: Results of a QI initiative

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Other Collaborators: Dr. Glenio Mizubuti, Dr. Anthony Ho, Dr. Wiley Chung, Sue Vasily, Ashley Furevik

Background: Rib fractures are a common injury with significant morbidity and an all-cause mortality of 6% for single fractures to over 33% for multiple fractures in the elderly.[1] Epidurals and peripheral nerve blocks improve pain control compared to IV opioids.[2-4] The APMS at KGH is often involved with post-rib fracture pain, but analgesic management varies. In addition, APMS involvement is at the discretion of the admitting service, and APMS is not always involved in care of rib fracture patients.

Objectives: Given the risk of complications and the benefits of epidurals and regional anesthesia, a QI project was undertaken to implement a standardized protocol for identification of high risk patients and for analgesia in rib fractures. The aim was to increase identification of high risk rib fracture patients, increase APMS involvement, and ensure multimodal and regional anesthesia uptake.

Methods: A standardized analgesia protocol for identification and management of medium to high-risk patients was developed, using STUMBL[1] risk stratification. Baseline data before implementation were collected through a retrospective review of all rib fracture patients at our center in 2020. Data included demographics, APMS involvement, multimodal analgesia use, and epidural and regional analgesia use. The protocol of risk stratification and analgesic management was implemented and involved Thoracic Surgery, APMS, and nursing. Repeat data was collected 6 months following implementation.

Results: A baseline audit found 287 rib fractures at our center in 2020. Of these, 54 were inpatients and 233 were outpatients. APMS was only involved in the care of 43% of admitted patients and 38% had neuraxial / regional (erector spinae plane block) analgesia or IV opioid patient controlled analgesia (IVPCA). Post-implementation AMPS consulted on 83% of admitted rib fracture patients, 50% received neuraxial / regional analgesia, and 20% received IVPCA. Two-thirds of patients were high risk of complications according to STUMBL stratification. In this subgroup, 54% were seen by APMS, 46% received neuraxial / regional analgesia, and 15% received IVPCA. Post-implementation APMS was involved with 84%, and 63% and 32% received neuraxial / regional analgesia and IVPCA, respectively.

Conclusion: Results showed increased APMS involvement, and neuraxial / regional analgesia and IVPCA utilization after implementation of the protocol. Increased neuraxial / regional analgesia and IVPCA use was most notable in the high risk patient subgroup.

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IV Dexmedetomidine in Cesarean Sections: Impact on patient experience

Kendall Verhulst, PGY-1; Supervisor: Dr. Jordan Leitch, FRCPC

Background: Cesarean sections are among the most common inpatient surgical procedure performed in Canada, with 94-96% of these surgeries performed with a neuraxial anesthetic. While generally well tolerated, intraoperative complications such as nausea, vomiting, anxiety, inadequate neuraxial anesthesia and shivering are common. Current rescue therapies for these complications can be associated with potentially deleterious complications and reduce patient satisfaction. Dexmedetomidine has been gaining prominence as an adjunctive analgesic and anxiolytic in general anesthesia and monitored anesthetic care and may represent a novel prophylactic agent to reduce the need for rescue therapies and improve the overall patient experience.

Knowledge Gap: Few studies have investigated the overall patient experience of neuraxial anesthesia with or without dexmedetomidine. Similarly, no studies investigated whether early administration of dexmedetomidine influences the rates of requiring rescue therapies for intraoperative complications during cesarean section under neuraxial anesthesia.

Study Objective: To determine the effect of intravenous dexmedetomidine on the patient experience during cesarean section under neuraxial anesthesia, and to determine whether dexmedetomidine reduces the rate of rescue analgesic and antianxiety therapy intraoperatively.

Methods: A mixed methods, double-blind, randomized control trial will be undertaken. Following appropriate ethics board review, fully informed consent will be obtained prior to randomization to a control group or the experimental group. A brief worksheet will be provided to the anesthesiologist or designate to record if patients reported intraoperative shivering, nausea/vomiting, anxiety, pain, or other distressing symptoms, and whether any rescue therapies were required. Finally, an electronic survey will be provided to patients to complete in the 24–48-hour period post-operatively to assess their experience and satisfaction with their anesthetic. Statistical analysis will be performed on the worksheet and survey results to determine if there are significant differences.

Hypothesis: Intravenous dexmedetomidine will be associated with increased patient satisfaction and lower rates of intraoperative rescue therapies for anxiety and analgesia.

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Analyzing transcriptomics to discover circadian pathways and networks in the naïve central nervous system

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Introduction: Circadian rhythms are near 24-hour internal cycles of biological processes associated with the earth's daily rotation cycle. These cycles are controlled by a central clock in the suprachiasmatic nucleus of the hypothalamus and many peripheral clocks throughout the body. At the molecular level, circadian clocks are regulated by transcriptional-feedback loops, whose components modify the expression of downstream clock-controlled genes (CCGs), of which there are many. Various tools can be used to investigate these CCGs and their interactions, including Metacycle, DynOmics, and weighted gene co-expression analysis (WGCNA).

Methods: To investigate these genes and mRNA-microRNA co-expression, we used mRNA and microRNA-sequencing samples taken from the cortex, striatum, hypothalamus, and liver of naïve male mice every 3 hours for 36 hours. For each tissue, gene counts were normalized with edgeR and arrayQualityMetrics was used to remove outliers. We removed genes whose mean expression was < 1. We used Metacycle to identify rhythmically expressed genes, dynOmics and WGCNA to identify microRNA-mRNA pairs, and g: Profiler to perform pathway analysis on the results.

Results: The decreasing number of cycling genes in each tissue is as follows: liver, cortex, hypothalamus, and striatum. Most appear circadian, though some genes' periods are around 8or 12 hours. mRNA genes tend to have peaks of expression during the transition between light and dark or vice versa. Though core circadian genes are rhythmically expressed across most tissues, few genes are shared across all tissues. Most of the cyclic mRNA-microRNA coexpression pairs are novel; between 27.18% and 46.28% of these pairs may involve microRNAs directly regulating mRNA expression. Finally, we found that most groups of rhythmically expressed mRNA genes contain markers of the immune and vasculature systems.

Discussion: Our results from Metacycle are overall supported by the literature, though we are surprised that the cortex had more cycling genes than the striatum. The vast number of novel mRNA-microRNA pairs suggests that microRNAs may be key for regulating CCGs, though further validation is needed. We hope researchers can use our results to inform their own research. To this end, we have made our results explorable at https://www.ghasemloulab.ca/. (Supported by NSERC and the Craig H. Neilsen Foundation)

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