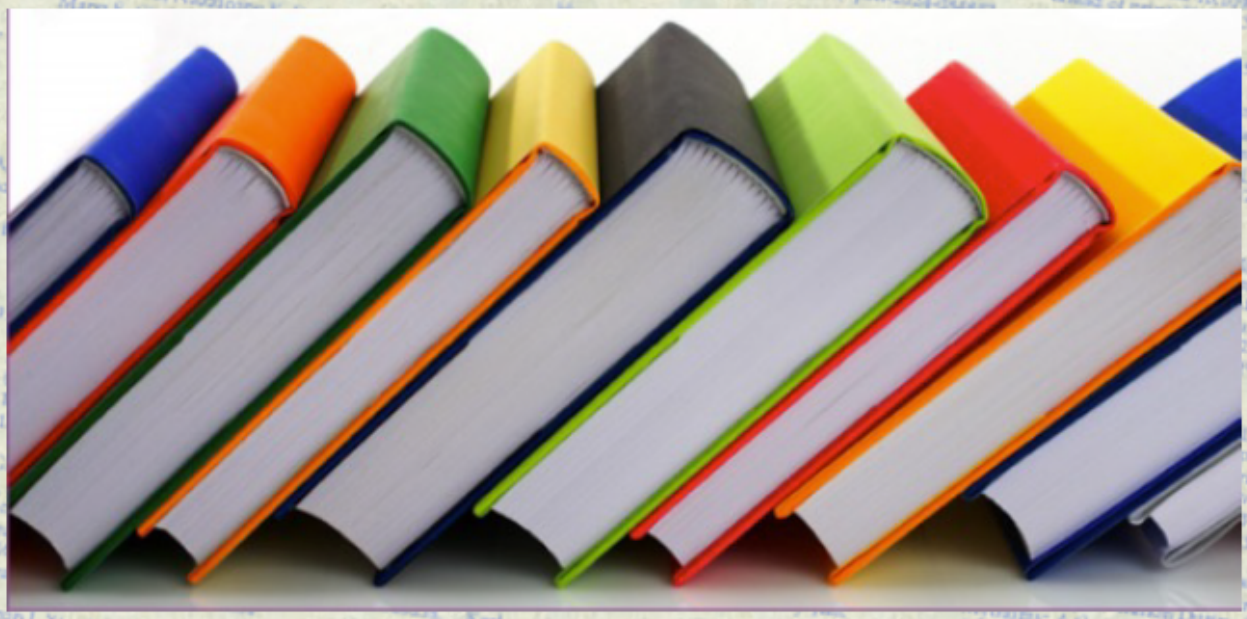
Queen's University

46th Annual Anesthesiology Research Day



Friday April 4, 2025 - Donald Gordon Centre, Kingston, Ontario

Queen's University
46th Annual Anesthesiology Research Day

Scientific Program Director and Residency Research Coordinator:
Ian Gilron, MD, MSc, FRCPC

Research Day Co-moderators:
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Daenis Camire, BScN, MD, MSc, FRCPC

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Institutional support:

• Queen's Department of Anesthesiology & Perioperative Medicine

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

Held on April 4, 2025 – Donald Gordon Centre, Kingston, Ontario, Canada.

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 – 1030 **Wellness break**

1030 – 1145 **Oral presentations (5)**

1145 – 1300 **Lunch on site**

1300 – 1345 **Oral presentations (3)**

1345 – 1430 **Wellness break**

1430 – 1530 **Oral presentations (4)**

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

Wine & Cheese to follow (Donald Gordon Center)

Oral Presentations (alphabetical order)

Azargive Saam, PGY-4
"Indications, Risks, and Management of Extubating Adult Patients Under Anesthesia"

Danielle Bourgeois-Lapiccirella, PGY-2
"Investigating usage and reducing wastage of nitrous oxide at Kingston General Hospital: a quality improvement initiative"

Alex Branco, PGY-1
"Exploring the Psychological Impact of Awake Intubation: A Scoping Review of Current Literature"

Toros Canturk, PGY-2
"Anterior Tracheal Injury Secondary to Sternotomy During Coronary Artery Bypass Grafting"

Stephanie Chevrier, PGY-3
"Remote Learning and Supervision of Ultrasound-Guided Nerve Blocks"

Geoffrey Kerr, PhD, Queen's M.D. Candidate
"A Systematic Review of Clinical Trials Involving Participants with Refractory Pain: Definitions, Interventions, and Evidence Gaps"

Eileen Kim, PGY-1
"Does Intermittent Bolus in Plane Block Catheters Improve Pain Control and Recovery? – Review and Quality Improvement Study"

Noah Letofsky, PGY-3
"Conversion from rapid atrial fibrillation to normal sinus rhythm after abdominal insufflation: A case report"

Vina Li, PhD Candidate, Queen's DBMS
"The role of glial cells in disease progression and symptoms in an animal model of multiple sclerosis"

Ryan Navarro, BSc, MD Candidate
"Diurnal pain rhythmicity in clinical trial participants with fibromyalgia: A comparison with neuropathic pain"

Taylor Perry, PGY-2
"Cardiac Changes after Effective Dose Carbetocin for Elective Caesarian Section "

Michael Pierce, PGY-1
"The spontaneously breathing patient undergoing video-assisted thoracoscopic surgery - feasibility study for a novel approach"

Hallie Prescott, PGY-1
"Regional Anesthesia for High-Risk Rib Fractures: Assessing Bleeding Risk in Anticoagulated Patients Receiving ESP Blocks"

Pat Price, PGY-2
"Perioperative Factors Influencing Early and Late Sternal Wound Infections in Cardiac Surgery Patients: A Retrospective Cohort Sub Study of the VISION Cardiac Study"

Doriana Taccardi, PhD Candidate, Queen's DBMS
"Circadian rhythmicity of symptomatic phenotypes in multiple sclerosis: is fatigue more important than pain to characterize MS?"

Jason Thompson, PGY-1
"Quantitative Analysis of Patient Experience Following Oral Awake Intubation: A Post-Procedure Survey Study"

Natalie Wilcox, MSc Candidate, Queen's DBMS
"Contribution of gut-derived γδ T cells to spinal cord injury"

Makenna Williams, BSc, MD Candidate
"Impact Of Participant Exclusion Criteria On Results Of Clinical Pain Trials"

Poster Presentations

Hailey Gowdy PhD Candidate, DBMS	**"Examining sex differences in the diurnal variability of thermal nociception"**
Mara Majer MSc Candidate, DBMS	**"Using dried blood spots to investigate rhythmicity in chronic low back pain: a feasibility study"**
Christina Meier BSc Candidate, DBMS	**"Rhythmic cell composition in a model of neuropathic pain"**
Ciara O'Connor PhD Candidate, DBMS	**"Sex differences in microglial circadian rhythms and their contributions to neuropathic pain rhythmicity"**
Amanda Zacharias PhD Candidate, DBMS	**"Transcriptomics implicate neutrophil activity in the rhythmicity and chronicity of low back pain"**
Ruilin Zhao MSc Candidate, DBMS	**"Galectin-9 regulation of neuro-immune responses in inflammatory pain"**

Title: **Indications, Risks, and Management of Extubating Adult Patients Under Anesthesia**

Dr. Saam Azargive; Supervisor: by Jordan Leitch
Collaborators: Anthony Ho, Daenis Camiré, Glenio Mizubuti

Background: Awake extubation may result in coughing and hypertension. Deep extubation, in which extubation occurs while the patient is deeply anesthetized, may promote a smoother emergence. There is, however, a paucity of literature on deep extubation in adults, and no evidence-based guidelines that establish indications or contraindications to this procedure.

Purpose: The following questions guided the development of this scoping review: In adults, 1) What are the indications for deep extubation? 2) What are contraindications to deep extubation? 3) What are the complications of deep extubation? 4) What techniques and protocols for deep extubation are available in the literature?

Methods: A scoping review in accordance with PRISMA standards, was performed. Electronic databases (*Medline, Embase, Cochrane Web of Science* and *CINHAL)*, were searched and 3243 articles were identified. After removal of duplicates, 2761 article titles and abstracts were screened. A total of 2711 articles were subsequently excluded, and 50 full text articles were reviewed. This scoping review reports on the findings of 25 articles.

Results: There were 8 RCTs, 1 observational study, and 8 case reports. Common inclusion criteria included aged ≥18 years old, American Society of Anesthesiologists physical status 1-3, and surgical indications to avoid wound dehiscence and improve recovery. Frequently listed contraindications in these studies included difficult intubation, obesity, high aspiration risk, and current respiratory infection. Volatile anesthetics, typically sevoflurane, were used in all studies. Opioids, such as remifentanil, were frequently used for improving extubation conditions, while dexmedetomidine also improved these outcomes with favorable cardiovascular measures. Propofol was not frequently discussed, and no study used a total intravenous anesthetic technique.

Conclusion: The quality of the literature is low. Surgical indications to extubate deep included ophthalmology, otolaryngology, neurosurgery and vascular surgery while contraindications included difficult airway, obesity, aspiration risk, respiratory disease. Technical components frequently described included pre-oxygenation, testing airway reactivity, use of oral pharyngeal airway, and changes in positioning. Pharmacological approaches described included volatile anesthetics alone or in combination with remifentanil, dexmedetomidine, propofol, but not IV agents alone. Complications such as laryngospasm, bronchospasm, and oxygen desaturation were rare and few groups had an awake extubation group for comparison.

Investigating usage and reducing wastage of nitrous oxide at Kingston General Hospital: a quality improvement initiative

Danielle Bourgeois-Lapiccirella, Dr. Christopher Haley and Dr. Jessica Burjorjee

BACKGROUND:

Nitrous oxide (N2O) has a significant impact on our environment. Its atmospheric life is approximately 120 years, with a global warming potential of 265[1]. Hospitals that have previously investigated their piped nitrous oxide systems have determined that a significant proportion of nitrous oxide is wasted, while only a small amount is used clinically. The source of waste can be leaks within the piped system, over-ordering, stock expiration, and theft, among others[2,3]. N2O wastage from leaks is so ubiquitous that multiple societies, including the Canadian Anesthesiologists Society, have recommended the "elimination of nitrous oxide pipelines in Canadian healthcare facilities"[4]. At Kingston General Hospital (KGH), we have begun the process of eliminating our N2O pipeline.

PRELIMINARY RESULTS:

In the spring of 2024, we surveyed the department of Anesthesiology at KGH using a qualitative survey and found that clinical usage of nitrous oxide was low. N2O is mainly being used for pediatric inductions, c/sections under general anesthetic, and to facilitate difficult IV starts in anxious patients.
We proceeded to a quantitative audit of both purchased N2O and clinical use of N2O at the KGH site and found that over a 17-week period, 22 K-tanks of N2O were purchased at KGH (338,000 litres), while our clinical usage audits of the anesthesia machines showed that we use approximately 500 litres per week, accounting for 8500 litres usage over a 17-week period. This equates to 2.5% of our supply being used clinically, with 97.5% wasted.
Now that we've determined the significant amount of wastage of N2O, we are in the process of working with KGH administrators and our maintenance team to decommission our N2O pipeline and use E-cylinders at point of care to provide N2O for clinical use.

Our primary metric for this project is to attain a goal of zero nitrous oxide wastage at KGH. Our secondary metric is clinician satisfaction.

REFERENCES:

1. Open Anesthesia. *Environmental Impact of Nitrous Oxide.* OpenAnesthesia.org. Updated May 2023. Accessed March 2024. https://www.openanesthesia.org/keywords/environmental-impact-of-nitrous-oxide/?search_term=nitrous%20oxide
2. YouTube. (2021, January 27). *Nitrous Oxide Mitigation: Launching the UK and Roi National Audit*. YouTube. https://www.youtube.com/watch?v=OreKYfF0d8s
3. Centre for Sustainable Healthcare. *The Nitrous Oxide Project*. (2022, April 21). Accessed March 2024. https://sustainablehealthcare.org.uk/what-we-do/sustainable-specialties/anaesthetics/nitrous-oxide-project
4. Canadian Anesthesiologists' Society. *Canadian Anesthesiologists' Society (CAS) Background Paper for the CAS Position Statement on reducing harmful emissions, waste and costs.* (2024).

Exploring the Psychological Impact of Awake Intubation: A Scoping Review of Current Literature

Name: Alex Branco, PGY1
Supervisor: Dr. Daenis Camire
Collaborators: Jason Thompson (PGY1), Courtney Svab (Health Sciences Librarian)

Background: Awake intubations have the potential to reduce morbidity and mortality in patients with anatomically and/or physiologically difficult airways [1,2]. While the procedure is often the safest option in certain clinical situations, its psychological impact, specifically the development of post-traumatic stress disorder (PTSD), remains underexplored. Existing literature on this topic is limited, highlighting a significant knowledge gap regarding the patient experience of awake intubation.

Objective: This scoping review aims to provide an overview of the current literature on whether patients develop PTSD after awake intubation in ED, OR or ICU settings. We seek to identify key themes, methodologies, and gaps in research that will inform the design of a prospective observational study.

Methods: A preliminary literature search identified 20 articles related to patient experiences around awake intubation. To ensure a comprehensive review, we are collaborating with a research librarian to refine and expand the search strategy. The final search will be conducted across multiple databases, including Embase, Medline, Web of Science, and Scopus. The primary outcomes of this review include patient experiences surrounding awake intubation, particularly incidence of PTSD or acute stress responses, as well as rates of recall following awake intubation, and the types of medications that are used to supplement local anesthetics (e.g. opioids, sedatives). Secondary outcomes include the skill level of the operator and the screening tool that is used to evaluate the patient experience.

Results and Discussion: We hope that this review will provide valuable insights into the psychological consequences of awake intubation and highlight the need for further research on PTSD in this patient population. The findings will serve as the foundation for a future prospective observational study, where we plan to interview patients using a validated PTSD screening tool after experiencing awake intubation.

Conclusion: To be determined

References:

1. Apfelbaum, J. L., Hagberg, C. A., Connis, R. T., Abdelmalak, B. B., Agarkar, M., Dutton, R. P., Fiadjoe, J. E., Greif, R., Klock, P. A., Mercier, D., Myatra, S. N., O'Sullivan, E. P., Rosenblatt, W. H., Sorbello, M., & Tung, A. (2021). 2022 American Society of Anesthesiologists Practice Guidelines for management of the difficult airway *. *Anesthesiology*, *136*(1), 31–81. https://doi.org/10.1097/aln.0000000000004002

2. Mosier, J., Joshi, R., Hypes, C., Pacheco, G., Valenzuela, T., & Sakles, J. (2015). The physiologically difficult airway. *Western Journal of Emergency Medicine*, *16*(7), 1109–1117. https://doi.org/10.5811/westjem.2015.8.27467

Anterior Tracheal Injury Secondary to Sternotomy During Coronary Artery Bypass Grafting

Toros Canturk, MD and Dr. Yannis Godoy, MD.

Introduction: While it is considered a rare complication, anterior tracheal injury is one of the potential complications in any cardiac surgery requiring median sternotomy. The incidence of this procedure is difficult to ascertain as the case reports in this area are very scarce [1-3]. Just like any acute insult to the ventilation, the management goals of tracheal injury include temporization, airway protection, finding an alternative to maintain oxygenation and ventilation, and repair of the defect.

Case Presentation: 69-year-old patient presented for an elective coronary artery bypass grafting in the context of severe multi-vessel coronary artery disease. Awake arterial line, 16-gauge IV and asleep central line were performed. The smooth IV induction and 8.0 oral endotracheal tube were performed. The skin incision and dissection were unremarkable, but the patient developed a significant leak after the sternotomy.

The circuit and cuff pressure were reassuring. The surgery team informed us of a potential tracheal injury. We immediately asked for the bronchoscope to visualize the tracheal lumen. 100% oxygen and increased flows were immediately performed to optimize the current ventilation. The ET-tube was advanced further to near Carina level. The leak stopped and ventilation improved with moving tube distal to the suspected defect. Careful retraction of the ET tube was performed with the bronchoscope to visualize the defect (Figure 1,2) and its potential complications including bleeding. The lumen had only a scant amount of blood. The thoracic surgeon repaired the 2 mm defect with 3 interrupted Vicryl sutures. The final leak test was reassuring. The rest of the procedure was unremarkable. The patient was extubated as expected in our cardiac surgery intensive care unit without any post-operative respiratory complications.

Discussion: The median sternotomy continues to be the most common incision for cardiac surgery. Anterior tracheal injury is a rare complication of any sternotomy and case reports informing its management are very few in the literature [1]. Depending on the extent and complications due to a tracheal injury, it is crucial to have urgent surgical consultation for emergency management. Here, we are sharing a case of successful temporization and management of a tracheal injury. Depending on the centre, the response time for surgical consultation from a thoracic surgeon may vary. Therefore, it is crucial to discuss temporizing steps to ensure oxygenation and ventilation for patients experiencing this injury. Our first step after determining that we were dealing with a potential tracheal injury with an intact cuff was to deflate and advance the cuff distal to the injury. In the setting of cuff damage, exchanging the ET tube would be prudent. If patients urgently require ventilation, advancing the ET tube distally to primary bronchus can be considered to use the tube like a cuff-less ET tube. After a successful temporization, working closely with the thoracic surgeon for the repeated assessment of the trachea is vital. Visualization also allows the determination of any intraluminal complications such as bleeding pre and post-repair. Case reports discussing the approach and reasoning of rare but catastrophic injuries are crucial resources in the management of such complications.

Remote Learning and Supervision of Ultrasound-Guided Nerve Blocks

Stephanie Chevrier, Glenio Mizubuti (Supervisor), Sandra McKeown

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. Furthermore, expert availability for one-on-one guidance has become 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: To perform a review of the current literature on remote learning and supervision of ultrasound-guided nerve blocks to gain insight on the feasibility of this method as a tool for real-time remote teaching and learning of standard-of-care nerve blocks.

Research Question: Is remote learning and supervision of ultrasound-guided nerve blocks an effective training method for teaching in medicine (students, residents, continuing education, etc.)?

Design and Methods: This study consists of a systematic review. In collaboration with a Health Sciences Librarian, an initial search strategy in the Embase, Web of Science, Medline and Cochrane databases yielded approximately 1500 results. These articles' titles and abstracts were screened with pre-established inclusion and exclusion criteria. Included articles focused on medical students, residents, fellows or practicing physicians who received training in ultrasound-guided nerve blocks remotely. The intervention of interest was synchronous remote learning and supervision methods for ultrasound-guided nerve block training (e.g. web-based platforms, virtual reality simulations, teleconferencing). The initial screening yielded 29 results, for which full-text reviews were undertaken. Study quality will be assessed, and data extraction of important themes such as knowledge acquisition, technical skills, procedural competency, patient safety, rate of complications and learner satisfaction relating to the effectiveness of remote learning and supervision methods will be undertaken. Future steps will involve dissemination of findings.

References:

1. Bowness, J.S. et al. (2022) "Exploring the utility of Assistive Artificial Intelligence for ultrasound scanning in regional anesthesia," Regional Anesthesia & Pain Medicine, 47(6), pp. 375–379. Available at: https://doi.org/10.1136/rapm-2021-103368.
2. Brouillette, M.A. et al. (2020) "Regional anesthesia training model for resource-limited settings: A prospective single-center observational study with pre–Post Evaluations," Regional Anesthesia & Pain Medicine, 45(7), pp. 528–535. Available at: https://doi.org/10.1136/rapm-2020-101550.
3. Burckett-St.Laurent, D.A. et al. (2016) "Teaching ultrasound-guided regional anesthesia remotely: A feasibility study," Acta Anaesthesiologica Scandinavica, 60(7), pp. 995–1002. Available at: https://doi.org/10.1111/aas.12695.
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5. Miyashita, T. et al. (2013) "FaceTime® for teaching ultrasound-guided anesthetic procedures in remote place," Journal of Clinical Monitoring and Computing, 28(2), pp. 211–215. Available at: https://doi.org/10.1007/s10877-013-9514-x.
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Title: **A Systematic Review of Clinical Trials Involving Participants with Refractory Pain: Definitions, Interventions, and Evidence Gaps**

Authors: **Geoffrey J. Kerr, Meg Carley, Dawn Richards, Robert Dworkin, Eva Kosek, Andrew Rice, Amanda Ross-White, Blair Smith, Nadia Soliman, Mark Wallace, Camilla Zimmermann, Ian Gilron***

Background:
Refractory chronic pain, defined as pain resistant to first- or second-line treatments, presents a complex challenge for people who live with it and for those who care for them. Patients with this condition face increased healthcare utilization and caregiver burden, yet they are sometimes excluded from randomized controlled trials (RCTs). This systematic review seeks to synthesize evidence from clinical trials focusing on this population to establish one or more useful and context-specific definition(s) of refractory pain, evaluate evidence for current interventions in this population, and identify methodological gaps in existing research.

Methods:
A systematic search of MEDLINE, Cochrane Central Register of Controlled Trials, EMBASE, and PsycINFO databases, and manual searches of reference lists of included studies and relevant review articles has been conducted using predefined search strategy to identify RCTs that include participants with refractory pain. The review will extract data on trial definitions of refractory pain, rationale for focusing on this population, pain conditions and interventions studied, and trial methodologies (e.g., randomization, blinding, outcomes). Risk of bias and quality of evidence will be assessed for each trial. Where feasible, treatment effects will be compared for refractory versus non-refractory populations.

Next Steps:
The review process will include a detailed extraction of definitions and criteria used for refractory pain across studies. We will categorize interventions and compare their efficacy and safety profiles. Methodological variations and potential biases will be systematically analyzed to provide a clear picture of current research quality.

Anticipated Study Implications:
This review will address the lack of a standardized definition for refractory pain, which may guide future research and clinical practice, and ultimately improve care for patients with refractory pain. By comparing the efficacy of interventions in this specific population, the findings will inform the development of tailored treatment strategies. Moreover, the evaluation of trial methodologies will highlight best practices and areas for improvement in the design of future RCTs involving patients with refractory chronic pain.

Does Intermittent Bolus in Plane Block Catheters Improve Pain Control and Recovery? – Review and Quality Improvement Study

Resident's Name: Eileen Kim PGY1
Research Supervisor: Dr. Van Zyl
Collaborators: Dr. Haley, Dr. Mizubuti, Dr. McMullen
Suggested Funding Sources: No funding required

Background:
Plan block catheters are increasingly utilized for postoperative analgesia in surgical patients. However, optimal local anesthetic delivery techniques remain unclear. While planned intermittent bolus (PIB) and continuous infusion (CI) regimens are commonly employed, conflicting evidence exists regarding their relative effectiveness in improving pain control and patient recovery. Prior reviews have lacked plane block-specific evaluations, creating a critical gap in clinical guidance.

Study Purpose:
This study aims to evaluate the comparative effectiveness of PIB versus CI regimens for plane block catheters in adult surgical patients. By synthesizing data from recent randomized controlled trials (RCTs), this review will inform best practices for postoperative analgesia and patient recovery metrics. This review will guide a subsequent QI study which will provide education and assess implementation on the delivery method that demonstrates superiority according to the current evidence.

Research Question:
In adult surgical patients receiving plane block catheters (Population), does a PIB regimen (Intervention) compared to a CI regimen (Comparison) result in improved analgesic outcomes (primary outcome), pain scores, and reduced opioid consumption?

Design and Methods:
Study design to determined (systematic review VS scoping review VS narrative review) based on literature search.

- **Search Strategy**: Comprehensive searches will be performed in PubMed, Embase, Medline, ClinicalTrials.gov, and Web of Science through December 2024
- **Inclusion Criteria**: RCTs comparing PIB versus CI regimens for plane block catheters in surgical patients, reporting pain scores, opioid consumption, and /or recovery metrics (e.g., QoR-15 scores).
- **Exclusion Criteria**: Observational studies, non-human studies, case reports, studies on non-plane nerve blocks, conference abstracts, and non-English publications.
- **Data Extraction**: Two independent reviewers will extract patient characteristics, study details, infusion parameters, and outcome measures.
- **Analysis**: Data will be pooled using meta-analysis where feasible; a narrative synthesis will be conducted for non-quantifiable outcomes. Risk of bias will be assessed using the Cochrane Risk of Bias II tool.

Conversion from rapid atrial fibrillation to normal sinus rhythm after abdominal insufflation: A case report

Letofsky, Noah (presenter); Cupido, Tracy (supervisor)

Background: Atrial fibrillation is a supraventricular arrythmia often associated with cardiovascular disease. Treatment for atrial fibrillation can include medications for heart rate control, and medications, ablation or electrical cardioversion with the attempt to restore sinus rhythm.

Background: While there are case reports of vagal nerve stimulation or valsalva maneuvers causing conversion from rapid atrial fibrillation to normal sinus rhythm[1], a literature search did not reveal reported cases in the literature of conversion from rapid atrial fibrillation to normal sinus rhythm after abdominal CO2 insufflation.

Case: We present a case of rapid atrial fibrillation during laparoscopic hiatal hernia repair surgery in which CO2 insufflation of the abdomen was associated with a return of normal sinus rhythm. We postulated possible explanations for this unexpected response to insufflation and offer ideas for how to proceed if faced with such a situation in the future.

1. Ruan C-H. Instantly Converting Atrial Fibrillation into Sinus Rhtyhm by a Digital Rectal Exam on a 29 year old male. *Clinical Medicine Insights: Case Reports.* 2010;3. doi:10.1177/117954761000300001

The role of glial cells in disease progression and symptoms in an animal model of multiple sclerosis

Vina W. Li1, Julia P. Segal1, Nader Ghasemlou1,2,3
1 Department of Biomedical & Molecular Sciences, 2 Department of Anesthesiology, 3 Centre for Neuroscience Studies, Queen's University, Kingston, ON K7L 3N6, Canada

Multiple sclerosis (MS) is a central nervous system demyelinating disease, with over 50% of people with MS (pwMS) citing pain as their primary symptom. PwMS often report a diurnal rhythm to their symptom intensities, including fatigue and pain. When normal circadian rhythms are disrupted by shiftwork schedules and sunlight hour shift at high latitudes, the risk of MS increases significantly. We therefore sought to investigate the role of circadian rhythms in pain and disease progression of MS using the experimental autoimmune encephalomyelitis (EAE) model. Female C57BL/6J mice (7-12 weeks old) were induced with EAE using myelin oligodendrocyte glycoprotein (MOG35-55) in complete Freud's adjuvant (CFA); sham mice received saline instead of MOG35-55. Pain outcomes were assessed at multiple days post-immunization using the von Frey, Hargreaves and acetone assay for mechanical, thermal and cold sensitivity respectively. Pain assays were carried out at multiple timepoints throughout the day (ZT2, 8, 14, and 20; where ZT0 corresponds to lights-on and ZT12 to lights-off). For mice tested only at peak disease, mice were behaviour-tested at ZT2 and 8, given an indomethacin injection, and tested again at ZT14. Flow cytometry, qRT-PCR and immunofluorescence were used to characterize demyelination, immune cell infiltration and immune activation in the spinal cord. The results show that mechanical hypersensitivity oscillates in a circadian pattern, with EAE mice experiencing greatest sensitivity to mechanical stimuli at ZT8. At peak of disease, pro-inflammatory cytokines IL-1β, TNF-α, IFN-γ, IL-6, and CCL2 exhibit a pronounced circadian pattern, with the lowest expression of the cytokines at ZT8. Spinal cord infiltration by activated monocytes and macrophages shows a circadian pattern with its trough at ZT8. Myeloid cell activation in the dorsal horn at peak disease also exhibits a circadian rhythm with lower levels of activation at ZT8 compared to other timepoints. Given the reciprocating circadian oscillations in mechanical hypersensitivity and neuroinflammation, their potential interactions were further validated. After indomethacin injection, EAE mice exhibited increased mechanical hypersensitivity at ZT14, similar to ZT8. Correspondingly, indomethacin injection reduced the inflammatory cytokine expression levels and increased myeloid cell ramifications. To investigate the role of circadian rhythms in lesion development, we assessed myeloid activation in the core and rim regions of spinal lesions. The data showed a circadian rhythm in the chronic phase of disease with ZT8 being the peak of lesion-associated myeloid activation. Our data shows, for the first time, that symptom and pathology follow a circadian rhythm in the EAE model of MS, which may be regulated by circadian rhythms of neuroimmune interactions. Interactions between the nervous, immune and circadian systems merit further investigation to determine whether modulating circadian rhythm could uncover novel therapeutic targets for managing symptoms and disease progression in MS.

Diurnal pain rhythmicity in clinical trial participants with fibromyalgia: A comparison with neuropathic pain

Authors: Ryan Navarro, Wilma Hopman, Ian Gilron (Research Supervisor)

Introduction: Fibromyalgia (FM) is a chronic pain condition affecting 2-8% of the population, characterized by widespread pain, fatigue, and sleep disturbances. Temporal pain patterns, well-documented in inflammatory and neuropathic pain (NP), are less studied in nociplastic pain conditions like FM. Previous research has shown diurnal pain variability in NP, with peak pain intensity in the evening, but studies on diurnal rhythms in FM are limited. Understanding diurnal pain patterns in FM may enhance treatment strategies by optimizing timing of interventions. This study investigates diurnal pain patterns, clinical determinants, and inter-condition comparisons to improve insight into nociplastic pain mechanisms. These findings aim to inform future research and clinical approaches to FM management.

Methods: This exploratory study analyzed data from three randomized-controlled crossover trials: IMPALA (n=27)1 and CADENCE (n=41)2 for FM, and PAIN CARE (n=55)3 for NP. All trials involved participants with chronic moderate-to-severe pain persisting for ≥3 months. Pain intensity, rated on a 0-10 numerical scale, was measured at 8:00 AM and 8:00 PM over a 7-day pretrial baseline period. Trials compared treatments, including alpha-lipoic acid (ALA), pregabalin (PGB), and their combination. Baseline data were pooled for FM cohorts, while diurnal rhythmicity during treatment was analyzed separately for each trial. Statistical analyses assessed morning-evening pain differences using paired t-tests and Wilcoxon Signed Rank tests. Clinical determinants, including age, weight, and pain interference with activities, were analyzed for correlation with diurnal variability using Spearman's correlation and ANOVA. Data analysis was conducted using IBM SPSS, with significance set at $p<0.05$.

Results: Baseline data revealed statistically significant diurnal pain rhythmicity in both FM and NP cohorts. Evening pain intensity was higher than morning pain, with FM showing a 7% increase and NP a 20% increase. Comparative analysis demonstrated that diurnal variability was significantly greater in NP than FM ($p=0.025$). During treatment, at maximally tolerated doses (MTD), patients with NP exhibited significant diurnal variation regardless of treatment. For patients with FM, ALA and PGB treatments reduced diurnal variation such that morning-evening pain differences were no longer statistically significant. However, the PGB-ALA combination in FM preserved significant diurnal rhythmicity ($p<0.001$), with higher evening pain intensity compared to morning. Clinical determinants of diurnal variation differed between conditions. In FM, older age was associated with greater morning-evening differences ($p=0.032$). In NP, higher weight and greater pain interference with walking and work were associated with reduced morning-evening differences ($p=0.013$, $p=0.044$, and $p=0.004$, respectively).

Discussion: This study provides evidence of diurnal pain rhythmicity in FM, with evening pain intensity higher than morning. While similar to NP, the amplitude of diurnal variation in FM was less pronounced. These findings highlight the potential role of central sensitization, neuroendocrine dysregulation, and peripheral mechanisms in FM's pain patterns that may contribute to the observed diurnal rhythmicity of pain. Recognizing diurnal rhythmicity has clinical implications for tailoring treatment timing, such as evening administration of sedating analgesics. Future studies should investigate diurnal pain variation using larger cohorts and frequent time-point assessments to confirm these findings and optimize chronotherapeutic interventions for FM.

Research supported by the Queen's University Summer Studentship.

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Cardiac Changes after Effective Dose Carbetocin for Elective Caesarian Section

Taylor Mouliakis Perry, Ashley Waddington, Jordan Leitch & Jessica Burjorjee

Background: Carbetocin is commonly used for the prevention of post-partum hemorrhage (PPH), and is recommended as a first line agent by the Society of Obstetrics and Gynecology of Canada for PPH prophylaxis in Caesarian section (CS). Currently dose recommendations are 100mcg of carbetocin for all patients undergoing elective CS1. However, recently evidence found the ED90 of carbetocin for the prevention of PPH in non-labouring, non-obese patients to be only 14.9mcg2. Despite its widespread use carbetocin is not without its side effects and disadvantages3. Previously recommended doses of the shorter acting oxytocin have been shown to cause coronary vasospasm, resulting in chest pain ECG changes and increased troponins. Similarly, chest pain is a reported side effect of the administration of the longer acting carbetocin, current studies found rates to be 2/52 after administration of 100mcg during elective CS4. Beyond subjective symptoms, carbetocin has been found to cause hemodynamic and ECG changes. Carbetocin has been associated with increases in heart rate, decreases in blood pressure and increases in the QTc interval when given at a dose of 100mcg4,5.

Rationale: Research into the subjective and objective cardiac changes after carbetocin administration is relatively sparse and mostly limited to doses of 100mcg. Given emerging evidence supporting lower doses of carbetocin for effective PPH prophylaxis, more data is required regarding the efficacy of low-dose carbetocin, patient reported side effects and objective markers of cardiac changes. In this study we will examine the rates of patient reported cardiac symptoms, ECG changes and troponin increases after administration of low dose carbetocin (50mcg) compared to standard dose carbetocin (100mcg). Further, we will examine the relationship between patient-reported symptoms and objective markers of cardiac changes (ECG changes and troponin increase). We believe that significant findings in this study may necessitate updating of the current recommend dosing of carbetocin. Finally, biochemical or ECG findings suggestive of cardiac changes after carbetocin administration would necessitate further study, as this may confer an increased risk of perioperative morbidity and mortality akin to that of myocardial injury after non-cardiac surgery (MINS), a known risk for vascular morbidity and death in the non-obstetric population6.

Study Design: This is a single-center double-blind randomized control trial that will determine rates of subjective cardiac symptoms, troponin increases and ECG changes between participants receiving 50mcg or 100mcg of carbetocin for PPH prophylaxis during elective CS. We will be including participants who are undergoing elective CS under neuraxial anesthesia and excluding those with an elevated BMI and those with pre-existing cardiac conditions. Participants will be randomized into two groups and will be given either 50mcg or 100mcg of carbetocin for PPH prophylaxis. Data surrounding patient reported symptoms, ECG changes and markers of PPH will be collected during the CS. On postoperative day one a troponin will be collected. Finally, a chart review will be conducted for relevant medical and obstetrical history including estimated blood loss and change in postoperative hemoglobin as a safety end point.

Current Progress: This project is currently under review by ethics. A CTAQ grant has been obtained for this project.

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The spontaneously breathing patient undergoing VATS - a novel approach (proposal)

Presenter: Dr. Michael Pierce **Supervisors:** Dr. D. Camire/Dr. A. Ho **Collaborators:** Dr. M. Bullen/Dr. A. Giles

Background: There is growing interest from the KHSC thoracic team in expanding non-intubated thoracic surgery (NITS) and the required anesthetic techniques. The literature suggests several benefits of performing NITS, including reduced ventilator-associated lung injury, improved postoperative respiratory function, and decreased risk of ventilator-associated pneumonia[1]. NITS requires advanced airway management techniques due to challenges such as patient positioning, excessive patient movements, hemodynamic instability, and rescue plans for desaturation and surgical complications[2]. Thus, patients with significant comorbidities, known difficult intubations, high aspiration risk, and unstable physiological states have typically been excluded from NITS due to the risks associated with the absence of a secure airway[2]. Up to 11% of NITS cases require conversion to intubated thoracic surgery as a result of desaturation, excessive patient movement, technical difficulties in achieving lung collapse, and the inability to control bleeding[3].

Our team contends that the main advantages of NITS are not from intubation avoidance but are from maintaining spontaneous breathing. We intend to overcome the difficulties of having to intubate a patient in the lateral position who is suffering from airway obstruction, desaturation, or from surgical complications (e.g., excessive bleeding). We propose to pre-intubate before turning the patient laterally, and allow spontaneous ventilation during surgery. This technique facilitates efficient transition to positive pressure ventilation and lung isolation, if needed. A secure airway also allows a deeper plane, thus reducing excessive patient movement. To facilitate lung isolation a bronchial blocker (BB) would be pre-loaded in the endotracheal tube (ETT) intraluminally during intubation and turned toward the operative side and be ready to deploy. Having an ETT in situ allows delivery of high flow O_2 through a T-piece with a long reservoir (+/- a PEEP valve at the end if necessary).

One of the problems with BB is retrograde migrate into the trachea, causing immediate total airway obstruction, loss of lung isolation, and the need to reposition it. This can be challenging as the patient is in a lateral position and the mishap could also frustrate efforts to stop a bleed. Ho et al. described a novel technique for pediatric[4] and adult[5] one-lung ventilation using a single-lumen ETT with a BB. In this method, the BB is passed through the Murphy eye of the single-lumen ETT and placed endobronchially. The tip of the ETT is positioned near the carina to prevent retrograde dislodgement. When pre-loading the ETT with the BB before intubation, the BB tip is made to slightly protrude from the Murphy eye. Once the clinical crisis is resolved, the BB can be deflated. Our approach, in short, is NITS without the "Non-Intubated" component and aims to expand the eligibility criteria.

To intubate while maintaining spontaneous ventilation, we will use the STRIVE-HI protocol (SponTaneous Respiration using IntraVEnous anesthesia and Hi-flow nasal oxygen)[6], utilizing propofol TCI to achieve adequate anesthesia, facilitating laryngoscopy while allowing the patient to continue breathing spontaneously. The STRIVE-HI method has been demonstrated to maintain oxygenation and airway patency[6].

Methods: This will be a prospective, observational case series involving 5-10 patients undergoing VATS with spontaneously breathing. During this process, we will administer GA using the STRIVE-Hi to a depth of PSI of 30-40 for ETT-BB pre-placement. Remifentanil will be used to control respiratory rate and maintain hemodynamic stability using propofol, remifentanil, and, if required, nitroglycerin, labetalol, hydralazine, or esmolol. Further, local anesthetic will be applied to the vocal cords and airway to facilitate endotracheal intubation.

Patients undergoing elective VATS deemed suitable for a spontaneously breathing approach. Suspected difficult intubation no longer needs to be an exclusion criterion.

Primary Outcomes: Successful completion of the procedure without conversion to conventional positive pressure ventilation and paralysis, intraoperative oxygenation stability, and postoperative complications.

Secondary Outcomes: Time to recovery/discharge, quality of surgical conditions, patient satisfaction.

Project Status: We are in the process of submitting an application for ethics approval.

Future Plans: If our technique is successful, a comparative trial will follow.

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Regional Anesthesia for High-Risk Rib Fractures: Assessing Bleeding Risk in Anticoagulated Patients Receiving ESP Blocks

Name: Dr. Hallie Prescott; Supervisor: Dr. Theunis van Zyl;
Collaborators: Dr. Glenio Mizubuti, Dr. Anthony Ho, Dr. Gregory Klar

Background: Effective analgesia for rib fractures is critical in reducing complications and mortality, particularly in elderly patients. Common management strategies include opioid-based intravenous patient-controlled analgesia (IV-PCA), thoracic epidurals, and peripheral nerve blocks. While thoracic epidurals have been shown to provide superior analgesia[1] as well as opioid-sparing benefits, they are contraindicated in anticoagulated patients due to the risk of epidural hematomas. Erector spinae plane (ESP) blocks have emerged as an alternative regional technique; however, there is a lack of clinical trials evaluating the safety of regional anesthesia in anticoagulated patients. Small observational studies and case reports have commented on the use of ESP blocks in anticoagulated patients with rib-fractures analgesia with no increased rate of bleeding complications.[2-3] Similarly, a retrospective observational study of ESP and fascial plane blocks in anticoagulated patients undergoing cardiac surgery—who are at high risk for bleeding—did not demonstrate an increased incidence of bleeding complications associated with regional anesthesia.[4] Our institution has implemented a rib fracture analgesia protocol prioritizing regional anesthesia for high-risk patients, with the goal of optimizing pain control while balancing potential bleeding risks. As a result, we have a patient population that can be observed to evaluate the safety of ESP blocks in anticoagulated patients and test this hypothesis.

Study Purpose: This study aims to assess the safety of ESP blocks in anticoagulated patients by evaluating rates of hematoma formation and other complications.

Research Question: Does anticoagulation increase the risk of hematoma formation in patients receiving ESP blocks for rib fracture analgesia?

Design & Methods: A retrospective chart review will be conducted on patients managed under our institution's rib fracture analgesia protocol since its recent implementation. Patient records will be reviewed to identify cases of hematoma formation and other relevant complications. Rates of hematomas will be compared between anticoagulated and non-anticoagulated patients to determine whether anticoagulation is associated with increased risk.

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Perioperative Factors Influencing Early and Late Sternal Wound Infections in Cardiac Surgery Patients: A Retrospective Cohort Sub Study of the VISION Cardiac Study

Pat Price, PGY-2; Supervisor: Dr. Joel Parlow

Abstract

Sternal wound infections (SWIs) remain a significant complication following cardiac surgery, with substantial impacts on patient outcomes and healthcare resources. This research aims to investigate the perioperative factors influencing SWI development using multivariable logistic regression. Our study will further categorize sternal wound infections into superficial and deep types, as well as those identified during the immediate postoperative period, versus those diagnosed after 30 days. The goal is to identify differential risk factors between these categories to guide targeted treatment, improved surveillance, and effective risk stratification strategies.

Circadian rhythmicity of symptomatic phenotypes in multiple sclerosis: is fatigue more important than pain to characterize MS?

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Rationale: Multiple sclerosis (MS) is a chronic autoimmune neurological disease with a variable prognosis and unpredictable course. Fatigue and pain are among the most common symptoms reported by people with MS (pwMS). Emerging evidence suggests substantial variability in the occurrence and intensity of MS symptoms such as fatigue (physical and cognitive), pain, and low mood and how they are perceived on a moment-by-moment and day-to-day basis. It is necessary to consider the influence of circadian rhythms (or, 24-hour cycles) when investigating variations in processes that have both a psychological and physiological component, such as fatigue and pain. Disrupted circadian rhythms can impact MS symptoms and may play a role in their daily fluctuations. Approved biomarkers for MS are mostly used for disease diagnosis and monitoring disease activity. The integration of biomarkers has revolutionized the management of other chronic conditions like cancer, where oncologists have been able to tailor treatment based on patients' molecular profiles. There is a need for more diverse biomarkers that can guide multi-disciplinary care and monitor common MS symptoms, like fatigue and pain. Altered circadian rhythms impact MS symptoms and may have a role in symptom variability and their intra-daily fluctuations. *Thus, understanding how circadian rhythms at the molecular and functional levels affect fatigue and pain in MS may help identify new therapeutic avenues*
Methodology: We hypothesize that pwMS exhibit altered circadian rhythmicity in fatigue and pain, and this variability is associated with immune biomarkers and self-reported symptoms. We assess MS baseline symptomatology by administering the CircaMS battery, including standardized MS questionnaires to assess fatigue, pain, and other psychosocial variables. We document ongoing intra-daily fluctuations in fatigue and pain by ecological momentary assessment (EMA, 10-day e-diary) both in a small cohort of pwMS in Kingston and in a larger cohort across Canada. Differential molecular profiles of key circadian genes and secreted immune mediators are identified at two times of day in a subset of pwMS.
Results: We have collected EMA and repeated blood samples from *N=21* pwMS in Kingston. Our national cohort has recruited *N=113* participants thus far; it is still open for recruitment across Canada. Our preliminary analysis shows that pwMS exhibited symptom variability, especially in fatigue compared to pain and mood. Symptomatic phenotypes are characterized in terms of rhythmicity, demographics, and scores in the CircaMS battery.
Discussion: Determining whether immune cell clocks are affected in MS may help to identify new biomarkers of this disease. Future studies will help 1) understand variability in MS symptomatology, including sex differences and disease severity; 2) identify biomarkers underlying the association between rhythmic symptomatology profiles and symptomatic phenotypes in MS; and 3) design bespoke interventions focused on symptomatology rhythmicity in MS. Extending this work is crucial to understanding how and why daily fluctuations in fatigue and pain occur in MS.

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Quantitative Analysis of Patient Experience Following Oral Awake Intubation: A Post-Procedure Survey Study

Presenters: Dr. Thompson PGY-1 and Dr. Alex Branco PGY-1; Supervisor: Dr. Camire

Funding: None

Introduction: Awake intubations are often performed in patients with anticipated difficult airways, or when it ensures safety for patients [1,2]. This procedure has the potential to be distressing and fear inducing for patients leading to possible post procedure trauma [3]. A preliminary review of the literature reveals a significant gap regarding the knowledge around the incidence of PTSD associated with awake intubations. We will perform a scoping review to help inform our methodology in designing a prospective trial addressing this research knowledge gap.

Purpose: Awake intubations are the safest, but hesitancy may be informing our practice around patients experiencing trauma through our intervention [4]. We already have patients experiencing trauma in their health care journey; and there may be a fear that we would be adding to this trauma through our anesthesia interventions. We want to determine if this suspicion of ours is founded in evidence-informed practice so that we can make the best decisions for our patients.

Method/Design: Prospective, observational study, which utilizes a post-procedure survey, validated in assessing PTSD, administered on a set point of time following an awake intubation (TBD). Contact with the patients would be conducted through a telephone call. Inclusion criteria: 1. Adult patients (ie. > 18 years old) 2. Operating Room, Intensive Care, or Emergency Department awake intubations. Exclusion criteria: 1. Asleep endotracheal intubation 2. Awake tracheostomies 3. Pre-existing diagnosis of PTSD. Our goal is to measure the primary outcomes: 1. Rate of PTSD after awake flexible scope intubation (FSI) vs. awake videolaryngoscopic intubation (VLI) 2. Rate of recall after awake intubation 3. Type of IV anesthetic used to supplement local anesthetic. Secondary Outcomes: 1. Skill level of the operator (ie. topicalizer or FIS/VLI operator) 2. Number of awake intubation attempts.

Results and Conclusions: To Be Determined

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Contribution of gut-derived γδ T cells to spinal cord injury

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Ciara D O'Connor, Nader Ghasemlou (supervisor)

INTRODUCTION: Spinal cord injury (SCI) is a life-altering condition caused by trauma to the spinal cord, often resulting in chronic pain [1] and motor dysfunction below the injury level [2]. There is a well-characterized pattern of immune cell migration to the injury site after SCI in both patients and research models, which is integral to the healing process and nerve regeneration [3]. However, this same immune response can contribute to secondary "bystander" injury wherein healthy tissue is damaged[4,5]. This secondary injury may contribute to the fact that the majority of people with an SCI experience mechanical hypersensitivity following the injury. Work in our lab has identified γδ T cells migrating to the site of SCI from the gut that may contribute to this chronic pain phenotype. γδ T cells are often over-looked given their small proportion of all immune cells. However, they play an important role in response to many neuroinflammatory conditions[6,7]. For example, γδ T cells exacerbated recovery in a model of traumatic brain injury by contributing to increased lesion volume and neuroinflammation via interactions with microglia[8]. Furthermore, bioinformatic studies have identified these cells as predictors of poor outcome in ischemic stroke[9]. Recent work has definitively shown that γδ T cells migrate from the small intestine to the meninges and brain at 3 days after transient occlusion of the middle cerebral artery[10].

METHODS: The migration patterns of immune cells will be assessed using the Kikume green red (KikGR) mice. KikGR mice are a photoconvertible model that enable the entire gut to be converted from expressing green fluorescent protein (GFP) to red fluorescent protein RFP, allowing the visualization of gut-derived cells throughout the remainder of the body[11]. SCIs will be performed using a standardized 50kdyn compression model using the Infinite Horizons Impactor. Cellular migration and morphological changes will be measured via immunofluorescent imaging and flow cytometry. Resiniferatoxin (RTX) injections will be administered at escalating timepoints to abolish sensory neurons to gain understanding of the role of sensory neurons in immune cell migration.

PRELIMINARY RESULTS: Preliminary work indicates that γδ T cells migrate to the site of SCI from the gut within 4hrs post injury in a sensory neuron dependent manner. Sensory neurons are necessary for γδ T cells to arrive in the spinal cord, but not to trigger them to leave the gut. γδ T cells are integral for the development of hypersensitivity in the acute period following SCI.

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IMPACT OF PARTICIPANT EXCLUSION CRITERIA ON RESULTS OF CLINICAL PAIN TRIALS

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Background:
Randomized controlled trials evaluating analgesics for chronic neuropathic pain often employ strict exclusion criteria, potentially limiting generalizability to real-world patients. In particular, exclusion of individuals with refractory pain—characterized by severe, longstanding, and pharmacoresistant symptoms (1) —may bias efficacy estimates and influence clinical prescribing patterns.
Purpose:
Many RCTs exclude patients with severe, longstanding, and pharmacoresistant pain, potentially leading to inflated efficacy estimates that do not accurately reflect real-world outcomes (2). By analyzing exclusion parameters such as pain duration, severity, concomitant medication use, prior failure of the study drug, and pharmacoresistant pain, this review aims to determine whether studies with stricter criteria report lower numbers needed to treat. The findings will help assess the generalizability of RCT data and highlight the need for more inclusive study designs to better inform clinical decision-making.
Methods:
284 randomized controlled trials and their associated efficacy analysis were identified and provided by the Neuropathic Pain Special Interest Group of the International Association for the Study of Pain (IASP). Studies were screened for exclusion criteria related to 1) pain duration, 2) pain severity, 3) use of concomitant analgesia, 4) previous failure of the study drug, and 5) pharmacoresistant pain (e.g., exclusion of patients unresponsive to an adequate trial of all drug classes indicated as first, second, or third line (2). Extracted data included study design, population characteristics, exclusion parameters, and efficacy outcome (NNT). Studies were then assigned a grade for each exclusionary parameter, and we compared the grade of exclusion to the determined efficacy of the study drug (NNT).
Results:
Preliminary findings suggest that trials with more restrictive exclusion criteria—particularly those excluding refractory pain patients—report higher treatment efficacy, reflected by lower NNTs. This trend highlights a potential bias in neuropathic pain RCTs, where study populations may not reflect the complexity of real-world patients with severe and treatment-resistant pain.
Conclusion:
Recognizing and addressing biases in study design is critical for improving the applicability of clinical trial data to everyday practice. Future research should consider the inclusion of broader patient populations in analgesic trials to ensure that reported efficacy outcomes better reflect the diverse and often treatment-resistant nature of chronic neuropathic pain. By critically evaluating how exclusion criteria shape trial results, this review aims to contribute to a more accurate understanding of analgesic efficacy and guide more evidence-based prescribing practices for neuropathic pain management.

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