Queen's University
42nd Annual Anesthesiology Research Day

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Ian Gilron, MD, MSc, FRCPC

Research Day Co-organizer:

Glenio Mizubuti, MD, MSc

Queen's Scientific Adjudicators and Moderators:

Rob Tanzola
MD, FRCPC

Tracy Cupido
MD, MPH, FRCPC

The Galway Visiting Lecturer: **Norm Buckley BA (Psych), MD, FRCPC**

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Research Nurse:
Jess Shelley, RN, BNSc, CCRP

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

Held on April 9, 2021.

Supported by Educational Grants from:

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VIRTUAL SCIENTIFIC PROGRAM OUTLINE

0800 – 0805 **Opening Remarks**

– Dr. Ramiro Arellano

0805 – 0815 **Research Day Introduction**

– Dr. Ian Gilron

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

0945 – 1000 **Wellness break**

1000 – 1130 **Oral Presentations (6)**

1130 – 1230 ***Virtual lunch on your own***

1230 – 1315 **Oral Presentations (2)**

1315 – 1400 ***Dr. Norm Buckley*****,**
Professor Emeritus, Department of Anesthesia, McMaster University
Scientific Director, Michael G. DeGroote Institute for Pain Research and Care
Scientific Director, CIHR SPOR Chronic Pain Network

"The story of a national Pain Research network, and the role of anesthesia in its leadership"

1400 – 1415 Q&A

1415 – 1430 Closing remarks

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

The Queen's Judges will be:

Dr. Rob Tanzola, Associate Professor, Queen's Dept of Anesthesiology & Perioperative Medicine

Dr. Tracy Cupido, Assistant Professor, Queen's Dept of Anesthesiology & Perioperative Medicine

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Oral Presentations (alphabetical order)

Marielle BALANASER, MD Candidate (Queen's)
Combination pharmacotherapy for the treatment of neuropathic pain in adults: A review update (proposal)

Courtney BANNERMAN, PhD Candidate (Queen's CNS)
The gut microbiome influences spinal cord injury pain outcomes (update)

*** Joint Presentation ***
Daenis CAMIRÉ, PGY-4 and Nick LAO, MD Candidate (Queen's)
Measurement of Movement-Evoked Pain versus Pain at Rest in Postoperative Pain Trials (update)

Jared COHEN, PGY-1
A Novel Treatment Approach to Complex Regional Pain Syndrome (CRPS): Combined Peripheral Nerve Block and Physiotherapy (proposal)

Mitra KNEZIC, MSc Candidate (Queen's DBMS)
Circadian rhythmicity of chronic low back pain (update)

Mohammed MOHIUDDIN, MD Candidate (Queen's)
Efficacy and safety of drug combinations for chronic pelvic pain: A systematic review (proposal)

Landon MONTAG, MSc Candidate (Queen's Centre for Neuroscience Studies)
Examining the Effects of Pain, Cognition and Emotion on Treatment Outcomes for Pain Management in an Interdisciplinary Chronic Pain Clinic (proposal)

Francis NGUYEN-DO, PGY-2
Improving perioperative analgesia for video-assisted thoracoscopic surgery (proposal)

Rex PARK, MD Candidate (Queen's)
Prevalence of Postoperative Pain Following Hospital Discharge: A Systematic Review (proposal)

Sergiy SHATENKO, PGY-2
Can a single day Focused Cardiac Ultrasound (FoCUS) training course for staff physicians with no prior FoCUS experience be used to successfully teach image acquisition, interpretation and integration? (proposal)

Vincent SO, MD Candidate (Queen's)
Association Between Postsurgical Pain and Heart Rate Variability: A Scoping Review (proposal)

Gursharan SOHI, MD Candidate (Queen's)
Nonopioid drug combinations for cancer pain (proposal)

Steve TRESIERRA, PGY-2
A Quality Improvement Project to Evaluate Preoperative Fasting at KHSC (proposal)

Theunis VAN ZYL, PGY-2
Improving rib fracture analgesia: Implementation of a standardized protocol (proposal)

Poster Presentations

An Institutional Policy Approach to Reduce Intraoperative Benzodiazepine Use to Prevent Delirium in Cardiac Surgery Patients
Thomas Stambulic

Combination Pharmacotherapy for the Treatment of Neuropathic Pain in Adults: A systematic review update

Marielle Balanaser[1], Meg Carley[2], Ian Gilron

ABSTRACT

Neuropathic pain is described as shooting or burning pain arising from a variety of etiologies. Chronic neuropathic pain causes significant morbidity in the general population each year, and lack of efficacious treatments increases strain on the finite resources of the Canadian healthcare system. First-line pharmacologic treatments for chronic neuropathic pain include antidepressant and anticonvulsant monotherapies, which are subtherapeutic and demonstrate dose-related side effects in many patients. Combination therapy has shown promise of providing superior pain management with fewer adverse effects to these patients. As an update of Chaparro et al.'s 2012[1] review, this on-going systematic review and meta-analysis seeks to combine data from eligible randomized controlled trials (RCTs) to arrive at a recommendation for combination therapy in the treatment of neuropathic pain. Electronic searches were conducted to identify RCTs of various drug combinations used in the treatment of neuropathic pain from CENTRAL, MEDLINE, EMBASE, and several trial registries. Included studies are double-blinded RCTs assessing combination therapy with two or more drugs compared to placebo and/or at least one single agent comparator used in the treatment of chronic neuropathic pain in adults. We have identified 16 eligible studies. Data extracted includes all study drug and combination therapy details, as well as data related to outcomes of efficacy, tolerability, and safety. Risk-of-bias assessment was conducted for all included papers using Cochrane risk-of-bias tool. Similar studies evaluating the same drug class combination will be combined and evaluated for potential new meta-analyses, as well as eligibility for addition to the opioid-gabapentinoid vs. gabapentinoid monotherapy meta-analysis done in the original review.

1. Chaparro LE, Wiffen PJ, Moore RA, Gilron I. Combination pharmacotherapy for the treatment of neuropathic pain in adults. Cochrane Database Syst Rev. 2012 Jul 11;(7):CD008943.

The gut microbiome influences spinal cord injury pain.

Courtney A Bannerman, Katya Douchant, Julia P Segal, Prameet M Sheth, Nader Ghasemlou

Introduction

Spinal cord injury (SCI) is a devastating injury to the central nervous system in which 60 to 80% of patients will experience chronic pain. Unfortunately, the pain is notoriously difficult to treat with options currently available today. Patients are also commonly faced with other compounding injuries and medical challenges, often requiring frequent hospitalization and antibiotic treatment. The microbiome has been shown to change after injury in both rodents and patients, referred to as gut dysbiosis.

Methods

Mice received a contusion injury (50 kdyn) injury with the Infinite Horizons impactor, and from day 1 to day 7 post-injury were gavaged with 150ul or either saline (control), microbial communities, or an antibiotic cocktail (kanamycin 4mg/mL, gentamicin 0.35 mg/mL, colistin 8,500 U/mL, metronidazole (2.15 mg/mL, and vancomycin 0.45 mg/mL). Their locomotor recovery (Basso mouse scale) and mechanical hypersensitivity (von Frey monofilaments) was accessed throughout injury. Fecal pellets were collected whenever locomotor recovery or hypersensitivity was accessed.

Results

Mice treated with the antibiotic cocktail showed a more serve onset of mechanical hypersensitivity than the saline and microbial community treated mice. However, not locomotor differences were observed between the 3 groups. These results suggest that the gut microbiome may play a role in the severity of SCI pain. It is possible that correcting gut dysbiosis could offer patients effective pain management and improved quality of life.

Systematic review of movement-evoked pain versus pain at rest in postsurgical clinical trials and meta-analyses: A follow-up review

Nicholas Lao, Daenis Camire, Amanda-Ross White, Tim Brennan, Henrik Kehlet, Jason Erb, and Ian Gilron

Background: Postoperative pain is one of the most prevalent and disabling complications of surgery that is associated with personal suffering, delayed functional recovery, prolonged hospital stay and chronic postsurgical pain. Previous studies have distinguished between pain at rest (PAR) and movement-evoked pain (MEP) after surgery. In most studies including both measures, MEP has been shown to be substantially more severe in intensity than PAR. Furthermore, since MEP is commonly experienced during normal activities (e.g. breathing, coughing, walking etc.), it has a greater adverse functional impact than does PAR. In 2011, a previous systematic review by Srikandarajah and Gilron, showed that only 39% of reviewed trials included MEP as a trial outcome and 52% failed to identify the pain outcome as either PAR or MEP. Consequently, an editorial in 2011 by Kehlet and Dahl confirmed that there has been no progress in the quality of assessment, despite the need to include movement-associated pain in perioperative analgesic trials was emphasised almost 20 years ago.

Study Question: In postsurgical pain treatment trials: 1) what is the frequency of use of pain at rest (PAR) versus movement-evoked pain (MEP) as a trial outcome, and 2) what methods are used to assess MEP?

Purpose of Study: Main data to be extracted will be:
1. Designation of movement-evoked pain as the trial primary outcome
2. Designation of pain at rest as the trial primary outcome
3. Distinction between movement-evoked pain and pain at rest in assessing pain
4. Method of evoking pain for the assessment of movement-evoked pain

Study Design: We will search the following electronic bibliographic databases: MEDLINE, EMBASE, The Cochrane Library (Cochrane Database of Systematic Reviews, Cochrane Central Register of Controlled Trials (CENTRAL), Cochrane Methodology Register). As a convenience sample of 2014-2019 postsurgical pain treatment trials, this review will be limited to thoracotomy, knee arthroplasty and hysterectomy surgical procedures involving humans and will focus on randomized controlled clinical trials and meta-analyses that report pain as a trial outcome. Articles will be excluded if they: are not randomized controlled trials, include a mix of surgeries, do not deal with outcomes following surgery, do not report pain scores, or report pain only after 1 week postoperatively. No analysis of subgroups is planned at this time.

Progress: A total of 1489 articles were reviewed across three surgery types with an estimated 17% of these results meeting inclusion criteria (N=249). Currently, the PROSPERO Review Protocol registration is complete. The Review Protocol has been published in JMIR Research Protocols. An update will be presented of the articles reviewed, including protocols for ongoing studies and how they've addressed this problem. Plans for future analysis including standard effect size calculations will also be discussed.

Limitations: Given that the focus of this review is on pain outcome measurement only, reviewed trials will not be evaluated with respect to trial quality or risk of bias. As the expected time in adopting recommendations from the previous 2011 systematic review is indeterminate, there may be potential for misrepresentation of earlier articles in bolstering analgesic trial methodology.

References:

Kehlet, H., and Dahl, J. B. (2011). Assessment of postoperative pain-need for action! *Pain*, *152*(8):1699-700. doi: 10.1016/j.pain.2011.03.013

Srikandarajah S, Gilron I. (2011). Systematic review of movement-evoked pain versus pain at rest in postsurgical clinical trials and meta-analyses: A fundamental distinction requiring standardized measurement. *Pain*, *152*(8): 1743-1739. doi:10.1016/j.Pain.2011.02.008.

A Novel Treatment Approach to Complex Regional Pain Syndrome (CRPS): Combined Peripheral Nerve Block and Physiotherapy – A Research Proposal

Dr. Jared Cohen
Supervisor: Dr. Tracy Cupido
Collaborators: Dr. Etienne Bisson, Tom Doulas, Dr. Scott Duggan, Dr. Christopher Haley, Rachel Phelan

Complex regional pain syndrome (CRPS) is a chronic, and often debilitating, pain condition. Development of CRPS is commonly associated with local trauma, such as a fracture, sprain, or surgery. However, many patients with CRPS will report only very trivial injuries to the area, or no injury at all. Patients with CRPS can develop a number of signs and symptoms of the condition, including hyperalgesia and allodynia, temperature changes in the limb, motor dysfunction, and limb edema[1]. The pathophysiology of CRPS is poorly understood. Some evidence has suggested that microvascular dysfunction and peripheral ischemia may play a key role in CRPS development[2].

The successful use of peripheral nerve blocks for CRPS has been reported in the literature[3]. Though the mechanism is not fully defined, vasodilation after a peripheral nerve block may improve microvascular dysfunction in the limb, and the analgesic effects may allow patients to more actively participate in physiotherapy. Unfortunately, there is very little quality evidence investigating the use of peripheral nerve blocks in CRPS.

This study will investigate the effects of a single-shot brachial plexus nerve block followed by physiotherapy, compared to physiotherapy alone, in patients with CRPS of the upper extremity. This will be a single-blind, two-armed, parallel, randomized control trial. Participants who meet Budapest criteria for CRPS will be randomized to either receive a single-shot axillary brachial plexus nerve block followed by an examination and manipulation of the limb by a physiotherapist, or receive no regional anesthesia. All participants will then complete a regimen of six weekly physiotherapy sessions, with an at-home graded motor imagery program.

The primary outcome measure will be limb range of motion. Secondary measures will include the CRPS Severity Scale and Patient Global Impression of Change scale. Participants will be assessed in these measures at baseline, and at week two, four, and six of physiotherapy.

We hypothesize that participants receiving the nerve block will have greater improvements in their range of motion and overall CRPS severity, compared to participants who underwent physiotherapy alone.

1. Shim, H., Rose, J., Halle, S. & Shekane, P. Complex regional pain syndrome: a narrative review for the practising clinician. *Br. J. Anaesth.* **123**, e424–e433 (2019).
2. Coderre, T. J. & Bennett, G. J. A hypothesis for the cause of complex regional pain syndrome-type I (reflex sympathetic dystrophy): Pain due to deep-tissue microvascular pathology. *Pain Med. (United States)* **11**, 1224–1238 (2010).
3. Detaille, V. *et al.* Use of continuous interscalene brachial plexus block and rehabilitation to treat complex regional pain syndrome of the shoulder. *Ann. Phys. Rehabil. Med.* **53**, 406–416 (2010).

Circadian rhythmicity in chronic low back pain

Mitra Knezic, Ana Constantin, Jesse Joynt, Elizabeth Brown, Daenis Camiré, Rosemary Wilson, Courtney Bannerman, Julia Segal, Cortney Haird, Tracey Stevenson, Chloé Nobis, Gabrielle Pagé, Scott Duggan, Etienne Bisson, Ian Gilron, Nader Ghasemlou

Low back pain is the leading cause of disability worldwide and affects 80% of individuals throughout their lifetimes. Although most cases are classified as acute, a considerable number of individuals develop chronic low back pain (CLBP) that persists for more than three months and results from either neuropathic or inflammatory origins. Previous work suggests that pain fluctuates over time, where neuropathic pain is most intense at night and inflammatory pain reaches a peak in the morning. Understanding fluctuations in pain intensity is central to a thoughtful clinical assessment and may provide clues to the underlying causes. Adults with CLBP as their primary complaint were recruited from a tertiary chronic pain clinic prior to intake assessment. Individuals were first asked to complete a baseline assessment of their pain and sociodemographic factors followed by a blood collection in the morning and evening to depict differences within a 24-hour period at the cell, mRNA, and protein levels. Ecological momentary assessment electronic diaries were used to track daily symptoms for 7 days, where participants rated their pain, mood, and fatigue on a 11-point numerical scale at 8:00AM, 2:00PM, and 8:00PM. While the majority of participants (n=63, 57% female, mean age=51± 14) displayed a constant pain profile, a subset (27%; nocturnal group) reported more intense pain at night relative to in the morning and a smaller group (13%; diurnal group) reported an inverse cyclical pattern (classified by percent change in pain score/day). Female participants with constant pain reported a significantly greater depressed mood and fatigue compared with their rhythmic counterparts. Upon examination of blood samples processed for a complete blood cell count with differential, males with nocturnal pain had a significantly reduced percent change in basophils when compared to both the constant and diurnal pain pattern groups. As there were no other significant differences in percent change of immune cells in the blood in the evening relative to the morning, it is possible that the behavioural effects of daily fluctuations in pain can be explained by an increase in activation of the immune cells rather than an increase in total cell number. We identified three differing patterns of daily pain intensity throughout the day in our population of adults with CLBP. As CLBP can arise from various inflammatory biological mechanisms which have been shown to have opposing rhythmic patterns, these findings may help influence future research and identify new therapeutic strategies to decrease or eliminate fluctuations in pain.

Efficacy and safety of drug combinations for chronic pelvic pain: A protocol for a systematic review

Mohammed Mohiuddin, Rex Park, Ursula Wesselmann, Caroline Pukall, Keith Jarvi, Curtis Nickel, R. Christopher Doiron, Ian Gilron

Background: Chronic pelvic pain (CPP) with various etiologies and mechanisms, affecting men and women, is a major challenge. Monotherapy is often unsuccessful for CPP, and combinations of different classes of medications are frequently prescribed, with the expectation of improved outcomes. Although a number of combination trials for CPP have been reported, we are aware of no systematic review of the available evidence on combination drug therapy for CPP.

Objectives: We have developed a protocol for a systematic review to evaluate available evidence of efficacy and safety for CPP.

Methods: This systematic review will involve a detailed search of RCTs investigating drug combinations to treat CPP in adults. The databases searched will include the Cochrane Central Register of Controlled Trials (CENTRAL), MEDLINE and EMBASE from their inception until the date the searches are run to identify relevant studies. The primary outcome will be pain relief measured using validated scoring tools, and secondary outcomes, where reported, will include: AEs, serious AEs, sexual function, quality of life, and depression and anxiety. Methodological quality of each included study will be assessed using the Cochrane Risk of Bias Tool.

Results: The systematic review defined by this protocol is expected to synthesize available good quality evidence on combination drug therapy in CPP, which may help guide future research and treatment choices for patients and their health care providers.

Conclusion: This review will provide a clearer understanding of the efficacy and safety for combination pharmacological therapy for CPP.

Abstract: Examining the Effects of Pain, Cognition, and Emotion on Treatment Outcomes in an Interdisciplinary Chronic Pain Clinic
Presenting author: Landon Montag

Supervisors: Dr. Tim Salomons & Dr. Etienne Bisson

Co-investigators: Dr. Scott Duggan, Dr. Christopher Haley, Dr. Rosemary Wilson, Dr. Ian Gilron

Introduction/Aim:
Patients' beliefs in their clinical team and expectations of pain relief may interact with drug effects to significantly impact chronic pain treatment outcomes. The proposed study will use a lidocaine infusion model to better understand how psychological factors can enhance and extend the treatment response. This study will also investigate whether central sensitization partially mediates the association between treatment beliefs and outcomes.
Methods:
Patients scheduled for a lidocaine procedure (N=94) at the Kingston Health Sciences Centre Chronic Pain Clinic will be recruited. Health- and pain-related measures, as well as scales examining therapeutic alliance, expectations of the treatment plan, and self-reported measures of central sensitization will be collected pre-treatment and 8 weeks post-treatment. Patients will also report their pain intensity three times a day for 8 weeks post-treatment to measure treatment response.
Data Analysis:
Comparative analyses and correlations will be performed to determine whether higher scores in measures of therapeutic alliance and expectations are associated with greater and longer lasting pain relief. Explanatory analyses will examine the degree to which other baseline measures provide additional explanatory power in helping us phenotype individuals receiving strong placebo effects from lidocaine infusion. A mediational analysis will also be conducted to determine whether central sensitization is a mechanism of the association between treatment related beliefs and treatment response.
Conclusions:
Ultimately, this proposed study may elucidate the role of expectancy effects in enhancing lidocaine infusion treatment outcomes and may allow for the optimization of clinical protocols to maximize these benefits.

Improving perioperative analgesia for video-assisted thoracoscopic surgery (VATS)
Francis Nguyen-Do, Ashley Furevick, Susan Vasily, Ken Reid, Kenneth Duncan

BACKGROUND:
The development of video-assisted thoracoscopic surgery (VATS) has offered improved mortality, morbidity, postoperative pain, reduced length of stay and improved postoperative pulmonary function compared to open procedures. However, VATS is still associated with significant acute and chronic postoperative pain. Inadequate analgesia may lead to splinting, inability to breathe deeply or cough, atelectasis, pneumonia and hypoxemia. Commonly used analgesic techniques include multimodal systemic analgesics and regional anesthesia.

This quality improvement project will use a Plan-Do-Study-Act approach to study our centre's current VATS perioperative pain management to identify areas of deficits and potential change ideas.

FRAMEWORK
Aim statement: We aim to decrease dynamic pain scores for patients undergoing elective VATS at time of PACU discharge and 24 hours post-operation by 30% by 12 months of project implementation.

Measures
Outcome measure: Dynamic pain scores at time of discharge from PACU and 24 hours post-operation. QoR15 survey scores.
Process measures: Percentage of VATS patients receiving preoperative analgesia, multimodal analgesia, regional anesthesia.
Balance measures: Regional anesthesia complications, post-operative complications, medication adverse effects.

BASELINE DATA
From September 2020 to December 2020, 19 VATS procedures were identified.

- Mean dynamic pain scores (DPS 0-10) were 5.6 and 3.6 at PACU discharge and 24-hours postoperatively, respectively.
- 14 patients had no documented dynamic pain score in PACU.
- Preoperatively, 36.8% received acetaminophen and 26.3% received a gabapentinoid.
- Commonly used intraoperative analgesics were long-acting opioid (89.5%) and ketamine (84.2%)
- No patients received preoperative NSAIDs and 15.8% received intraoperative ketorolac.
- Regional anesthesia was used in 74% of patients.

NEXT STEPS:
1. Identify barriers to PACU dynamic pain assessments and reinforce the importance of assessment and documentation.
2. Implement QoR-15 survey

CHANGE IDEAS:
1. Create infographic cognitive aid to be displayed in the presurgical clinic to remind physicians to consider preemptive, multimodal and regional techniques.
2. Inform PACU staff of QI initiative and reinforce the importance of pain assessments
3. Collaborate with thoracic surgeons regarding possible VATS analgesia order set.

Prevalence of Postoperative Pain Following Hospital Discharge: A Systematic Review (Proposal)

Authors: Rex Park, Mohammed Mohiuddin, Ramiro Arellano, Esther Pogatzki-Zahn, Gregory Klar, Ian Gilron

Background
Pain is one of the most common, feared, and unpleasant symptoms associated with surgery. However, there is a clear gap in patient care after surgical patients are discharged from hospital, resulting in poorly controlled postoperative pain. Inadequate pain management after discharge can have detrimental effects on quality of life and lead to the development of chronic postsurgical pain. The severity of postoperative pain before discharge is well described, but less emphasis has been placed on assessing pain at home after hospital discharge.

Objective
The objective of this review is to summarize the prevalence of moderate-to-severe postoperative pain within the first 1 to 14 days after hospital discharge.

Methods
A detailed search of epidemiological studies investigating postoperative pain will be conducted on MEDLINE and EMBASE from their inception until the date the searches are run. The primary outcome will be the proportion of patients reporting moderate-to-severe postoperative pain at rest and with movement within the first 1 to 14 days after hospital discharge. The secondary outcomes will include a comparison of postoperative pain after discharge between patients who underwent ambulatory and inpatient surgery, and adverse outcomes attributable to poor pain control after hospital discharge (eg, readmission to hospital, emergency room or other unplanned medical visits, or a decrease in quality of life).

Results
The protocol has been registered in PROSPERO (registration number CRD42020194346). The search strategies for MEDLINE and EMBASE have been completed. The final results are expected to be published in December 2021.

Conclusion
This systematic review is expected to synthesize evidence describing the prevalence of postoperative pain after hospital discharge. Available epidemiological evidence may help inform the magnitude of the problem of postoperative pain at home after hospital discharge.

Focused Cardiac Ultrasound training as continuing medical education (CME) for staff physicians

Sergiy Shatenko, Glenio Mizubuti

Purpose: Point-of-care ultrasound (POCUS) has become ubiquitous and indispensable in multiple specialties including critical care, emergency medicine, internal medicine, and more recently anesthesia. POCUS is now being taught in almost all anesthesia residency programs across Canada, however this is a fairly recent development with many staff physicians having finished their training before the introduction of ultrasound in the Anesthesiology curricula across Canada. As such, there is a need for practicing physicians to acquire these skills. More specifically Focused Cardiac Ultrasound (FoCUS) is arguably the most useful scan for the perioperative physician. We want to investigate if a FoCUS training course for staff physicians with no prior FoCUS experience can be used to successfully teach image acquisition, interpretation and integration with retention of knowledge 2 years after.

Methods: We will recruit 50 staff clinicians from hospitals across Eastern Ontario. A pre-workshop questionnaire and test assessing baseline knowledge will be administered followed by a single day POCUS workshop. At the end of the workshop, a practical exam on a standardized patient will be administered to the study participants, evaluating image acquisition, interpretation and clinical correlation. A repeat questionnaire and test will also be administered at the end of the workshop. Finally, 2 years after the completion of the workshop, the participants will be asked to re-write the post-workshop test and complete a questionnaire about their current use of POCUS.

Results: Pending.

Conclusion: Pending.

Title: Association Between Post-Surgical Pain and Heart Rate Variability: A Scoping Review

Authors: Vincent So, Marielle Balanaser, Gregory Klar, Jordan Leitch, Michael McGillion, PJ Devereaux, Ramiro Arellano, Joel Parlow, Ian Gilron

Abstract:

Introduction:
Surgical interventions can elicit neuroendocrine responses and sympathovagal imbalance, affecting cardiac autonomic function. Cardiac complications account for 30% of post-operative complications and are the leading cause of morbidity and mortality following non-cardiac surgery. One cardiovascular parameter, heart rate variability (HRV), has been found to be predictive of post-operative morbidity and mortality. HRV is defined as variation in time intervals between heartbeats and is affected by autonomic balance. Furthermore, altered HRV has been shown to predict cardiovascular events in nonsurgical settings. In multiple studies, experimentally induced pain in healthy humans leads to reduced HRV suggesting a causal relationship. In different studies, chronic pain has been associated with altered HRV, however, it remains unclear how much HRV impairment is due to pain itself versus autonomic changes related to analgesia.

Objectives: We will review the available evidence describing the association between post-surgical pain and HRV alterations in the early post-operative period.

Methodology: We will conduct a scoping review of relevant studies using detailed searches of MEDLINE and EMBASE, in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA). Included studies will involve participants undergoing non-cardiac surgery and investigate outcomes of: 1) measures of pain intensity; 2) measures of HRV; and 3) statistical assessment of association between #1 and #2. As secondary review outcomes included studies will also be examined for other cardiovascular events and for attempts to control for analgesic treatment and pre-surgical HRV differences amongst treatment groups in the analysis.

Preliminary Results: We conducted a detailed search on MEDLINE and EMBASE. Detailed searches were conducted from the inception of the database until the date the searches were run. The search included terms related to heart rate variability, post-surgical pain, non-cardiac surgery, and relevant cardiovascular outcomes. There were 230 articles retrieved. Following abstract review, 22 articles are eligible for full-text review. Full-text review and data extraction is currently in progress.

Conclusion: In summary, this scoping review will explore the association between HRV and post-surgical pain. Depending on the identified studies and the data available, associations between HRV and post-surgical cardiovascular outcomes may also be assessed, with the overall aim to inform future research questions to better understand cardiovascular outcomes following non-cardiac surgery.

Title: Nonopioid drug combinations for cancer pain: a systematic review

Authors: [1]Gursharan Sohi[§], [2]Augusto Caraceni, [3]Dwight E. Moulin, [4]Camilla Zimmermann, [5]Leonie Herx, [1]Nicholas Lao, [1,6-8]Ian Gilron*

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[4]Division of Palliative Medicine, Department of Medicine, University of Toronto, Toronto, Canada;
[5]Division of Palliative Medicine, Department of Medicine, Queen's University, Kingston, Canada;
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[7]Centre for Neuroscience Studies, Queen's University, Kingston, Ontario, Canada;
[8]School of Policy Studies, Queen's University, Kingston, Ontario, Canada.

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

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

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

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

A Quality Improvement Project to Evaluate Preoperative Fasting at Kingston Health Sciences Centre

Resident name: Steve Tresierra
Research Supervisor: Dr. Stacy Ridi
Collaborators: Behar Entezari
Suggested funding sources: None

Research Question:
The purpose of this study is to evaluate our current preoperative fasting policy at Kingston Health Sciences Center and to implement strategies to reduce prolonged fasting in the preoperative period. Our goal is to have 50% of KHSC elective patients consuming clear fluids between 2-4 hours preoperatively and to reduce median clear fluid fasting times to 6 hours.

Introduction
Fasting in the preoperative period centers around patient safety and reducing the risks of aspiration under general anesthesia. The practice of "nil per os" or nothing by mouth after midnight has been a common practice in anesthesia for several decades. Recent changes in fasting guidelines have called this tradition into question. The current Canadian Anesthesia Society guidelines recommend that "Unless contraindicated, adults and children should be encouraged to drink clear fluids (including water, pulp-free juice, complex carbohydrate beverages, and black tea or coffee up to two hours before elective surgery. Pediatric patients should also be encouraged to consume clear fluids as defined, up to one hour before elective procedures."[1] Despite advances in our fasting guidelines, a recent audit of 72 patients presenting for elective surgical procedures at Kingston Health Sciences Centre revealed that nearly 70% of patients were outside of our target window of consuming clear fluids within 2-4 hours prior to surgery. Our quality improvement project will evaluate barriers contributing to prolonged fasting times and implement strategies to encourage clear-fluid consumption preoperatively. Our goal is to have 50% of patients presenting for elective procedures to consume clear fluids between 2-4 hours preoperatively and to reduce median clear fluid fasting times to 6 hours.

Proposed study design
This study will be conducted as a quality improvement project. Our next step will be to perform a more extensive evaluation of recent fasting times for patients presenting for elective procedures. We will record the duration of fasting from when the patient was NPO to the anesthesia start time. The information collected will be used to determine current barriers or misconceptions, leading to prolonged fasting times. We will then implement strategies to reduce our fasting duration preoperatively. Our plan is to educate members of the multidisciplinary team on the new fasting guidelines so that a clear consensus is established, and patients will be provided with concise fasting instructions. By educating members of the team, we plan to have pre-operative clinics encouraging clear fluid consumption up to 2 hours prior to surgery. For patients awaiting surgery, we plan to encourage communication between the OR and SDAC to give patients clear fluids when their surgery is delayed. We also plan to provide laminated instruction sheet to clinical areas to provide clear instruction and images of appropriate clear fluids. Following the implementation of these strategies we will be collecting data on clear fluid fasting averages prior to surgery to assess for change.

Improving rib fracture analgesia: Implementation of a standardized protocol

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Supervisors: Dr. Chris Haley & Dr. Greg Klar
Co-investigators: Dr. Anthony Ho, Dr. Glenio Mizubuti, Ashley Furevick

Rib fractures are a serious medical injury with high rates of complications including mortality, intubation, and ICU stays. Rib fractures are often managed with regional anesthesia techniques such as epidural placement for analgesia and improved respiratory function. Currently at KGH there is no protocol or evidence based guidelines available for management of rib fracture patients. This project will be a quality improvement project conducted at Kingston General Hospital. The project will complete a 1-year retrospective chart review of all rib fracture patients at KGH during the year of 2020. Data will be collected on all rib fracture patients, and whether or not high risk patients were seen by the Acute Pain Management service, and managed with evidence based best practices for analgesia. Evidence based guideline will be developed and distributed for Thoracics, Nursing and Anesthesia for rib fracture patient management. The guideline will identify patients at high risk of respiratory complications and suggest involvement of APMS, as well as providing guidelines on pain management for APMS. Post implementation data will be collected to determine if there have been improvements in the number of high risk rib fracture patients consulted to APMS and managed with appropriate analgesic interventions.

Critical Appraisal Essay

By: Jesse Chen, PGY1, Anesthesiology and Perioperative Medicine

Publication title: '***Stress Management Training improves Overall Performance during Critical Simulated Situations***'

Authors: F. Sigwalt, G. Petit, J. Evain, D. Claverie, M. Bui, A. Guinet-Lebreton, M. Trousselard, F. Canini, D. Chassard, A. Duclos, J. Lehot, T. Rimmele, M. Lilot

Anesthesiology 2020; 133: 198 – 211

Introduction

The ability to perform under crises is vitally important to the practicing anesthesiologist. Teaching residents how to perform effectively under stress is therefore an important aspect of an anesthesiology training program. This article was selected for a critical appraisal because it highlights a unique way residents can learn to maximize their potential and their performance in stressful situations. It follows intuitively that acute stress leads to a decrease in cognitive capabilities (previously termed 'cognitive overload').7 This cognitive overload contributes to a significant decrease in clinical performance.4 Therefore, the ability to manage acute stress effectively can be theorized to decrease cognitive overload and improve performance. This may have an additional impact on other relevant stress-related disorders such as sleep disturbance, depression, and burnout.2

Simulation-based training (SBT) was developed as a way for medical learners to practice crisis management skills without the consequences of a real emergency.5 Currently at our institution, junior residents are exposed early on to SBT as way to learn crisis management. However, there is minimal exposure to stress management training. As well, many stress management strategies exist but no study has yet attempted to elucidate its utility specifically for anesthesiology trainees. This paper describes a technique developed by the French Armed Forces called 'Tactics to Optimize the Potential (TOP)' (Figure 1) as a novel method to reduce stress and improve performance in anesthesiology trainees undergoing SBTs. Studies have shown the effectiveness of TOP in the military field8 and it is hypothesized that similar benefits could be derived in the realm of anesthesia training. Testing this hypothesis may provide evidence-based insight on the usefulness of stress management techniques in improving trainees' crisis resource management which is a critical aspect of anesthesiology practice.

Techniques	Description	Goal
Mental projection of success	Technique to positively approach any difficult or stressful situation in an optimal state. It is the mental anticipation of a perfectly executed action, whether occurring the next day or months in the future. It is based on the representation of the subject to himself and the situation to which he is (or will be) confronted. This technique is often used in professional sports.	Energizing activation
Mental rehearsal[17]	A boosting technique. Mental repetition, while in a state of relaxation, of an action that has been performed before. When engaging in mental rehearsal one imagines performing without having to actually do anything.	
Revitalizing breathing[43]	Breathing technique based on inspiration lasting four times longer than expiration. This technique is better when performed in the standing position, with arms stretched to the sides in a "T-body formation." The expiration must be quick and the revitalizing breathing cycle repeated 10 times.	
Psychophysiological dynamization	A physical warm-up combined with a mental preparation performed immediately before an essentially physical activity. This technique uses the following principles: alternating tension-muscle relaxation, respiratory rhythm favoring relaxation, synchronous breathing, and alternating gesture-recovery.	
Activation level regulation	Derived from psychophysiological dynamization. A technique to maintain or to return to the desired activation level (optimal performance zone) during an activity, which may include breaks where the action is less intense. This technique combines relaxation or warm-up exercises with imaging strategy.	Regulation
Positive reinforcement	Envisioning a previous success (positive or pleasant event) while in a state of relaxation. It is a technique which increases the frequency of appearance of a desired behavior owing to the appearance of a pleasant stimulus.	
Mental imagery[44,45]	Symbolic representation that allows learners to cognitively process objects momentarily or permanently, absent from their perception. Mental imagery consists of mentally picturing a situation or an action by integrating the maximum of relevant sensitive elements (in particular kinesthesia, sight, and hearing).	
Cardiac coherence biofeedback[21]	Breathing modulates the autonomic nervous system regulation of the heart rate. Exhalation boosts the parasympathetic tone leading to a decreased heart rate. Conversely, inhalation decreases the parasympathetic tone resulting in an increased heart rate. Cardiac coherence biofeedback regulates heart rate variability by applying standardized breathing (6 breaths/min).	
Muscular relaxation	Based on the tension–relaxation response: focused muscle contraction and relaxation of different target muscle groups, usually starting with the feet and moving up to the head.	Recovery
Breathing relaxation[43]	A very simple relaxation breathing exercise based on expiration lasting four times longer than inspiration. This may be performed in a standing, sitting or supine position. It may be repeated during several minutes.	
Paradoxical relaxation	Focused attention on different parts of the body using imagery to optimize muscle tone (relaxed, tense). The objective is to focus on and understand the physical and psychological events that interfere with achieving profound relaxation.	
Postural relaxation	Relaxation technique designed to reduce painful muscle contractions due to prolonged heavy loads in order to accelerate recovery.	
Sensory relaxation[21]	Inspired by the autogenic training[46] and based on the use of different senses in order to relax. This can be practiced through simple meditation or reflection on pleasant mental images or sounds. Modern approaches include watching a video or listening to a recording.	

For more details, refer to the book written by Dr. Perreaut-Pierre entitled "Comprendre et pratiquer les Techniques d'Optimisation du Potentiel," InterEditions.
Here are few web links suggested for further details about Tactics to Optimize the Potential applications, all accessed March 30, 2020:
https://www.youtube.com/watch?v=1-ODfP6gdMU (Short presentation of Tactics to Optimize the Potential, subtitles available in English on YouTube)
https://www.youtube.com/watch?v=iMeD_Ce2vYw (Subtitles available in English on YouTube)
https://www.coevolution.fr/presentation-en/ (Tactics to Optimize the Potential training, English version available)
https://www.optimisermonpotentiel.fr/ (French website about Tactics to Optimize the Potential)

Figure 1. Elements of 'Tactics to Optimize the Potential'

Methodology

This study was a prospective randomized controlled trial of 128 anesthesiology and critical care resident trainees from Lyon University in France who were enrolled in a high-fidelity simulation program during the 2016-2017 academic year. The sample size was sufficient given the niche population in focus. The number of participants is typical of an anesthesiology training program and therefore is similar to our own practice. No exclusion criteria was applied which is reasonable given its similarity with the target population in question. Participants were subject to a stratified randomization process by a blinded investigator according to postgraduate year (1 to 5). They were selected into two parallel arms (TOP vs control). This study was ethically sound as approval was obtained from the French Ethics Review Board (Comite de Protection des Personnes) prior to its commencement and all participants were consented verbally and through writing.

The experimental protocol consisted of a series of 4 simulation scenarios representing various critical incidents in anesthesia and critical care medicine targeted to a specific postgraduate level (20 different scenarios in total). Those in the TOP arm participated in an additional 6 training sessions in the weeks leading up to the simulation designed to introduce them to 'Tactics to Optimize the Potential' and how to engage in its stress management strategies. Those in the control group received no such training prior to their simulation. During the simulation, the TOP arm were provided a 5min 'TOP reactivation' exercise prior to each of their scenarios. The control arm were instructed to complete an unrelated mental exercise in those same 5min time periods (i.e. interpreting various laboratory results unrelated to the scenario). Clinical performance was evaluated by a clinical scenario-specific task checklist, the Ottawa Crisis Resource Management Global Rating Scale,3 and the Team Emergency Assessment Measure (TEAM) Score .1 Subjective stress levels were also evaluated pre and post stress management training by the visual analog scale (VAS) of perceived stress. Those in the TOP arm were also asked to evaluate the technique's utility and usefulness.

The study's primary endpoint was mean overall performance according to the sum of the clinical performance, Ottawa Scale, and TEAM score. Secondary endpoints were the individual scores plus VAS stress rating. Statistical analyses were performed for both primary and secondary endpoints by independent t tests with an intentional to treat basis. Additionally, an analysis of covariance was performed to account for the individual scenarios as a cofactor.

In conclusion, the experimental protocol is highly reproducible because of the detailed description and commonly used standardized scoring. However, the description of how the 'Tactics to Optimize the Potential' program is taught and performed is not well elucidated. In the paper's appendix, a description of training goals is highlighted but the specific way that one can achieve those goals is not described (see Figure 1). Additional videos and links are included but these are all in the French language and not easily accessible to an English audience. On the other hand, the assessment of clinical performance through three separate scoring systems (with at least two clinically validated scores) is comprehensive. Statistical analysis with independent t testing is also reasonable given the study design. Since this was a novel randomized control trial, no prior methodology validation exists.

Results

Of the 134 randomized participants, 66 were randomized to the TOP arm and 68 to the control arm. Five individuals in the TOP arm did not participate in the TOP sessions and were therefore excluded from the study. In the control group, one individual declined to participate. In the end, 61 participants were analyzed in the experimental arm, and 67 in the control arm.

The percentage of those who had exposure to prior simulation training was balanced (48% vs 52%). There was a balanced percentage of age and gender as well. However, 11% of the TOP group had had prior exposure to stress management techniques compared to 21% in the control group. Therefore, the 2 arms of the study were similar enough to be comparable.

The main result of the study was that overall performance was 9% greater in the TOP group as compared to control. There was no significant difference between TOP and control when
evaluated by the clinical performance score. However, the Ottawa Scale score was 11% higher in TOP vs control. Similarly, the TEAM score was 8% higher in the TOP arm. With regards to the perceived stress VAS, there was no significant difference in perceived stress prior to the TOP training but the perceived stress was 17% lower in the TOP arm as compared to the control arm after TOP training. However, there was no difference in VAS scores pre- or post-scenario (Figure 2).

	Tactics to Optimize the Potential (n = 61)	Control (n = 67)	*P* Value	Difference (95% CI)	Effect Size (95% CI)
Primary endpoint					
Overall performance*	59 ± 10	54 ± 10	0.010	5 (1–9)	0.50 (0.16–0.91)
Secondary endpoints					
Performance in high-fidelity simulation					
Clinical specific performance, points	48 ± 11	44 ± 11	0.073	4 (0–8)	0.34 (–0.05 to 0.74)
Ottawa Global Rating Scale score, points	29 ± 6	26 ± 6	0.011	3 (1–5)	0.49 (0.10–0.90)
Team Emergency Assessment Measure score, points	39 ± 9	36 ± 8	0.049	3 (0–6)	0.38 (0.01–0.80)
Psychometric data after specific preparation†					
After specific preparation VAS of stress, mm	52 [42–64]	63 [50–73]	0.005	–10 (–16 to –3)	0.44 (0.26–0.59)
Postscenario VAS of stress, mm	29 [21–50]	33 [21–55]	0.330	–4 (–12 to 4)	0.28 (0.10–0.44)
Postdebriefing VAS of stress, mm	12 [3–24]	13 [9–27]	0.293	–2 (–8 to 2)	0.29 (0.11–0.45)
VAS–stress reduction, mm	54 ± 25	30 ± 27	< 0.0001	24 (14–34)	0.92 (0.52–1.32)
VAS–simulation performance, mm	51 ± 22	26 ± 26	< 0.0001	25 (16–34)	1.04 (0.64–1.44)

Figure 2. Main Primary and Secondary Endpoints of the Study

Adequate details of the various performance scores are shown but not of the various VAS scores at the numerous timelines as indicated in the study. Only pre- and post-TOP training VAS scores are included in the result tables. Additionally, no data was displayed of the participants' perceived ease-of-use and efficiency-of-use of TOP training even though this data was collected.

Discussion & Critique

The main conclusion of this study is that stress management training, specifically 'Tactics to Optimize the Potential' leads to a significant improvement in performance of trainees in simulated critical emergencies. The results demonstrate that while overall mean performance is improved, it is not because of an improvement in clinical performance but rather an improvement in crisis resource management and non-technical aspects of clinical care. These results are a direct answer to the stated purpose of the study. The authors explain these results by positing that stress management does not compensate for a lack of clinical knowledge but might help to mobilize resources already stored in memory and optimize the cognitive, social, and personal skills that contribute to safe and efficient task performance. These results are novel in that no study has yet investigated the effect of stress management training in clinical performance.

There are, however, a few limitations to this study. Firstly, this experiment was performed in a structured simulated setting with ample time for stress management 'reactivation' prior to performance. In a real clinical setting, where emergencies are often unpredictable and unexpected, one can wonder if such training will continue to be beneficial. Furthermore, the control arm participated in a 5min evaluation of labwork prior to their scenario in contrast to training reactivation in the TOP arm. This might not be a null intervention since the interpretation of complex labwork can exacerbate stress in trainees. Finally, although the study collected data on subjective stress, more objective data on stress (i.e. heart rate variability, salivary cortisol) could add to the interpretation of the results. This data is easily measured.
This paper also opens many avenues for future research. I for one wonder about the usefulness of stress management training in an actual clinical setting. As well, it would be helpful to elucidate the long-term clinical performance of repeated stress management training in residency. Anesthesiology training is an invariably stressful experience –residents are quickly thrown into critical emergency situations during their training. Would early and serial training in stress management augment this steep learning curve? Could there be long term benefits post-residency for trainees that are adept in managing their own stress? There are numerous stress management techniques published in various sources. 'Tactics to Optimize the Potential' is a single technique. More research could be done on these various other techniques to elucidate the most effective training regimen. Nonetheless, the results of this study are significant enough to question whether stress management training either pre-residency or during residency can help new trainees deal with critical events. It may be possible that even a brief overview of stress management can help 'cognitively overloaded' residents deal with that 2am call to a devastating trauma or a 'Code 99 Anesthesia to Connell 5'.

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Critical Appraisal

By: Devin Stirling, MD, PGY-1, Queen's Anesthesiology & Perioperative Medicine

"***Body Habitus and Dynamic Surgical Conditions Independently Impair Pulmonary Mechanics during Robotic-assisted Laparoscopic Surgery***."
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Introduction
In 2000, the ARDSNet study popularized lung protective ventilation with the demonstration that lower tidal volumes decreased mortality in ventilated patients with acute respiratory distress syndrome and acute lung injury [1]. Since that time there has been increased attention to ventilator settings and how these can impact patient outcomes. Positive end expiratory pressure (PEEP) is used routinely in patients undergoing mechanical ventilation to decrease atelectasis, however most anesthesiologists set PEEP at a relatively arbitrary value, such as 5cmH_2O, as a standard of practice. With the knowledge that ventilator settings can impact patient outcomes, it is important to understand how to optimize these settings for our patients. In particular, the optimal PEEP for a patient is likely to change depending on surgical and patient factors, especially in cases of obesity or pneumoperitoneum where the lungs have external pressures causing increased atelectasis. It is therefore important that we gain an understanding of how to optimize PEEP for individual patients in various circumstances to prevent lung trauma.
This study examines the effects that surgical conditions of pneumoperitoneum and steep Trendelenburg, as well as patient Body Mass Index (BMI) have on airway mechanics of patients [2]. The authors aimed to delineate the changes in pulmonary mechanics based on BMI and surgical factors. They hypothesized that increasing BMI would be associated with increased atelectasis, increased driving pressures and elevated lung elastance, which would all be exacerbated by pneumoperitoneum and Trendelenburg positioning. They used this data to calculate "Optimal PEEP" (o-PEEP) for individual patients at each surgical stage studied.

Methodology
This study utilizes a cross-sectional observational design to measure airway and esophageal pressure (Pes) along with tracheal gas flow to calculate multiple pulmonary mechanics in patients of various BMI categories at different stages of abdominal robotic surgery. The authors then calculate the o-PEEP and compare how this differs depending on BMI category, positioning, and abdominal insufflation. The o-PEEP is calculated using the formula o-PEEP = set PEEP – end expiratory transpulmonary pressure to find an end expiratory transpulmonary pressure of 0cmH2O, where transpulmonary pressure = airway pressure – Pes.
The trial was registered at clinicaltrials.gov, however, registration was filed following study completion rather than prior to data collection and analysis.

Results
The study enrolled 99 patients, of which 8 were excluded from the analysis. The main results are those that relate to the o-PEEP. O-PEEP ranged from 0 – 36.6 cmH2O through the different surgical stages and BMI categories. At each stage o-PEEP was increased for subjects with BMI 30 or greater compared to BMI less than 25. For BMI less than 30 o-PEEP increased with pneumoperitoneum

compared to baseline, whereas it increased in all subjects with the addition of Trendelenburg and robot docking compared to baseline. When desufflated o-PEEP estimates returned to baseline levels.

Discussion

The study authors conclude that due to significant alterations in lung mechanics from high BMI and surgical conditions PEEP may need to be individualized, potentially to high pressures, based on these factors.

The findings at first seem to support the role for personalized PEEP based on Pes monitoring, with patients calculated o-PEEP in the study ranging from 0 to as high as 36.6 cmH20 depending on surgical stage, position, and BMI. There are a few assumptions that are made in interpreting this data however – the biggest of which is that the Pes is directly equal to the pleural pressure (Ppl). The authors find the o-PEEP in the study using the formula under the assumption that Pes is equal to Ppl. While often used as a surrogate for Ppl, the assumption that Pes equals Ppl for the purpose of determining o-PEEP in this study is problematic for a few reasons. It has previously been found that there are regional changes in pleural pressure – meaning that Pes can only estimate the Ppl at one locus of the lung whereas other zones are either over- or under-estimated [3]. This makes the assertion of a single calculated value for o-PEEP less convincing with this method as it only considers the mechanics of a small portion of the lung and may not be optimal for other areas. Additionally, previous studies measuring Ppl and Pes simultaneously have shown that Pes can significantly overestimate Ppl, and that this difference varies with position [4]. Changes in position displace surrounding structures, such as those in the mediastinum, in relation the esophageal catheter which may produce the variable relationship between local Pes and Ppl [5]. This makes direct comparisons of Ppl via measurement of Pes in different positions more nuanced than the study assumptions account for and may affect the analysis of the effects of positioning. With this is mind the calculation of o-PEEP used in this study may in fact be overestimating the true o-PEEP in some instances, which, if followed blindly in a clinical setting could potentially lead to barotrauma in ventilated patients. Another assumption is that the calculation of non-negative trans-pulmonary pressures accurately predicts the prevention of alveolar closure and reopening, however some studies have suggested that alveoli closure may happen at even slightly positive trans-pulmonary pressures [6].

Even if the study's o-PEEP truly decreases atelectrauma, the question remains if this produces a clinically significant improvement in respiratory outcomes. There has been evidence to show that Pes guided PEEP settings may increase oxygenation and compliance and even have a mortality benefit, however this has been in the setting of ICU patients with acute lung injury or acute respiratory distress syndrome and was found in a rather small study of only 61 patients in supine with head elevated to 30 degrees [7]. Whether this also holds true of patients in the intraoperative setting and various surgical positions remains to be seen. It must also be considered that high PEEP can have other deleterious effects such as decreased venous return to the heart and decreased cardiac index [8], making it important to not use a measure such as the o-PEEP in isolation in determining appropriate ventilatory settings. In conducting the study, patients were excluded if they had a smoking history of 20 pack years or more, or nearly any respiratory condition besides obstructive sleep apnea. These exclusion criteria are understandable for an initial study examining the question at hand, however, investigation in these patient groups is needed as these are the patients at high risk of post-op pulmonary complications which this method of personalizing PEEP would aim to prevent. Different lung diseases also affect the lung physiology in different ways, and it would be important to classify these separately and determine which groups may benefit from this kind of intervention to allow for personalization of PEEP and those patient groups in which this may provide an inaccurate target.

Conclusions

This paper is important to highlight a knowledge gap in anesthesia practice. While many anesthesiologists have been trained to use arbitrary PEEP values, this study challenges that practice and gives a potential method to individualize PEEP for patients. However, more work needs to be done to determine the clinical significance of PEEP personalization in the operating room, and to further confirm the accuracy and validity of the use of Pes to guide PEEP settings before widespread adoption of this method should be encouraged.

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