Introduction
Percutaneous edge-to-edge mitral valve repair using the MitraClip device represents a novel, less invasive treatment option for patients with symptomatic severe mitral regurgitation [1]. Percutaneous tricuspid valve repair has been described as technically feasible in patients with severe functional tricuspid regurgitation unsuitable for surgery [2]. This case report describes a patient who received both procedures at the same intervention.

Methods and Results
A 80-year-old woman with previous history of hypertension, atrial fibrillation, multiple previous TIA’s was referred to the Structural Heart Clinic for evaluation of valvular disease due to progressive functional decline and peripheral edema. Upon work up she was found to have severe tricuspid regurgitation and moderate mitral regurgitation. She underwent a Mitraclip procedure and a tricuspid clip procedure at the same intervention under general anesthesia with transesophageal echocardiography guidance. The patient tolerated the procedure well. She was extubated at the end of the procedure and discharged from the intensive care unit on post-operative day 1. A post-operative transthoracic echocardiography showed mild mitral regurgitation and mild to moderate tricuspid regurgitation.

Discussion
MitraClip procedure has become a more acceptable technique for high-risk patients with severe mitral regurgitation with over 15,000 cases done worldwide. Recently percutaneous tricuspid valve repair became an alternative for patients with severe symptomatic tricuspid regurgitation and high risk for surgery, however very few cases of simultaneously tricuspid and mitral valve repair have been reported.

References:


Implementing a new electronic medical record (EMR) system at an academic health institution is an expensive endeavor. Certain factors may improve this transition and allow for productivity similar to pre-implementation status sooner. Our institution has had an EMR since 2000 and an Anesthesia Information Management System (AIMS) in the perioperative environment since January 2002. A systematic review of previously reported EMR implementations from 2000-2011 demonstrated negative impacts including changes to workflow and work disruption. Mixed observations were found on EHR quality, adoption and satisfaction.1 Another systematic review specifically addressing EMR implementations in hospitals demonstrated recommendations based on content, context, and process.2 Our objective was to investigate which factors allowed to increase provider comfort level in the transition to a completely new EMR system. Factors that increase provider level comfort in the implementation of a new EMR system in the perioperative environment has not been investigated or published.

Methods:
After obtaining Institutional Review Board approval, anesthesia providers were selected for participation from a large academic health system implementing the EPIC system. One week prior to implementation, a pre-implementation survey was sent to all anesthesiologists and nurse anesthetists. Each survey respondent was given a unique identifier. Following a three-month transition period, a follow up survey was sent to all pre-implementation survey respondents. Respondents were given a $5 coffee card for completing each survey. Survey responses from those who responded to both surveys were analyzed. Analyses were conducted using Stata v12 (College Station, TX).

Results:
The response rate for the pre-survey was 54% (87/160). The pre-implementation survey elicited information on length of experience as an anesthesia provider,
knowledge with the EPIC system, provider comfort level, and factors which would make adoption to the new system easier at the front end. The response rate for the post-survey was 75% (65/87). Factors which were most significantly increased provider level comfort were repetitive use and interaction with a Super User. Having an on-site trainer, shadow charting, playground environment, and a training checklist were less helpful (.23-.36) than originally speculated.

Discussion:
EMRs offer tremendous potential to improve quality, productivity, and outcomes in patient care, but they also represent one of the most significant and expensive changes healthcare organizations may undertake. Implementation of a new EMR in the perioperative environment poses many unique challenges. We have identified factors which may make this transition smoother from a provider and cost standpoint for an academic health center or organization.

References:
Introduction: Multiple cardiovascular emergency medications (CEM) are recommended to be ready to use before cardiac anesthesia induction (1). The objective of this study was to assess the effect of pharmacy preparation of four CEM in terms of utilization, waste, and economic impact (2).

Methods: Ethics approval was waived for this quality improvement study. A three phase design was used: Pre-pharmacy (2 weeks): anesthesiologists prepared all CEM; Pharmacy (5 weeks): Pharmacy prepared 4 CEM; and Post-pharmacy (2 weeks) anesthesiologists prepared all CEM. Anesthesiologists were free to use CEM independently. A CEM kit with four medications stable for seven days was prepared for every single case by the hospital pharmacy. Each kit contained glycopyrrolate (0.2 mg/ml, one syringe 2 ml), ephedrine (5 mg/ml one syringe 10 ml), phenylephrine (100 mcg/ml, two syringes of 20ml) and norepinephrine (16 mcg/ml one 250 ml bag).

Outcomes: Medications administered were obtained from the electronic anesthesia record. Residual CEM were collected at the end of the case and only full syringes and bags minus one syringe load for boluses were considered waste. The cost of CEM administered and wasted was compared between phases.

Results: Only direct costs were analyzed. Medication used was collected in 153 cases (Pre=41, Pharmacy=73 and Post=40). The estimated cost of CEM administered was C$ 7,017.09 (C$ 45.86 per case). There were no differences in proportion of cases receiving any CEM between phases. Phenylephrine cost was significantly lower during pharmacy phase (Pharmacy C$6.75 ±3.46, Pre: C$ 4.23 ± 3.46, p < 0.001). Other medications did not show cost differences between phases. There were significant differences between anesthesiologists and total CEM cost (χ²(9) =26.13, p =0.002). The waste information was collected in 70 cases (Pre=27, Pharmacy=35, Post=21). The estimated cost of the CEM wasted was C$ 1,420.93 (C$ 20.29 per case). There were no differences in CEM waste between phases although there was an increasing trend during the pharmacy phase related to vasopressin use. Approximately one-quarter (26.3%) pharmacy CEM medications were returned unused and used for another case, with projected savings of C$7,674.00 for 1,000 cases.
**Conclusion:** Waste of CEM in cardiac anesthesia is substantial with a projected direct cost of C$20,290.00 per 1,000 cases in a year. Pharmacy preparation of CEM seems to be cost effective increasing the medications expiration.

**References:**


Introduction: Several indices have been recently used to monitor nociception intensity under general anesthesia (GA), most of them based on a single parameter. The PMD monitor (Medasense Biometrics, Israel) uses the NOL index, a multiparametric index derived from heart rate (HR), HR variability, plethysmograph wave amplitude, skin conductance, skin temperature and its fluctuations. The index ranges from 0 (no pain) to 100 (max pain). The PMD monitor has been recently shown to have a high sensitivity and specificity to discriminate nociception under GA. With the latest version PMD-200, we tested the NOL response during noxious stimuli at various doses of remifentanil (RF). The hypothesis was an inverse correlation between RF dose and NOL alteration.

Methods: After Ethic Committee approvals, 26 patients received desflurane-RF based GA with an epidural analgesia (EA) for laparotomy. A tetanic stimulation was applied to the forearm of the patients at 4 RF doses (0.005 μg/kg/min before and after EA loading, 0.05 and 0.1 μg/kg/min). Intubation and incision were processed at 0.05 μg/kg/min RF dose. Pre- and post-stimulation NOL mean values were compared. ROC curves were constructed to assess the ability of the individual parameter to discriminate between noxious and non-noxious state at RF 0.005 μg/kg/min. Correlation between RF dose and post-stimulation NOL values was assessed.

Results: AUC for discrimination between noxious and non-noxious states for NOL was 0.92 vs 0.69, 0.71, 0.64 for HR, MBP and BIS respectively. Pre-stimulation NOL values ranged for 5 to 8 with no significant difference when RF infusion increased. Post-stimulation values at RF doses of 0.005 before and after epidural load, 0.05, and 0.1 μg/kg/min were, respectively, 24, 21, 14 and 7, significantly higher than the pre-stimulation values (p< 0.0083). Post-stimulation values significantly decreased when RF dose was higher. Correlation test between NOL values and RF doses was r = -0.584 (p< 0.0001).

Discussion: In this study, NOL index was the only parameter responding to all noxious stimuli under general anesthesia, regardless to RF dosage. NOL was better for discriminating a noxious from a non-noxious state compared to single measures. NOL values after stimulus decreased with the high dose of RF, showing a significant inverse correlation between opioid dose and NOL index. The high sensitivity and specificity of the NOL index in this study suggests it has great potential as a monitor of nociception intensity during anesthesia.
**References:**


Receiver operating characteristics curve analysis: discrimination of experimental noxious stimulus period from non-noxious stimulus period at minimal remifentanil dosage (0.005 mcg/kg/min). NOL: Nociception Level index; HR= Heart Rate; MBP= Mean arterial Blood Pressure; BIS= Bispectral index.
INTRODUCTION
Administration of anesthetics depends on the surgical noxious stimulation in general anesthesia, in particular the analgesics. While the heart rate (HR) and blood pressure readings displayed on the patient monitor provide convenient information for anesthesiologists, those readings are too static to quantify the noxious stimulation or the transient changes of the physiological status. For example, by reading the HR information, it is not easy to acquire the opposite impacts of noxious stimulation on the autonomic nerve system -- the tachycardia is caused by sympathetic activation, while noxious stimulation often elicits a transient bradycardia lasting less than 10 seconds via vagal activation. It has been well known that the heart rate variability (HRV)\(^1\), which quantifies the above-mentioned transient change or more generally the time-varying beat-to-beat intervals, serves as a portal to study the autonomic nerve system. However, traditional HRV analysis techniques are short of quantifying the dynamical information in the time varying beat-to-beat intervals\(^2\), particularly the transient heart rate change after the noxious stimulation\(^3\). This drawback limits the application of HRV analysis in clinical anesthesia. We show that this kind of transient heart rate changes caused by noxious stimulation can be detected and quantified by using a modern “time-varying power spectrum” technique, and the quantification can help differentiate several types of noxious stimulation.

METHODS
The study was approved by the local institutional Research ethics Board and written consents were collected. We conducted a prospective observational study by enrolling patients undergoing laparoscopic cholecystectomy. The physiologic recordings, including the electrocardiogram (ECG), was collected from the Philips Intellivue\(^\text{TM}\) patient monitor. We simultaneously recorded the accurate timestamps of noxious anesthetic events, including the moments of endotracheal intubation, skin incision and the insertion of laparoscopic trocar. A modern time-varying power spectrum called concentration of frequency and time (ConceFT)\(^4\) is applied to analyze the beat-to-beat HR data from the ECG recording.

RESULTS
We analyzed data from 17 patients to obtain the preliminary results. The beat-to-beat HR data showed that the transient bradycardia is prominent right after different kinds of noxious stimulations, including endotracheal intubation, surgical skin incision and...
the insertion of laparoscopic trocar(Fig.1). The results indicate that the "time-varying HRV indices" derived from the time-varying power spectrum performs best for detecting noxious stimulation. The results also showed that the action of laparoscopic trocar insertion produces a stronger transient bradycardia than the other types of surgical noxious stimulation.

DISCUSSION
Using ConceFT, we can quantify the transient HR change during noxious stimulation. This hidden information inside the ECG could differentiate different types of noxious stimulation; particularly, we could classify the transient HR responses by the somatic and visceral pain.

References:

Demonstration and analysis

Subfigure A: representative beat-to-beat heart rate shows the transient bradycardia lasting less than 10s at the moment of noxious stimulation. It is more obvious during trocar insertion than skin incision. Arrow1: laparoscopic trocar insertion; Arrow 2: skin incision; Arrow 3: trocar insertion at the other site. Subfigure B,C: The serial prediction probability analysis shows better discrimination of various indices than the standard heart rate readings on the patient monitor (OHR). The Trocar insertion (subfigure C) is more prominent than the laparoscopic skin incision (subfigure B)
285352 - CONVERTING PULSE OXIMETER TONE OUTPUT TO PLAY MUSICAL INSTRUMENTS VIA MUSICAL INSTRUMENT DIGITAL INTERFACE (MIDI)

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Introduction
Medical instruments such as pulse oximeters use sound to convey important information to personnel in the operating room. These sounds are a useful way of communicating continuously, however, multiple devices outputting simultaneously can create a distracting, and difficult to distinguish, cacophony of sound. Multiple Instrument Digital Interface (MIDI) is a standard communication protocol used in the music industry. It allows for interfacing multiple devices together and for the use of powerful software tools to control these devices. To utilize the advantage of MIDI in the operating room, an adapter for a clinical Masimo Radical 7 pulse oximeter was developed in order to convert the pulse rate and SPO2 data to MIDI format. The result is the ability to connect the pulse oximeter to any music recording software directly and is the first step towards integrating an audio standard for all devices in the operating room.

Methods
The design of this novel device was exempt REB approval. A novel device termed the “Pulse Oximeter-to-MIDI Output” (POMO) was developed. The device consists of an Arduino Mega, RS232 Shield a MIDI-to-USB converter, a custom circuit, and 3D printed case. The ASCII data from a Masimo Radical 7 is transmitted via RS-232 from the RS-232 port on the pulse-oximeter to the Arduino shield. This data is then transmitted to the Arduino which has been programmed to convert the information into a corresponding pitch and tempo. This pitch and tempo are then used to create MIDI commands that are transmitted via a MIDI-to-USB converter to a computer running GarageBand. A case for the device was developed using rapid-prototyping additive manufacturing techniques. The case contains a light emitting diode (LED) which echoes the patient’s pulse rate along with a toggle button which switches the device between a single note and chord mode.

Results
The device was successful in interfacing a Masimo pulse oximeter with GarageBand (Figure 1). When connected to GarageBand, the user can, select from a multitude of musical instruments (e.g. piano, guitar) to play at each pulse. As designed, the pitch of the sound corresponds to the SPO2 value (high pitch for high SPO2 and vice versa), while the tempo corresponds directly to the measured pulse rate. In preliminary testing and simulated environment, we were able to achieve high fidelity pitch and tempo.
changes which responded in real-time to changes in the physiological data.

Conclusion A device to provide MIDI interfacing to a clinical Masimo pulse oximeter was developed. Such a device demonstrates the feasibility, and potential advantages, of integrating MIDI into the operating room to reduce excessive noise and provide a standard for collecting data from multiple sound-emitting devices. Further studies are required to assess the utility of this in the clinical environment.

References:

Figure 1: POMO Device outputting saturation tone in classical piano in real-time from pulse-oximeter to GarageBand
BACKGROUND
We sought to assess whether the use of image recognition technology would assist in anesthesia procedures such as intubation or ultrasound-based procedures by offering realtime identification of tissues. Remarkable progress has been made in image recognition, primarily due to the availability of large-scale annotated datasets and deep convolutional neural networks (CNNs). CNNs enable learning data-driven, highly representative, hierarchical image features from sufficient training data.

METHODS:
A vocal cord database (open source) of 250 images and 1500 regions of interest was used. Each ROI was labeled as vocal cords, arytenoids, false vocal cord, adenoids. Features were extracted from each ROI using pre-trained CNNs and used to train support vector machine (SVM) classifiers in the tasks of distinguishing laryngeal anatomy. For a baseline comparison, classifiers were also trained on 80 images. Five-fold cross-validation (by case) was conducted with the area under the receiver operating characteristic curve (AUC) as the performance metric.

RESULTS:
Classifiers trained on CNN-extracted features were comparable to classifiers trained on human-designed features. Both the SVM trained on CNN-extracted features and the SVM trained on human-designed features obtained an AUC of 0.90.

CONCLUSION:
We obtained strong results using transfer learning to characterize and identify vocal cords in anatomical images. This method allows us to directly classify a small dataset of area of interest and identify vocal cords in a computationally inexpensive fashion without any manual input. The incorporation of such technologies may improve the safety by guiding novices or out of hospital providers with intubation. Furthermore, the identification of sono-anatomy realtime may assist with safety and accuracy and better outcomes when performing regional anesthesia blocks.

References:
Introduction

A barrier to quality improvement is a lack of access to accurate and routinely collected adverse event measures. Prospective identified complications based on standard definitions are considered the gold standard, however, these data require resource intensive data collection and are not available for most patients. Health administrative data codes, including adverse event indicators, are already collected for all inpatients in Canada. These codes represent a more efficient way to identify adverse events, but only if such codes accurately identify patients who truly experience (or truly do not experience) an adverse event.

Recently, a set of Patient Safety Indicators (PSIs) based on administrative codes were developed for Canadian data. While these indicators provide face and content validity, their diagnostic accuracy has not been tested. Therefore, we measured the accuracy of PSIs in identifying surgical patients whose adverse events were initially measured by the National Surgical Quality Improvement Program (NSQIP), which is considered the gold standard method to identify adverse events in surgical patients.

Methods

Following ethical approval, we performed a study of diagnostic accuracy to validate Canadian PSIs. We linked all patients at The Ottawa Hospital who were entered in the NSQIP database to their health administrative data record in our Data Warehouse. We then identified all NSQIP complications (the reference standard) and all PSIs from each patient’s record. These data were used to measures the accuracy of the PSIs in identifying a patient who truly did (or did not) experience a complication per NSQIP data. Positive and negative likelihood ratios (+LR/-LR) were calculated, along with sensitivities and specificities to describe the accuracy of having any PSI coded on having experience any NSQIP complication, as well as each of the individual components of the PSI framework.

Results

We identified 12898 patients who were enrolled in NSQIP and successfully linked to their corresponding administrative record. NSQIP complications occurred in 2885 patients (22.4%), and PSIs were identified in 2445 (18.7%). The baseline characteristics were similar between NSQIP + patients and PSI+ patients.
The +LR for a PSI in identifying a patient who also had an NSQIP complication was 6.4; the -LR was 0.4. Sensitivity was 0.60, and specificity was 0.90. These values were similar across different surgery types and routes or hospital admission. Individual PSI components were highly specific, but had poor sensitivity. (+LR range 7.7-131; -LR range 0.39-0.90).

**Discussion**
Based on accepted standards for diagnostic accuracy, PSIs based on clusters of administrative data codes have adequate accuracy to identify people who truly do, or do not, experience a complication while in hospital. Therefore, PSIs could be used to monitor and study adverse event rates across all surgical patients. The generalizability of these findings to other hospital inpatients should be evaluated.

**References:**
N/A.
Introduction: The number of required anesthesia providers in Canada continues to fluctuate. Previous studies in the past decade identified a shortage of providers, with some improvement in the national vacancy rate towards the end of the decade. Interventions including increased residency training positions, utilization of anesthesia assistants and technicians, and other hospital policy changes may have contributed to this improvement. The purpose of this study was to reassess the current and near future need for anesthesiologists in Canada.

Methods: An email list of all Canadian department heads of anesthesiology was obtained from the Canadian Anesthesiologists’ Society. Following ethics approval, one iteration of an online survey was sent out in December 2016. Results were compared to a similar survey from 2010.

Results: A total of 232 electronic surveys were sent to the identified department heads. Preliminary analysis is based on respondents (14%) representing anesthesiology departments providing care at 36 different sites. Of the respondents, 19% represented academic health science centres and 81% represented community centres. There were a total of 271 full time equivalent anesthesiologists (1.0 FTE) and 143 part time (< 1.0 FTE) anesthesiologists. Of these providers, 38% were general practitioner anesthetists (GPAs) and 62% were specialist anesthesiologists. When asked regarding the current availability of FTE anesthesiologists, 76% reported having about the right number, 20% reported having too few, and 4% reported having too many. A total of 13 unfilled FTE positions were identified from 5 different sites. Eight anesthesiologists from 7 departments were reported to be working past their planned retirement, with the majority doing so for personal or financial reasons (50%), while some cited staffing issues (25%). When asked to estimate the number of FTE anesthesia providers needed in the next 5 years, 48% of respondents expected no change, while 52% estimated needing more providers. This has slightly changed from 2010 when 40% expected no change and 60% estimated an increased need. Twenty-two sites reported expecting to recruit anesthesiologists in the next 5 years. Of these sites, expected recruitment of 7 GPAs and 52 specialist anesthesiologists was reported.
Discussion: These preliminary results suggest an overall current and future need for anesthesia providers. Unfilled FTE positions were identified in 14% of responding sites, while 20% reported currently having too few FTEs available. A majority of responding sites reported expecting to recruit more providers, particularly specialist anesthesiologists, in the next 5 years. We note that conclusions at this time are based on limited data, and will continue to revise the results as additional responses become available.

References:
Introduction: Nationally, there continues to be wide variability in the availability and the utilization of Anesthesia Assistants (AAs) by departments of anesthesiology. The purpose of this study was to follow-up a 2010 survey, re-assessing the current number of AAs and related professions (anesthesia technicians; ‘ATs’) their utilization, and their impact on the specialty of anesthesiology in Canada.

Methods: Ethics approval for this project was obtained at our institution. An email list for Canadian Department Heads of Anesthesiology was obtained using a collection of data available from provincial authorities and CIHI. The Canadian Anesthesiologists Society assisted with this process. An online survey was distributed in both English and French in December 2016. Frequencies and percentages were calculated. Comparisons were drawn to the most recent data on this topic, collected in December 2010 using an earlier iteration of the Human Resources in Anesthesiology survey.

Results: A total of 232 surveys were sent. A preliminary analysis is based on respondents (14%) representing departments providing care at 36 different sites. By 2016, 50% of departments routinely used AAs or ATs, compared to 44% six years ago. Preliminary data from Quebec was not available for comparison. As in 2010, all institutions that employed AAs were in an urban setting (population > 10,000). Less than half of AAs (44%) assist with technical support, compared with 100% in 2010. Only one institution (4%) had access to 24/7 AA support. No institutions report a decrease in their need for full-time anesthesiologists after introducing AAs. 73% of departments allow AAs to monitor patients under General Anesthesia. Unchanged from 2010, 70% of departments allow AAs to monitor patients under Regional Anesthesia (RA). 84% of departments allow AAs to monitor patients under Monitored Anesthetic Care, up from 57%. The majority of respondents strongly agree that AAs' improve efficiency, productivity, patient safety, and job satisfaction of other team members in the workplace, and that AAs are an important part of the workplace team.

Discussion: Preliminary results indicate that AAs have become more commonly used, although still only at urban centers. Patterns of practice have remained largely unchanged; with AAs monitoring more patients under MAC. Interestingly, as AAs have become more widely adopted, their scope of practice appears to have shifted, with less than half of AAs currently employed participating in room set-up, a task they
universally performed in 2010. Satisfaction with the service provided by AAs remains high, and further implementation has not led to any reduction in the need for Royal College-trained anesthesiologists.  

NB: these conclusions are based on preliminary and incomplete data. A further revision will be available in advance of June 2017, as additional responses become available.

References:
Background: With increasingly more complex surgical patients and the trend toward decreased hospital stay after operations (1), mobile communication provides an immense opportunity for health care providers to connect with patients in the perioperative setting. Our goal is to eventually build a perioperative platform that can be easily customized to any surgery at any institution. We focused our first prototype on the postoperative care of Cesarean Delivery (CD) patients due to the prevalence of the surgery (2) and technology-savvy nature of this age group.

Objective: Through a user-centered, iterative feedback process, we performed needs assessment and designed a simple proof-of-concept prototype application to track important signs and symptoms in for anesthesiology follow up of elective Cesarean delivery (CD) patients.

Method: We obtained Research Ethics Board approval and full informed consent. This study involves three cycles of individual structured interviews with patients (total 14) and anesthesiologists (total 9). The interview first consisted of standardized questions that explore the anesthesiologists' and patients' perspectives about perioperative monitoring. Then the participants interacted with the prototype and give feedback focusing on 4 major domains: appearance, content, navigation, and overall user experience. At the end of each cycle of interviews, the data from the interviews undergoes both qualitative and quantitative analysis to facilitate prototype improvement. This iterative process has three cycles.

Results: Perioperative follow up by anesthesiologists may be the ideal but not routinely done in practice. Both anesthesiologist and patient believe a mobile application would be useful for patient education and early detection and management of anesthetic-related adverse events. A concise decision tree-based questionnaire would be helpful in identifying patients requiring anesthesiology follow-up. However, medical-legal and privacy concerns and manpower logistics are obstacles for the application to be successfully integrated into practice. While helpful for follow-up, a mobile application should not be used for medical emergencies, nor replace in-person clinical visits. Conclusion: There is a role for mobile application to improve perioperative communication amongst anesthesiologists and patients following Cesarean delivery. A decision-tree based questionnaire maybe helpful in identifying patients requiring closer follow-up. Concerns for privacy, medical-legal issues, and workload need to be addressed. The mobile application prototype will be displayed at the conference. The iterative process of this study demonstrates a participant-driven
method for developing user-centred mobile tools relevant to anesthesia. The results of this study will guide us in further iterative development and implementation of a mobile monitoring and communication platform for perioperative care.

References:


Figure 1. Prototype screenshot
This is an example screenshot of our prototype, showing the page of data trends.
Background: Surgery in the pregnant population is uncommon. Around 0.75% - 2% of pregnant patients undergo non obstetric surgeries each year. Rigid bronchoscopy is especially challenging in this group of patients who are at risk of pulmonary aspiration and difficult airway. There is currently no case reports of this procedure performed in the obstetric population. Local ethics committee approval has been obtained.

Case report: A 30 years old female was 30 weeks into gestation when she presented after inhaling a hairpin. She was subsequently scheduled for rigid bronchoscopy for foreign body removal. Pre-operatively, she was counselled for risks of preterm labour, aspiration and awareness. Aspiration prophylaxis was given. Intravenous midazolam and glycopyrolate were given and her airway was topicalised in the induction room. A further 2mg of midazolam and 20mg of ketamine was given and target controlled infusion (TCI) of propofol at 2mcg/ml was started. The surgeons inserted the rigid bronchoscope uneventfully. After passing the vocal cords, lignocaine was given via the bronchoscope. Oxygen was connected to the side port and she was tilted to a left lateral position. Throughout the surgery, her mean arterial blood pressure and saturation were maintained. Propofol TCI ran at 2.5-3mcg/ml. The patient reacted occasionally but this was quickly suppressed by deepening anaesthesia with boluses of propofol. The post-operative cardiotocography (CTG) was normal. Two months later, she had an uneventful delivery.

Discussion: The main goals of anaesthesia for surgery in the pregnant population are to maintain normal maternal physiology, avoid tetratoxic drugs, avoid stimulating the uterus and avoid awareness during general anaesthesia. In airway surgery, pregnancy posts more challenges due to a higher aspiration risk, higher oxygen consumption as well as lower functional residual capacity. We have demonstrated how such a procedure can still be done safely with careful preoperative preparation and intraoperative care involving a multi-disciplinary team.

References:
2. Continuing Education in Anaesthesia, Critical Care and Pain 2006; 6: 83-85
Introduction:
The induction of anesthesia in a patient with a large anterior mediastinal mass can precipitate life-threatening compression of airway and cardiovascular structures. Diagnosis of such masses can be delayed in pregnancy as symptoms may mimic the normal cardiorespiratory changes of pregnancy. We present the anesthetic management for Cesarean delivery of a parturient with a large anterior mediastinal mass at 34 weeks gestation. Written consent was obtained from the patient.

Case Description:

The patient was a 30-year-old G3P2 with a 4 month history of dyspnea and cough, attributed to asthma and physiologic changes of pregnancy. A CT scan was done the preceding week to assess for pulmonary embolus, and instead confirmed a 12 cm anterior mediastinal mass with lymphadenopathy suggestive of lymphoma. Tracheal compression and deviation was noted, along with significant compression of the left mainstem bronchus, as well as the left subclavian artery and vein. She initially denied orthopnea, chest pain or hoarseness. An echocardiogram demonstrated minor, peripheral left pulmonary artery compression. A multidisciplinary meeting was held with anesthesiology, high-risk obstetrics, medical oncology and the patient; an elective Cesarean delivery was planned for the following day. The patient was reassessed the next morning and had developed profound positional dyspnea, hoarseness, and a new “choking sensation” overnight, with no clinical evidence of SVC syndrome. Significant progression of her airway compression was suspected, thus an urgent, awake lymph node biopsy was performed for tissue diagnosis, followed by immediate administration of steroids prior to her Cesarean delivery. Otolaryngology and cardiac surgery were on standby for emergency rigid bronchoscopy and cardiopulmonary bypass (CPB), respectively. A right-sided radial arterial line and left-sided femoral central line were placed. To expedite emergent CPB in the event of cardiovascular collapse, the right femoral vessels were exposed and CPB lines were primed and readily available. Adequate epidural anesthesia was achieved with 12 mL of 2% lidocaine. The patient was hemodynamically stable until immediately following delivery; precipitous hypotension (60/20) followed by bradycardia (50 bpm) was noted prior to administration of uterotonics. She was tilted further to her left side, and given phenylephrine 300 mcg and ephedrine 10 mg IV. Her hemodynamic status returned to baseline and she was transferred to the ICU post-operatively.

Discussion:

This case highlights the severe, acute decompensation that can occur with a rapidly growing mediastinal mass, and the need for a constantly evolving, multidisciplinary plan. Previous case reports describe having CPB teams on standby. However,
establishment of CPB can take several minutes, thus others have described preoperative cannulation in high-risk patients.\textsuperscript{3-4} For our patient, in consultation with cardiac surgery, we elected to have our CPB team on standby with adequate exposure of the femoral vessels, to avoid cannulation and further complications.

References:

Figure 1

Repeat computed tomography done immediately after Cesarean section showing the large anterior mediastinal mass.
Development of a Checklist to Aid Handovers in an Obstetric Post-Anesthesia Care Unit

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Introduction
Handing over patient care in the post anesthesia care unit (PACU) is an integral part of anesthesia practice. Current handover practices have been shown to be haphazard and suboptimal (1) and concerns have been raised regarding the potential of patient harm (2).

Inter-anesthesia handovers of obstetric patients in an obstetric ward have been assessed with inadequacies identified (3). There are no studies regarding handover between anesthesia providers and PACU nurses after obstetric anesthesia –chiefly after cesarean delivery. Evidence supports the implementation of standardized checklists to warrant accurate information delivery to PACU nurses (4).

We decided to evaluate and improve our obstetric PACU handovers through a quality improvement (QI) process.

Methods
After REB approval, we commenced with a questionnaire-based survey of 20 Obstetric PACU nurses. The questionnaire explored their satisfaction using a standard 7-point satisfaction scale and asked for items commonly omitted during handovers by anesthesia providers. Five handovers were observed with respect to structure and content.

A Comprehensive search of electronic data-base (PubMed) in English-language using keywords: “cesarean delivery/section”-“handover”-“PACU” “post anesthesia care”-“recovery”-“checklist” and “obstetric anesthesia” was carried out to identify improving handovers strategies, the relevant inclusion items of a PACU handover checklist and methods for designing validated checklists. Five handovers were then observed and screened with the draft checklist.

To arrive at a consensus on the relevant checklist items, we used modified Delphi approach. 7 local expert Obstetric anesthetists, were asked to answer a -yes/no-questionnaire of items deemed relevant to be included in the checklist over two rounds. These items were derived from the literature review and the nurse questionnaire.

Results:
The nurse survey revealed 45 % slight dissatisfaction with handovers. The most commonly missed items listed by nurses were: neuraxial morphine dose and timing, total and type of intravenous fluids, uterotonic drugs and patient allergies. The PACU nurses strongly supported a standardized process for handing over patient care. The observed handovers were highly variable with respect to content and organization.
The literature search did not reveal any prior studies in Obstetric anesthesia PACU. No additional items were identified on observing handovers using the draft checklist. Data obtained from all sources facilitated the development of a standardized checklist unique for Obstetric PACU (figure 1). We observed handovers using this checklist and found it easily usable.

**Discussion:**
Nurse satisfaction survey and observed handovers suggested further improvements could be made with potential benefits for patient safety. We are now evaluating handovers in our Obstetric PACU using this tool. Our handover tool may be of value to other obstetric centers.

**References:**
3. Anaesthesia 2015, 70(Suppl. 3), 11–101

**obstetric pacu handover checklist**

<table>
<thead>
<tr>
<th>Obstetric PACU Handover Checklist</th>
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<td>Name</td>
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<td>Allergies</td>
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<td>Vascular access</td>
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<td>IV peripheral/central lines</td>
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<td>Post-operative orders</td>
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<td>Anesthetic complications/events</td>
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<td>Destination</td>
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Please mark items as follows:
- YES → Item has been verbally relayed by provider to nursing staff.
- NO → Item is recorded/document but was omitted by provider.
- ND → Item is not recorded/document stored.

**figure 1**
Introduction: The Ex-Utero Intrapartum Treatment (EXIT) procedure is used to secure the airway of neonates with congenital abnormalities prior to separation from the placental circulation. This complex interdisciplinary procedure requires closed loop and timely communication between teams and team members.\textsuperscript{1,2} The aim of this project was to design and implement a high fidelity simulation addressing all aspects of maternal and fetal care for a planned EXIT procedure. The goal was improve the safety and efficiency of care for the mother and fetus as a result of the simulation, and to determine the value of such a simulation endeavor overall.

Methods: Patient consent was obtained for this case report. A team of adult and pediatric anesthesiologists and simulation specialists designed a scenario to simulate a planned EXIT procedure. The scenario was implemented and debriefed with all 6 teams (adult anesthesia, obstetrics, obstetrical OR nursing, pediatric anesthesia, pediatric ENT, and NICU) present. Post simulation surveys and interviews were used to evaluate the impact on team performance, communication and patient management.

Results: The simulation provided an opportunity to refine the airway management plan for the fetus, to share mental models among and between the care teams, and to troubleshoot equipment issues prior to the actual procedure. The simulation was a high-yield exercise for each of the teams involved.

Discussion: The EXIT simulation facilitated both the practical and non-technical aspects of both maternal and fetal care in this case. Future interdisciplinary high fidelity simulations such as this may prove invaluable prior to planned complex, rare procedures at our facility.

References:
Intubation during EXIT procedure
Fiberoptic intubation of partially delivered neonate during EXIT procedure.
Introduction: Pregnancy may aggravate the natural history of neurovascular lesions such as cerebral aneurysm and arteriovenous malformation (AVM) leading to increased risk of rupture and hence intracranial bleed. To date, there is no clear guideline in literature regarding the mode of anaesthesia for parturients with this type of intracranial pathology presenting for non-neurosurgical intervention. 

Methods: Informed consent for publication had been obtained from patients. We present a series of three patients with neurovascular lesions during pregnancy who presented for elective caesarean section.

Results: In our study, the mean age was 29.3 years (range 27-32 years old). Two patients had intracranial AVM and one patient had cerebral aneurysm. They underwent different modes of anaesthesia for caesarean section: one had general anaesthesia (GA), one had spinal anaesthesia and one had epidural anaesthesia. All three cases had good maternal and neonatal outcome.

Discussion: Our case series shows that there is no conclusion for the choice of anaesthetic technique for caesarean section in this group of patient and should be decided on a case-to-case basis. The emphasis of anaesthetic management is to maintain stable systemic, cerebral and placental hemodynamics while avoiding increased intracranial pressure in the parturients.

References:
Cases J. 2008;1: 327-329
Introduction: Multimodal analgesia has largely replaced pain mono-therapy with opioids, however, opioids still remain the most commonly used medications to treat acute post-operative and trauma pain \(^1\). Other foundational analgesics and adjuvants might help reduce pain scores and opioid requirements\(^2\). For example, multiple meta-analyses found that lidocaine infusions were able to decrease post-operative pain intensity and reduce opioid consumption for some surgical procedures. However, the effects of lidocaine infusions have yet to be studied in trauma patients\(^3,4\). In this case series, we have documented two trauma cases in which the addition of lidocaine was found to improve pain management for these patients.

Methods: Local REB approval was waived. Patient 1 was 60 year-old who fell from a 10 foot ladder resulting in T12-L1 fracture dislocation and multiple spinous process avulsions from T10 down. Patient 2 was a 37 year-old involved in a motor vehicle collision resulting in multiple rib fractures (4-10) along with lung contusions and a diaphragmatic laceration. These patients were started on multimodal analgesia including acetaminophen, NSAIDs and Gapabentin in addition to Hydromorphone patient controlled analgesia (PCA). Due to poor pain control and the high opioid requirements, the acute pain service team decided to add lidocaine infusion (1mg/kg/hour) concurrently with the PCA to control the patients’ pain.

Results: Both patients showed significant improvement in their NRS scores and opioid consumption (figure). Within less than 24 hours, there was more than a 60% reduction in opioid PCA usage and more than a 75% reduction in NRS. Due to the significant improvement, lidocaine infusion and PCA were stopped within 24 hours with no report of side effects.

Conclusion: Lidocaine infusion can be a useful adjuvant in pain management for trauma patients. It was found to reduce patients’ opioid consumption and improve pain scores. This suggests that lidocaine infusion has the potential to be a promising modality of pain management in patients with poor pain control post-trauma. Further studies are required to investigate the benefit of adding lidocaine infusion to poly trauma patients.

References:

3-McCarthy GC, Megalla SA, Habib AS Impact of intravenous lidocaine infusion on postoperative analgesia and recovery from surgery: a systematic review of randomized controlled trials. Drugs. 2010;70:1149-63


Pain scores (NRS) and hydromorphone usage (0.2 mg/bolus) during lidocaine infusion
281099 - PAIN CONTROL OF A MULTIPLE PREGNANCY ON A PATIENT WITH POST-TRAUMATIC PELVIC PAIN AND HYPEREMESIS GRAVIDARUM.

Author(s)
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Presenting Author

Co-Authors(s)
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Introduction:
We describe the challenges of adequate pain management in hyperemesis gravidarum and multiple gestations

Method: Case Report
REB approved
Consent obtained

Female 31-year-old, 52kg, 5.7" (G3 T1 P1 A1 L1), severe chronic post-traumatic pelvic pain, admitted for hyperemesis gravidarum (HG), at 11th week gestation with monochorionic diamniotic twins.

PMHX: Grave’s disease treated with propylthiouracil for one year, bilateral PE secondary to oral contraceptive use, MVA five years before with multiple pelvic and leg fractures, bladder perforation and splenectomy, anxiety, depression and PTSD.

Medications: Hydromorph contin 24mg q8h p.o. and hydromorphone 8mg q4h and p.r.n, amitriptyline 25mg qhs., also stemetil, gravol ondasetron, pantoprazole, enoxaparin and stool softeners.

After admission, anti-nausea medications was changed to IV; hydromorph contin 24mg tid po, hydromorphone 12mg po. q3h and lorazepam 0.5 mg qhs. Still unable to tolerate PO, pain reported > 50%, the pain service was consulted.

The patient reported multiple episodes of withdrawal at home due to HG; before the pregnancy, the dose of hydromorphone was 120mg/day total. In order to prevent withdrawal, 50% of this dose was going to be changed to fentanyl patch, aprox. 100mcg q72hr, reduced hydromorphone to 8mg q8h p.o. and hydromorph contin the same

Reevaluation at 24h: Improved pain control, better p.o. tolerance, still requiring hydromorphone 8mg consistently. We increased the fentanyl to 125mcg q72hr, hydromorph contin the same and hydromorphone 8mg q8h p.r.n. This was done to accommodate the increase in pain since the pregnancy.

Discharge, 48 hours later with what she reported as excellent pain control.

The Twins were delivered by C-section at 32 weeks. The fentanyl was reduced and then stopped. Three years later, they are all healthy.

Discussion
Pain management in pregnant women with previous pelvic fractures is challenging. Post-traumatic osteoarthritis in the loadbearing acetabulum and pelvic ring can lead to chronic pain and gait problems,(1) and considering the physiological changes of pregnancy, alterations in the composition of the pelvis, its shape, the plane of inclination and internal dimensions of the true pelvis(2), an already painful condition
can worsen. Pain control in this patient is more dynamic, as complications may develop and the pain can increase as the fetus grows. Changes in medications’ route of administration should be addressed as required, but still provide the flexibility of p.r.n. doses. Withdrawal should be avoid as it’s a source of stress for the pregnancy.

**Conclusion**
Chronic pain patients with high risk pregnancies require a pain service with urgent response capabilities, and as multiple gestations carry their own source of complications, the opioid withdrawal treatment requires a neonatal unit with PICU capabilities.

**References:**


Pelvic fracture

Surgical fixation of Right pelvic fracture.
LESHER OCCIPITAL NERVE ENTRAPMENT AND THORACIC OUTLET SYNDROME MIMIC CRPS ON A PEDIATRIC PATIENT

Author(s)
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McMaster University
Presenting Author

Co-Authors(s)
Janice Yu - McMaster University

Introduction
To reinforce the importance of the mechanics of the lesion to determine the most possible diagnosis.

Methods
REB approved.
Consent obtained.

16-year-old-female, football player, working as a waitress, leaned forward to pick up plates from a table and simultaneously looked up, immediately presented tingling and numbness over the right eyebrow, above the upper lip, cheek, chin, temple and hairline, progressing to the scalp down to the level of the occiput right side, then "shocky pain" in the distribution of C5-C6 up to the level of the right wrist, swelling of the right arm, tenderness at the shoulder, elbow and wrist. Pain at the area of the rhomboids and trapezius from T2 to T4.

All investigations were negative/normal (whole body technetium scan, right upper extremity EMG, doppler ultrasound, MRI of head, neck, chest, right brachial plexus, C1 esterase assay, quantitative immunoglobulins, T&B cell assay, alpha fetoprotein and testosterone, LFTs, P-ANCA and c-ANCA, rheumatoid factor, CT head, chest Xray, CBC, ECG, INR and PTT, and D-dimer). Evaluated by neurology, rheumatology, dermatology, physical medicine rehabilitation and adolescent medicine.

Diagnosis: CRPS Type 1.

Treatment: toradol, naproxen, acetaminophen, and gabapentin 600mg qid with suboptimal results for a month.

Chronic pain service consult: Current diagnosis didn't follow the criteria for CRPS. On evaluation, tenderness on the lesser occipital nerve (LON) distribution and severe spasm of the elevator scapula (ES). LON block and trigger points on ES were done. Pain subsided to 2/10 for the first time.

New Diagnosis: Lesser occipital nerve entrapment and non-specific thoracic outlet syndrome (TOS). Added treatment: Baclofen 10mg tid and morphine SR 10mg bid and morphine IR 5 mg q/once. A day later, the face, occiput, arm pain and edema disappeared.
Six months later only taking baclofen 5-10mg qhs if needed.

Discussion
TOS remains a diagnosis of exclusion and can be present with overlapping or similar clinical pictures,(1,2) as in this case with lesser occipital nerve entrapment.

TOS can occur in pediatric patients.(1,2,4) Women are 3-4 times more likely to develop neurogenic TOS.(4) Some symptoms are: paresthesias in the upper limb, pain in the neck, trapezius, shoulder and/or arm, chest, supraclavicular, occipital headache,
and parasthesias in the fingers. Compression and irritation of the upper plexus (C5, C6, C7) can cause pain in the anterior aspect of the neck from the clavicle to the mandible, ear and mastoid area, occasionally radiating into the side of the face. The anatomical anomalies are most often located in the posterior scalenic triangle. (2) Many patients report awaking at night with paresthesias.

**Conclusion**

CRPS Budapest criteria was developed to ensure accurate CRPS diagnosis, steps should be taken to follow this criteria. (3)

Neurogenic TOS, especially 'disputed' neurogenic TOS, is more difficult to diagnose because there is no standard objective test to confirm clinical impressions. (2,4)

**References:**

References

**Introduction:**
Buprenorphine is a semisynthetic opioid with agonist and antagonist effects at the opioid receptor. Sublingual buprenorphine-naloxone preparations (suboxone) have a well-established role in the treatment of opioid addiction\(^1\). It has high affinity at the mu-opioid receptor that may offer a “blockade effect” to other opioids that typically last in excess of 24 hours\(^2,3\). There has yet to be a standardized method of treating acute pain in patients on suboxone, however, evidence in the literature suggest optimizing the multimodal analgesia by either increasing the dose of suboxone (with no other opioids) or adding higher doses of potent opioids (with or without stopping suboxone)\(^4\). In this case report, we present two methods of post-operative pain management for a patient who is on suboxone.

**Case Report:**
This report involves a 55-year-old male patient who is known to have chronic pain with a history of opioid dependence. The patient has given the proper consent to share the information in this report. The patient was receiving suboxone in 3 divided sublingual doses (4mg/1 mg, 2mg/0.5 mg and 4mg/1 mg) in addition to nabilone at 0.5 mg TID. His average pain score (NRS) was 4/10. He was admitted for an elective right side total knee arthroplasty which was complicated by a severe infection that required irrigation and debridement under general anesthesia after 3 weeks. During both procedures the patient received general anesthesia. After his primary surgery, he was kept on the same dose of suboxone that he was given preoperatively and was administered by adductor canal nerve block with a catheter for two days. He also received acetaminophen, gabapentin, nabilone, NSAIDS and hydromorphone immediate release (4 mg q3 hours per oral PRN). His pain was very much controlled with average (2/10) at discharge. In his second operation, he did not have a nerve block due to the extensive infection and the same multimodal analgesia regimen planned for him. His pain score before surgery (10/10) and became intolerable in the immediate postoperative period. The patient received boluses of intravenous ketamine (total 30 mg) and intravenous hydromorphone (total 6 mg) over a 1-hour period with additional multimodal analgesia with no response. At this point, hydromorphone was stopped and his dose of suboxone was doubled. Shortly after administering 8 mg suboxone the patient experienced a significant improvement, with his pain being reduced by 50%. No side effects were reported. His pain continued to be controlled (average 4/10) with a gradual tapering down of suboxone back to its baseline dose after 4 days.
Discussion:
This case report highlights the challenges that physicians may face when dealing with patients on Suboxone and the possible ways to manage those patients. Understanding the unique pharmacology of this drug and identifying those patients pre-operatively is crucial to formulating an appropriate pain management plan.

References:
Introduction: Osteoarthritis (OA) of knee is a major cause of pain and disability among adults. Radiofrequency (RF) neurotomy of the genicular nerves supplying the knee alleviates knee joint pain and restores function. In most centres, it is performed under fluoroscopic guidance. We in the present study evaluated the feasibility and efficacy of using ultrasound guided (USG) needle placement for diagnostic genicular nerve block.

Methods: 20 elderly patients with chronic knee pain (VAS > 50mm for > 3 months) with advanced osteoarthritis (Kellgren Lawrence grade 3-4) underwent diagnostic genicular block (24 knees) as 4 patients had bilateral knee involvement with the help of USG. The affected knee was placed in a semiflexed position with a pillow underneath. A high frequency linear USG probe (6-13 MHz) was used under aseptic precautions to identify superomedial, superolateral and inferomedial genicular artery. A 26G 1½in hypodermic needle was then inserted in an out-of-plane manner in order to reach near the artery identified. Once the needle reached the desired target 2-3 ml of 0.25% bupivacaine was injected after negative aspiration for blood. The genicular nerve lies in close proximity of the artery and hence it was assumed to be covered by the local anaesthetic. Pain was assessed using the Visual analogue score (VAS) at the time of discharge i.e. 2 hours post procedure. If pain relief was found to be > 50%, diagnostic genicular block was considered successful and patients were planned for radiofrequency neurotomy at the next visit.

Results: 24 knees (20 patients with 4 patients suffering from bilateral advanced OA), underwent USG diagnostic genicular block and were discharged after 2 hours. The mean pre procedure VAS score was 76mm which reduced to 29 mm post procedure (p 50% was documented in 22 out of the 24 knees. These were thus planned for RF neurotomy.

Discussion: RF neurotomy of the genicular nerves is a novel promising technique for pain relief of advanced osteoarthritic knees. Diagnostic genicular nerve block is generally performed under fluoroscopic guidance prior to RF neurotomy. We propose that Ultrasound is an extremely useful tool for performing the diagnostic genicular block as it be done as an OPD procedure and more so without the risk of radiation exposure.

References:
1. Rheumatology (Oxford) 2000 39 ; 490-496
2. Pain 2011 152; 481–487
284851 - CAN CHRONIC COUGH WORSEN A CHIARI TYPE I MALFORMATION AND PROMOTE OCCIPITAL HEADACHES?

Author(s)
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McMaster University
Presenting Author

Co-Authors(s)
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Janice Yu - McMaster University

Introduction
To recognize the relevance of the characteristics, complete neurological evaluation and imaging of chronic cough headaches.

Method: Case Report
REB approved.
Consent obtained.
Female, 38-year-old with asymptomatic Chiari Type I malformation (CIM), reported occipital headaches and dry cough.
MRI: worsening of CIM, cerebellar tonsils projecting 11mm below the foramen magnum with crowding.
A complete neurological and neuro-ophtalmological evaluation reported no significant findings.
Because the dry cough started at the same time as the occipital headaches, allergy testing was performed, revealing multiple environmental allergies; after the antihistaminic treatment, the dry cough and occipital headaches stopped.
MRI (a month later): CIM with mild decrease in cerebellar tonsilar descend, now 6.7 mm and less crowding.
MRI (a year after): CIM minimally noticeable.
The patient remains asymptomatic.
Key words: Chiari malformation, headaches, cough headache, allergies.

Discussion
CIM is found in 1 out of 10 MRIs and it can be asymptomatic. The most frequent symptom is cough headache, 30% of patients with CIM experience headache aggravated by cough and other Valsalva maneuvers (1), due to sudden increase in intrathecal pressure caused by obstruction to the free flow of CSF in the subarachnoid space. (2) This hindbrain malformation does not correlate with a higher incidence of primary episodic or chronic primary headaches. (1,5)

Cough headache can be a primary benign disorder diagnosed only if neuroimaging is normal (1,3)
Primary cough headache begins after age 60 and responds to indomethacin, while cough headache secondary to Chiari type I malformation usually begins before age 50, accompanied by posterior fossa sign/symptoms, does not respond to NSAIDs, tricyclics, tryptans, acetazolamide, Cox 2 inh., opiates or barbiturates.
Surgery is recommended in progressive posterior fossa or spinal cord
symptoms/signs, hydrocephalus, syringomyelia, refractory trigeminal and glossopharyngeal neuralgia.(1)

**Conclusion**
Chiari 1 malformation diagnosis is not enough to determine treatment. Cough headache has a different epidemiology in comparison with Chiari type 1 headaches, even though “cough related headache” might be the only symptom in both. Headaches triggered by coughing is an unusual clinical symptom and deserves specific attention.(4)

**References:**

**References**


MRI
Chiari Type 1 malformation with cerebellar tonsils projecting, 11 mm below the foramen magnum
Introduction:
The Acute Pain Service (APS) was first developed in the USA in 1985. Since then, hospitals in Canada and around the world have begun to create their own structure for the APS. In 1991, the first survey regarding APS use in the primary Canadian teaching hospitals was performed to evaluate the prevalence, structure, and function of APS. Our research team decided to conduct a follow-up survey to assess the development of the APS in Canada.

Method:
We administered a 26 question survey to the lead personnel of the APS teams or Anesthesia Departments at the leading Canadian teaching hospitals. This survey was structured to collect information describing the structure and function of the APS in these hospitals. The questionnaire was designed by two Anesthesiologists working in APS and the content was reviewed for validity by a domain specialist. The survey was approved by our institution’s Research Ethics Board and a list of targeted Canadian teaching hospitals was compiled. A copy of the survey was distributed to the lead postoperative pain management health care providers at these centres via email, and was accompanied by an explanation of the purpose of our study.

Results:
Among the 32 centres that were contacted, 21 centres (65.6%) responded. Out of the 21 responses, 18 centres (85.7%) stated that they have a structured APS (72.22% adults, 22.22% mixed, 5.56% pediatrics). Among the 18 centers with APS, 16 centres are run by an Anesthesiologists and 2 centres are ran by a Nurse or a Nurse Practitioner. Ten centres (55.55%) do not have a regional anesthesia group, while five centers (27.75%) have a regional anesthesia group that is separate from the APS team. Five centres (27.75%) have a structured APS fellowship and 11 centres (58.8%) have a structured regional anesthesia fellowship. Nine centres (50%) offer ambulatory nerve catheter analgesia after discharge home. Fifteen centre (83.33%) use standardized order set and 13 centre (72.22%) use an electronic record for APS. More than 50 % of the centres use intravenous lidocaine and ketamine as a part of their multimodal analgesia.

Discussion:
Based on our survey results, most Canadian teaching hospitals do have an APS implemented. The APS differs between centres with regards to who runs these services, type of analgesia provided, whether or not an APS fellowship is offered and the type of follow up care provided. This research project has the potential to generate additional research that aims to investigate limiting factors to APS availability in Canada, best patient outcomes with different APS, and reasons for hospitals choosing
specific APS.

References:
Objectives
To highlight the use of methadone in chronic pain doses for addiction patients with chronic pain.
To highlight the need of programs that promote a closer interaction between addiction physicians and pain physicians treating chronic pain addicts.

Method: Case Report
REB approved.
Consent given.
Male 22-year-old, IV drug user, leading to endocardis requiring bivalvular repair (aortic, mitral); LV dysfunction with EF of 33%; aneurysm of the left femoral artery, required surgery #2; chronic left leg pain secondary to diabetic neuropathy (insulin-dependent diabetic with poorly controlled sugars for years); smoker, 10 cigarettes a day.
In hospital: Methadone 30mg tid and hydromorph contin 15mg bid and hydromorphone 4m qid, the patient had no coverage for methadone pills and was economically incapable to cover the costs. The methadone dosing for addiction was covered, but was not effective for pain control. A Section 8 application was made multiple times until it was covered and the argument was deemed valid, where the cost of not covering this patient's pain control would prolong his struggle with addiction, as he most likely would self medicate with other forms of narcotis. Considering the cost to the provincial health system of his multiple surgeries and pathologies, the fact that he was an addict became secondary.
Sixteen months after, he had two leg surgeries and a diagnosis of renal dysfunction (creatinine clearance of 40%) due to uncontrolled diabetes. Methadone dose was reduced to 25mg bid and 12.5mg midday, the hydromorph contin 9mg bid and hydromorphone 3mg bid. Within the same month the urine was positive to cocaine.
Before entering rehab., we reduced the hydromorph contin and hydromorphone slowly until it was stopped. While in rehab., methadone 50mg once a day was not useful for his chronic pain, prompting him to leave. The patient couldn't find an addiction centre that was willing to work with the pain clinic doing the urine test on regular basis, so the clinic took it upon themselves to do this.
A month later the patient started on dialysis 3 times/week, drug tests were negative and ongoing. Methadone 15mg tid and 5mg at nighttime was enough to control his pain and withdrawals. The treatment is ongoing.

Discussion
Addicts with chronic pain are less likely to receive adequate pain management. While
relapse in a recovering individual may occur inspite of appropriate use of opioids, inadequate pain relief is also a significant risk factor for relapse.(1,4)

To provide effective pain management:
- The medication should be chosen on the basis of providing adequate pain relief (ex. the analgesic properties of methadone only last 6 to 8 hours, any pain relief obtained will not last all day) and dose accordingly.(3)
- Use the level of pain to determine the strength of the pain medication.
- Use around-the-clock dosing (long acting with short acting) and titrate accordingly.
- Prevent withdrawal.
- Have only one physician prescribing all the pain medications.
- Reduce the medication to the minimum dose necessary to control the pain.
- When needed, wean the patient from the medication and reassess the pain syndrome.
- Regular drug tests.(1,4)

Conclusion
There are legal and medical challenges when treating addiction patients with chronic pain, but the cost to the health system is far greater in dealing with the complications of addiction than facilitating adequate coverage for the same medication on a different setting.

References:
Background
An endotracheal tube (ETT) should be placed with the tip >2.5cm above the carina and cuff below the cricoid cartilage to avoid endobronchial intubation or inadvertent extubation with neck movement. Based on current literature, the average success for oral intubation is 85.3%. Palpating the ETT tip as it slides down the trachea during intubation is effective in pediatrics. We studied palpation of the inflated ETT cuff after intubation while moving the ETT, which is not normal clinical practice, and hypotheses were that it may damage the tracheal mucosa, and achieve correct ETT depth. Throat pain was measured as a surrogate for upper airway damage.

Methods
With Ethics Board approval, informed consent was obtained from 150 participants. Design: Single blind randomized controlled trial with blinded patients and assessors. Subjects: Adult patients requiring intubation with ETT for anesthesia. (Patients undergoing head, neck, or cardiac surgery were excluded.) Palpation group: After intubation by the attending anesthesiologist, cuff pressure was set to 50cmH2O during palpation, then reset to ideal pressure after palpation. The investigator placed three fingers along the anterior trachea from cricoid cartilage, to sternal notch, then moved the ETT down, then up while palpating until the cuff was between the cricoid cartilage and sternal notch. Control group: The investigator taped the ETT where it was placed by the intubating anesthesiologist. ETT depth measurement: Measurements were taken with a fibre-optic bronchoscope from the carina to the tip of the ETT, to the cricothyroid membrane, and depth at the teeth. Tracheal damage: In the recovery room, blinded nurses assessed patient-reported throat pain on a scale of 0-10. Those with a pain score of 4 or more were considered to have pain.

Results
In the palpation group, 63 of 75 patients had the ETT at the correct depth compared to 51 of 75 did (p=0.035). Ten participants in the palpation group had pain; 21 in the control group (p=0.028). The palpation group had an average pain score of 0.6 ± 1.6; the control group was 1.5 ± 2.1. To see if it was a learned technique, we compared our first 10 attempts to the rest of the study. In our first 10 patients, 4 ETT were misplaced using palpation; in the remaining attempts showed 7 of 65 (p=0.047).
**Discussion** Palpation of the moving tracheal cuff did not worsen throat pain, improved ETT positioning, and was learnable. It requires no equipment and can be used outside the hospital, where many errors in ETT placement occur. Future research will investigate whether this technique can replace X-rays to confirm placement of the ETT in a patient in Intensive Care. This could reduce costs and avoid radiation.

**References:**
283082 - ACUTE REVERSIBLE ISCHEMIC HAND FOLLOWING RADIAL ARTERIAL LINE CANNULATION: MANAGEMENT AND LESSONS LEARNED

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Introduction: Arterial lines are a safe and commonly used invasive monitor to allow real-time blood pressure monitoring, blood gas analysis and laboratory measurements. Nonetheless, arterial lines have been associated with complications including vascular occlusion, thrombosis, digit ischemia, hematoma formation, catheter-related infection and sepsis.¹

Clinical Features: We obtained written permission from the patient mentioned herein regarding disclosure and publication of this report. An 83-year-old female was scheduled to undergo a modified neck dissection and midface reconstruction with a free flap as the primary surgical management of an exophytic soft palate tumour. Due to the duration of the case and advantages of continuous intraoperative hemodynamic monitoring, a 20-guage Arrow® arterial line was inserted by palpation using an aseptic technique into the right radial artery. Within a few minutes, the patient complained that her “hand felt quite numb”. Her right hand was noticeably blanched compared to her left hand (Figure 1). Pulse and oxygen saturation were still detectable on the affected hand. We elected to remove the radial arterial line, which resulted in immediate resolution of the palor and neurologic symptoms. Surgery proceeded and patient recovery was uneventful.

Discussion: Complications arising from the insertion of arterial lines are quite rare. A retrospective study of over 60,000 arterial line insertions conducted by Nuttall and colleagues found only 21 complications in total.² That said, the importance of identifying acute limb ischemia associated with arterial line placement is clear. Extensive tissue necrosis may occur after six hours of complete acute limb ischemia, resulting in loss of limb function, amputation or death.³ In this report, we review risk factors associated with arterial line complications and discuss the validity of pre-procedure examination, such as Allen’s test, in planning arterial line cannulation. We also examine standard operating room flow for opportunities to efficiently and practically prevent iatrogenic harm to our patients when invasive monitoring procedures are required.

References:

Figure 1
Comparison of the affected (right) and unaffected (left) hands of the patient 5 minutes after right radial artery cannulation.
Introduction: Incompatible blood product transfusion is associated with major morbidity & mortality and continues to be a significant problem in spite of evolving regulations and technology (1,2). The Canadian Transfusion Error Surveillance System (TESS) reports an ABO-incompatibility transfusion rate of 1:14,000 transfusions secondary to “errors in the transfusion chain” (1). This study reviews the documented blood product transfusion errors that occurred at our institution and identifies possible risk factors.

Methods: Ethics approval for this project was certainly obtained. As this project was a review of data that had already been collected, as well as a chart review, informed consent was not an issue and was not required. Blood Bank services at our Hospital have been keeping records of blood product transfusion errors and the root cause analyses, since 1999. These, and the corresponding patient charts, were reviewed for the following information: patient age, gender, presenting illness and blood type, date & location of transfusion error, product type/group transfused, complications, and reason for error.

Results: Between 1999-2015 we estimate that 369,934 units (PRBC: 209,150; FFP: 103,833; Platelets: 51,425; Cryoprecipitate: 5,526) were transfused. A total of 12 transfusion errors were identified during this period (1:30,800; PRBC: 10 [8 ABO-incompatible], FFP: 2; Table). The incidence of ABO incompatible PRBC transfusions was 1:26,100. Patients (74±6.7 yrs; M[6]/ F[5]); surgical [7]/medical [5]) who received the wrong blood type were predominantly in acute care settings (ICU [5]; OR[3]; ER[1]). Transfusion error -related medical sequelae ranged widely, from no reaction [6], mild [2]-severe [2], and death [2]. The cause of transfusion error in all but one resulted from failure to correctly identify the patient being transfused.

Conclusion: At our institution, blood transfusion errors occur within reported standards (1). Accurate patient identification at the bedside, immediately prior to transfusion, is critical to safe transfusion practice. This crucial step would greatly reduce the likelihood of blood product transfusion errors. Hospitals must continue to develop protocols and integrate technology to ensure correct patient identification.

References:
References
Background: Although enhanced recovery after surgery (ERAS) pathways includes fluid guidelines, the relationship between length of hospital stay and volume of intraoperative fluid administered has not been well established. We developed and implemented a comprehensive ERAS program at 15 hospitals in Ontario. The fluid guidelines recommended fluid restriction and administration of fluids in response to hemodynamic triggers such as hypotension or tachycardia. The guideline further suggested the use of cardiac output monitors to further guide fluid administration. The objective of this study was to determine if the volume of fluid administered intraoperatively was associated with prolonged length of hospital stay (LOS).

Methods: Following research ethics approval at each of the participating hospitals and written informed consent data were collected prospectively on all patients undergoing elective colorectal surgery who agreed to participate in our ERAS study. Data collected included demographics, perioperative compliance with the ERAS guidelines and patient outcomes length of hospital stay. A prolonged LOS was considered to be greater than the median LOS. Continuous variables were compared using design-adjusted t-tests and categorical variables using design adjusted Chi square tests. Generalized estimating equations accounting for clustering with site were used for risk adjustment in multivariable models.

Results: Between September 2012 and April 2015, 2,798 patients (1,345 females (48%); mean age 60.3 years) were enrolled in the ERAS program. Intraoperative fluid therapy data were incomplete or unreliable on 78 (2.7%) of the population and these patients were excluded. Patients underwent colonic (n=1,802, 64.4%) or rectal (n=996) resections and 1473 (52.6%) were performed laparoscopically. The median LOS was 5.0 days (interquartile range, 4 to 8.0). Intraoperative fluid therapy was predominantly a balanced salt solution (Ringer’s Lactate). The volume administered was 2.1 ± 1.2 L and advanced hemodynamic monitoring was employed in 761 (27.2%) patients.

Regression analysis identified Charlson Comorbidity Score ≥ 3 (Odds ratio (OR) 1.50 (Interquartile Range; 1.13 - 2.23), intraoperative fluid volume (L) (OR 1.53, 1.36 – 1.75), preoperative anemia (Hemoglobin < 130 g/L for males and < 120 g/L for females) (OR 1.58, 1.36 to 1.82) and surgical duration (≥ median= 189 min) (OR 1.55, 1.27 - 1.89) as predictors of prolonged length of stay. An oncology diagnosis was not associated with a prolonged LOS (OR 0.54, 0.44 to 0.67).

Discussion: Despite the recommendation for fluid therapy in our ERAS program, the volume of fluid administered in the operating room continues to be associated with prolonged LOS. Fluid management remains an important modifiable predictor of patient outcome following elective colorectal surgery and the indication for fluid during
surgery needs additional attention and consideration if we are to improve patient outcome.

References:
Introduction: The efficacy of tranexamic acid (TXA) to reduce red blood cell (RBC) transfusion has previously been demonstrated1, yet uncertainty persists regarding the need to treat those at lower risk for transfusion2, and assessment of overall drug safety remains incomplete2. We assessed the impact of a universal TXA protocol on RBC transfusion, postoperative hemoglobin (Hb) and adverse outcomes in patients undergoing hip and knee arthroplasty to determine whether TXA was effective at reducing RBC transfusion, both overall and in clinically relevant subgroups, without increasing the incidence of adverse outcomes.

Methods: REB ethics approval was obtained, and consent requirements were waived, for this retrospective observational study. All patients undergoing surgery both one year before and after implementation of a Universal TXA protocol were assessed. Protocol patients received TXA 20mg/kg iv, unless at high risk for complications. The primary outcome was the percentage of patients receiving perioperative RBC transfusion. Secondary outcomes included perioperative Hb and adverse events (death, MI, stroke, seizure, PE, DVT, and acute kidney injury). Logistic regression compared adjusted risks of transfusion post- vs pre-protocol for patients with all permutations of putative risk factors3-6 (anemia, low BMI or female sex). Chi square and logistic regression analysis was used with statistical significance at p < 0.05.
characteristics did not differ between groups (age, sex, body mass index, type of surgery or preoperative Hb). Overall TXA utilization increased from 32.3% to 92.2% while the transfusion rate decreased from 10.3% to 4.8% (odds ratio 0.40 [0.21, 0.59]). Reduced transfusion was observed for primary hip and knee arthroplasty (% reduction [95% CI]; -6.7% [-9.8, -3.6] and -5.5% [-7.8, -3.2] and less consistently for revision hip and knee surgery, (3.2% [-7.5, +13.9] and -12.6% [-30.3, +4.8] respectively. Pre-operative anemia increased, and obesity reduced the risk of transfusion. A transfusion sparing effect of the protocol was observed in both anemic patients [15% vs 27%] and non-anemic patients [2.9% vs 7.3%] (p < 0.05). Logistic regression demonstrated reduced transfusion regardless of sex, anemia or low BMI status (Figure). Postoperative day 3 Hb increased from 95.8 to 101.4 g/L after protocol implementation (difference 5.6 [4.3-6.9]) with greatest effect after primary hip and knee replacement (difference; + 8.1 [6.2-9.9] and + 4.8 g/L [4.3-6.9] (p < 0.001). No increase in adverse events was observed overall (p=0.845), or for DVT (p=0.226).

**Discussion:** The Universal TXA protocol was associated with increased TXA utilization and reduced RBC transfusion. Anemia increased transfusion risk and obesity decreased transfusion risk, but all patient subgroups benefitted from the protocol, strengthening the rationale for Universal therapy. Patients undergoing primary joint replacement experienced the most benefit and also had increased postoperative Hb. No increase in adverse events was observed.

**References:**
2. BMJ, 2014. 349: p. g4829

**FIGURE:** Effect of Protocol Based On Patient Risk Factors Category
Logistic regression is used to show adjusted transfusion risk and protocol effect for transfusion reduction for all permutations of three putative risk factors for transfusion in total joint arthroplasty.
Introduction: Anemia and hemodilution are associated with increased morbidity and mortality in patients undergoing cardiac surgery. Measurement of tissue PO2 and hypoxic biomarkers may provide evidence of tissue hypoxia in patients undergoing cardiac surgery who are exposed to acute hemodilutional anemia during cardiopulmonary bypass (CPB). We hypothesize that anemia causes tissue hypoxia and activates hypoxic signaling pathways, including nitric oxide (NO), methemoglobin (MetHb), free plasma hemoglobin (Hb), hepcidin and erythropoietin (EPO). These biomarkers could inform clinical decisions to treat anemic patients undergoing heart surgery.

Methods: With institutional research ethics board approval and informed consent, an observational prospective study was conducted on 64 patients undergoing cardiac surgery and CPB. Five arterial blood samples were taken including: baseline, two during CPB, following restoration of circulation, and after admission to the intensive care unit (ICU). Measurements included cerebral oximetry, arterial blood gas analysis and co-oximetry; plasma MetHb, nitrate, nitrite, hepcidin and erythropoietin (EPO) (ELISA) and plasma free Hb levels (Absorbance: $c_{Hb} = f_1A_{415} - f_2A_{450} - f_3A_{700}$). Data [mean (STDEV)] was analyzed by repeated measures one-way ANOVA and Spearman correlation coefficients.

Results: Fifty two of 64 patients [81%] were male of age 61(8) and with a body mass index of 28 (5). Hb levels decreased from a baseline value of 127 (16) to 102 (14) g/L during CPB [p < 0.05]. Cerebral oximetry decreased during CPB [71(6) vs. 64(3)%] while MetHb increased from baseline [0.78(0.41)] to a maximum value in the ICU [1.23(0.71) ; p < 0.001]. Plasma free Hb increased from 0.08(0.13) to 0.29(0.27) g/L and plasma nitrate decreased (p < 0.05 for both). Hepcidin remained unchanged while plasma EPO levels increased from 9.4 (7.7) to 15.9 (15.9) IU/mL after ICU admission [p < 0.05]. Changes in MetHb correlated with changes in EPO [r=0.3452, p=0.0162]. Free Hb on CPB correlated with MetHb in the ICU [r=0.34, p=0.03] and change in EPO...
Discussion: Our findings suggest that hemodilutional anemia resulting from CPB and cardiac surgery is associated with changes in cerebral oximetry and increases in biomarkers of tissue hypoxia including MetHb and EPO. Changes in MetHb correlated with changes in EPO suggesting that tissue hypoxia may have contributed. Plasma free Hb increased modestly during CPB, but this change correlated with ICU MetHb and the change in EPO, supporting a role for free Hb in the hypoxia signaling cascade. Further characterization of patient-specific biomarkers of anemia-induced tissue hypoxia, in combination with Hb level, may help to define patient-specific treatment thresholds for acute anemia.

References:
Introduction:
Shared decision making (SDM) promotes a partnership between the physician and the patient in health decision making, a hallmark of patient-centered care. SDM is the optimal approach when the best treatment is unclear, and personal preferences about the risks and benefits should guide the treatment choice. Given the increased risk associated with surgery in the elderly, SDM could help to ensure high-risk older patients make surgical decisions consistent with their preferences. Best practice guidelines recommend documentation of SDM in the surgical consultation note. However, little is known about how well SDM is actually documented. Therefore, we aimed to evaluate SDM and patient decisional need documentation among elderly patients having elective surgery.

Methods:
We conducted a historical cohort study on 240 randomly sampled preoperative surgical consultation notes from a single tertiary care center. Eligible patients were 65+ years and had elective surgery. Two raters independently extracted data using pre-piloted forms. Variables included 9 essential elements of SDM and the validated 4-item SURE test, which screens for patients’ decisional needs. All data was compared for interrater consistency and disagreements were resolved by consensus. We performed descriptive analyses on all variables. Risk-adjusted analysis and thematic qualitative analysis of surgical note quotes will be performed. We obtained Research Ethic Board approval for this study.

Results:
Consultation notes were available for 233/240 patients (97%). Of the 233 consultation notes reviewed, 100% documented an actual choice being made and the plan for implementation of that choice. The patient’s treatment preferences (15%) and self-efficacy (3%) were least commonly documented. No consultation note documented all 9 SDM elements. Moreover, none included documentation associated with all 4 SURE test items. Patients’ certainty about the decision, categorized as “Sure of myself,” was documented most often (16%), while having adequate support and advice, categorized as “Encouragement” was least frequently documented (2%) (Figure 1B).

Discussion:
Our retrospective chart review demonstrates a lack of SDM documentation in elderly patients’ preoperative surgical consult notes. Although we cannot comment about discussions that occurred during the consultation, a gap exists between recommended and actual SDM documentation. More research is needed to develop and evaluate interventions for improving standardization and practice of SDM documentation for the perioperative surgical consult note.
References:

Figure 1: Documentation of SDM and SURE criteria.

A) 9 essential elements of SDM. B) Patient's decisional needs using the SURE test.
Introduction:
The prevalence of pre-operative anxiety can be as high as 80% in surgical populations. Perioperative clinical trials have revealed that pre-operative anxiety is associated with reduced short-term postoperative recovery, poor functional outcomes, increased pain scores, wound infections, increased length of stay and even mortality. The greatest anxiety has been linked with the fear of the unknown, specifically the process of physically being taken to the operating room. Strategies such as implementation of the pre-anesthetic clinic(PAC), the use of videos of what to expect leading up to surgery, calming music, and pharmacological treatments have been costly or with mixed effects. Virtual reality(VR) technology presents a new educational opportunity for patients in an effort to reduce pre-operative anxiety. Through immersive 360° simulation, patients can ‘experience’ the journey of being prepped for surgery and transferred to the OR. Patients learn about their pre-operative experience in an engaging/active manner by having the perception of being physically present in the pre-operative experience days/weeks prior to their procedure date. Thus, we have constructed and are evaluating an immersive 360° simulation to educate patients about the pre-operative experience, to investigate whether A) immersive 360° VR video can reduce pre-operative anxiety, and B) how this approach compares to current practice of viewing traditional educational videos.

Methods & Results:
With ethics approval, forty-five out of 100 patients have been recruited for this study during their visit to the PAC and equally randomized to two groups: 1) watching a traditional video on a television screen OR 2) viewing an immersive 360° VR simulation using Gear VR© goggles. Anxiety levels will be assed during their PAC appointment and the day of surgery using the validated Visual Analog Anxiety Scale(VAS). Secondary measures such heart rate and mean arterial blood pressure will also be analyzed at the same time points. For the immersive 360° simulation group, the change in VAS scores pre and post 360° video use will be assessed using a paired t-test, or a Wilcoxon signed rank test for the case of non-normally distributed data. To answer our second question of how this approach compares to current practice of viewing traditional educational videos, we will compare the VAS scores between the two groups. The mean VAS scores will be compared between the two groups using a two sample two sided t-test, or Wilcoxon rank sum test should the data be found to be non-normally distributed.

Discussion:
This is the first RCT to investigate the use of VR to reduce morbidity through patient education. The tool created in this trial, if effective, will serve as the foundation for the use of VR in patient education across many different realms – redefining the hospital
care experience in an attempt to improve patient outcomes.

References:
Maranets I, Kain ZN: Preoperative anxiety and intraoperative anesthetic requirements. Anesthesia & Analgesia 1999; 89:1346–51
McCleane GJ, Cooper R: The nature of pre-operative anxiety. Anaesthesia 1990; 45:153–5
Introduction: In an attempt to improve surgical morbidity and mortality on a global scale, the World Health Organization (WHO) created the Surgical Safety Checklist (SSCL) as part of their Second Global Patient Safety Challenge. In 2015, the Cape Coast Teaching Hospital (CCTH) in Cape Coast, Ghana completed the transition from community institution to full-fledged teaching hospital. With this transition, a significant increase in the number and acuity of presenting cases was noted. In conjunction with a visiting team from Kybele non-profit humanitarian group, one of the strategies identified to help modify morbidity and mortality on entry to the institution was the implementation of the SSCL. This project is a component of an ongoing partnership between Kybele and CCTH and will continue to be evaluated and reinforced during future visits.

Methods: This Quality Improvement (QI) project was designed to implement and assess the SSCL process at CCTH and is integral to the ongoing delivery of healthcare at CCTH. REB was not sought as this is strictly QI. In keeping with the implementation guide published by the WHO, didactic information sessions as well as demonstrations in the operating rooms by Kybele members familiar with the SSCL began implementation. Data was gathered at the time of SSCL implementation via staff opinion surveys. Six months following implementation, during a return visit to CCTH, Kybele members reviewed the implementation of the SSCL. The staff opinion survey was recirculated and a random chart audit was also completed to identify both presence and completion of document for each surgical patient. Use of the SSCL was systematically observed in the operating theatres during scheduled elective cases. Information collected was synthesized to allow for revision of the SSCL to accommodate the nuances and logistics of local practice.

Results: Data collected was via 5-point Likert scale demonstrated an improvement in staff opinions of the SSCL including; endorsement of its role in improving communication, improving patient care and its use as a routine tool. In collection of additional comments it was noted that time constraints and surgeon resistance were significant barriers to the use of the SSCL. Common themes included identification of SSCL as a patient safety marker, as well as perceived improvement in nursing empowerment in the operating theatre.

Conclusion: Implementation of the SSCL at CCTH is a testament to the universality of the WHO initiative and confirmation of the described implementation plan. Initially implemented as part of a plan to reduce maternal and newborn mortality, in the hands of local leaders, the SSCL has been disseminated throughout the institution and has
become a standard of care.

References:
Introduction: Postoperative delirium and cognitive dysfunction occur in 30% of patients\(^1\) and the incidence may be as high as 62% in elderly patients undergoing major orthopedic surgery.\(^2\) It is estimated that postoperative delirium increases hospital costs approximately 2.5-fold over patients who do not experience it.\(^3\) The annual costs of postoperative delirium secondary to prolonged hospital admission are estimated to be $164 billion dollars in the USA alone\(^3\) and $17 million dollars at the University Health Network in Toronto.\(^4\) Despite the high incidence and poor outcomes associated with these debilitating disorders, no effective treatment strategies currently exist.

Our long-term goal is to build the first Centre for Perioperative Brain Health, a research platform to study perioperative cognitive outcomes. This multidisciplinary, translational research center will then be used to develop mechanistic-based treatments for delirium and postoperative cognitive dysfunction (POCD). Specifically, in this first study we will determine: 1) the incidence of post-operative delirium and POCD and 2) identify risk factors for delirium and POCD, in high-risk elderly patients who are undergoing elective major orthopedic surgery.

Methods and Data Analysis: Local Ethics Committee approval was obtained for this prospective, observational cohort study which will assess patients undergoing hip/knee arthroplasty in a single Canadian academic centre. Delirium will be assessed twice daily during admission using the 3D-CAM. Cognitive function will be tested with a state-of-the-art computer based cognitive assessment tool [CogState Brief Battery (CBB)]\(^5\) pre-operatively and on post-operative day 2, 6-weeks and 4.5-months. The primary outcome is a change in CBB score from baseline to 4.5 months. The secondary outcomes are: the incidence of postoperative delirium, proportion of patients with severe cognitive dysfunction (CBB ≤ 80) at 4.5 months, proportion of patients with mild cognitive impairment (MCI) at 4.5 months, effect of preoperative MCI, preoperative chronic inflammatory states, post-operative delirium, and post-operative complications on the postoperative cognitive changes at 4.5 months. A linear mixed effects model will be used to analyze the scores and to determine the effect of predictor variables. With 6 predictor variables and an estimated 10% incidence of POCD, a 600-participant sample size will be necessary. Our hospital performs approximately 3,000 arthroplasties yearly so this sample population is achievable. A pilot study to assess recruitment rates yielded 95 participants in 3 months, suggesting that the full sample size could be enrolled in approximately 18 months. The study is underway.

Significance and Innovation: We will build the first Centre for Perioperative Brain Health in the world. We will use this platform to develop strategies to predict, prevent and treat delirium and POCD in patients undergoing elective surgery. Our
interventions will ultimately improve patient outcomes, shorten length of stay and reduce the immense costs, monetary and social, of delirium and cognitive dysfunction.

References:
Introduction: The last few decades has seen an increase in the number of quality and safety monitoring programs in healthcare. Owing to the nature of the work, Anesthesia Quality Assurance (QA) and Quality Improvement (QI) programs are well recognized in their importance towards minimizing morbidity and mortality in the perioperative setting. Such programs can be resource intensive and in spite of their importance, administering them outside of an academic medical setting can prove to be very challenging. Furthermore, smaller case volumes in community centres make it difficult to track measures of quality care, especially for more rare events. The purpose of this study was to investigate the extent of QA/QI programs in community Anesthesia Departments across a Canadian province.

Methods: After obtaining local REB approval, a structured survey questionnaire was sent to the Anesthesia Chiefs of Staff at the seven secondary/regional community hospitals serving the province. Surveys were distributed electronically and via post with reminder emails sent at 1 and 3 months. The survey consisted of qualitative and quantitative questions covering 33 standard QA/QI indicators over three temporal domains (pre-, intra- and post-operative time periods). It also addressed potential barriers to local QA/QI practices such as lack of support, staffing resources or time allocation.

Results: Five responses were obtained from the seven surveyed hospitals (response rate 71%). All respondents indicated their department had some form of QA/QI initiative. Morbidity and Mortality rounds were most common (60%) quality activity amongst respondents. Province-wide, the QA/QI programs were very heterogeneous in terms of which specific QA/QI indicators were monitored. No one single QA/QI indicator was consistently measured by all centres. Across all five centres who responded, a sum total of 46 standard QA/QI indicators were reported as being monitored. Of those, intra-operative (19/46) and post-operative (20/46) indicators accounted for the vast majority of initiatives. Independent of the extent of their QA/QI programs, several departments (3/5) reported insufficient resources and time as a barrier. Some programs were physician-lead on a volunteer basis (2/5), while others were dependent upon hospital administration or other departments in the hospital for QA/QI support (2/5).

Discussion: This study demonstrates that community anesthesia departments across the province are working with limited resources to run QA/QI programs that are heterogeneous when compared to one another. Having a more uniform province-wide QA/QI program may improve the efficiency of these efforts, increasing the quality of such programs and ultimately improving the safety of patients undergoing anesthetic care.

References:
1. Anaesth Int Care 1993 21: 505-19
2. Anaesth Int Care 1996 24: 685-93
3. Anesthesiol 2009 110: 1158-75
Introduction: Adenotonsillectomy (AT) is one of the most common pediatric surgeries in North America (NA)\(^1\). The usual indication for AT is obstructive sleep apnea (OSA)\(^2\). Our goals were to survey NA pediatric anesthesiologists and otolaryngologists about AT management in terms of their confidence in perioperative decision-making and identifying key factors warranting elective overnight observation.

Methods: This study was approved by Research Ethics. The survey was deployed using SurveyMonkey\(^\text{TM}\) to the following affiliated members: American Society of Pediatric Otolaryngologists, Canadian Pediatric Anesthesia Society, anesthesiologists at all 16 Canadian pediatric tertiary care centers, Canadian Society of Otolaryngology-Head and Neck Surgery and the Society for Pediatric Anesthesia. Confidence in clinical practice and perceived usefulness of published clinical guidelines were assessed using a 5-item Likert scale (range-“strongly agree-disagree”). Other AT-related questions addressed preoperative evaluation, tools to diagnosis OSA and factors influencing elective admission. The survey design accounted for reliability and content validity. To achieve a ±3% sampling error for a 95% confidence level, 588 (13.9%) responses were required.\(^3\) All data are reported as proportions or medians.

Results: Survey response-rate was 14.7% (623/4238) and ranged from 11.5-61% by society/group. Most respondents were pediatric anesthesiologists (78.5%) from the United States (US), had pediatric subspecialty training (88.6%) and practiced in a pediatric tertiary care setting (57.2%). US compared with Canadian physicians were more confident in their process to determine appropriate postoperative care (Table 1). Canadian anesthesiologists were the least confident to clinically diagnose severe OSA. Polysomnography (PSG) ranked first for preoperative OSA diagnostic tools utilized by anesthesiologists and otolaryngologists, regardless of their country of practice, however, nasal endoscopy was favored by US physicians and overnight pulse-oximetry by Canadians; sleep-questionnaires and smart-phone home-sleep audio-recordings were favored by anesthesiologists and otolaryngologists, respectively. “Witnessed apnea” was common to both anesthesiologists and surgeons as a key preoperative symptom/sign warranting elective admission, however, reported “fatigue” and “medical comorbidities” were specific to anesthesiologists and surgeons, respectively. Respondents were split between “moderate-severe” (40.0%) and “severe” (40.2%) PSG-diagnosed OSA requiring admission; oxygen-saturation nadir threshold for admission was 80-85%. The majority (61%) of respondents reported 1-3 hours of required post-AT monitoring, however, Canadian anesthesiologist’s requirements were longer (3-4 hours).
Discussion: Canadian compared with US pediatric physicians, particularly anesthesiologists, appeared more conservative in their perioperative care of children undergoing AT. Preoperative PSG and witnessed apneas were key determinants of postoperative disposition following AT. Respondents were divided regarding threshold of PSG-determined OSA severity warranting an overnight stay.

References:

Table 1. Respondents in agreement to questions related to perioperative care of children undergoing adenotonsillectomy for OSA, by specialty and country sub-groups

<table>
<thead>
<tr>
<th>Statement</th>
<th>Statement</th>
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<tbody>
<tr>
<td><strong>Anesthesiologists</strong></td>
<td><strong>Otolaryngologists</strong></td>
</tr>
<tr>
<td>“Somewhat/strongly agree with statement” (%)</td>
<td>“Somewhat/strongly agree with statement” (%)</td>
</tr>
<tr>
<td>(Canadian)</td>
<td>(USA)</td>
</tr>
<tr>
<td>Q3. Published guidelines are helpful to determine post-op disposition*</td>
<td>Q3. Published guidelines are helpful to determine post-op disposition*</td>
</tr>
<tr>
<td>Q4. Confident in local process to determine overnight admission*</td>
<td>Q4. Confident in local process to determine overnight admission*</td>
</tr>
<tr>
<td>Q5. Confident to diagnose severe OSA based on Hx/Px*</td>
<td>Q5. Confident to diagnose severe OSA based on Hx/Px*</td>
</tr>
<tr>
<td>Q11. 3 yo healthy child with moderate OSA (AHI &lt;10) is suitable for ambulatory AT**</td>
<td>Q11. 3 yo healthy child with moderate OSA (AHI &lt;10) is suitable for ambulatory AT**</td>
</tr>
</tbody>
</table>

Note: AT = adenotonsillectomy; AHI = Apnea Hypopnea Index; Hx = History; OSA = Obstructive Sleep Apnea; Post-op= postoperative; Px = Physical Exam; Q=question; USA=United States of America; yo=year-old; *For Q3-5 Anesthesiologist and Otolaryngologist, n=475 and 133, respectively ** For Q11 Anesthesiologist and Otolaryngologist, n=445 and 126, respectively
COMPARISON OF SEIZURE DURATION USING SUCCINYLCHOLINE VS. CISATRACURIUM IN ANESTHESIA DURING ECT IN PEDIATRIC

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Abstract

Background: Succinylcholine is commonly used as a muscle relaxant in patients who are candidates for receiving electroconvulsive therapy (ECT). Our objective was to compare the variations caused by two drug regimens of cisatracurium and succinylcholine on seizure duration during ECT. Hemodynamic values were also observed for probable alterations.

Methods: Consent was obtained from all legal guardians and the research was approved by the institutional ethics committee. The study was a randomized, double blinded clinical trial conducted on 64 patients, divided into two groups of 32 patients, using simple randomization method. The muscle relaxant cisatracurium was used in the first group and succinylcholine was used in the second group undergoing ECT. The durations of the tonic phase, clonic phase and seizure duration were compared in the two groups.

Findings: The mean duration of the tonic phase in the cisatracurium and succinylcholine groups were 6.87 ±1.98 and 27.37 ±4.99 seconds, respectively which was significantly shorter in the cisatracurium group (P=0.001). On the other hand, the mean duration of the clonic phase in the succinylcholine and cisatracurium groups were 15.78 ±5.96 and 29.84 ±6.55 seconds respectively, which was significantly shorter in the succinylcholine group (P=0.001).

Discussion: Although cisatracurium is considered a muscle relaxant with intermediate duration of action, its low dose administration in ECT is not only without any limitations, but may also be a more appropriate alternative to succinylcholine. On the other hand, if the duration of seizures is reduced in ECT, it may no longer be an effective treatment, and as a result, since cisatracurium increases the seizure duration, it could have better therapeutic effects in ECT and prevent undesirable complications of succinylcholine.

Key words: electroconvulsive therapy, tonic phase, clonic phase, cisatracurium, succinylcholine

References:
1) Liu cc, QianXy , An Jx , Yu Zl . Electroconvulsive Therapy under General Anesthesia with Cisatracurium, Laryngeal Mask Airways, and Bispectral Index 2016 Mar; 32(1):17-9
Table 1 | Mean (SD), seizure duration, tonic phase, and clonic phase

<table>
<thead>
<tr>
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<th>cis (n = 32)</th>
<th>suc (n = 32)</th>
<th>( P ) value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seizure duration (s)</td>
<td>36.72±6.09</td>
<td>27.37±4.99</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Tonic phase (s)</td>
<td>6.87±1.98</td>
<td>11.59±3.47</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Clonic phase (s)</td>
<td>29.84±6.55</td>
<td>15.78±5.96</td>
<td>&lt;0.001</td>
</tr>
</tbody>
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*Independent t-test

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Introduction: There has been little research into stress and laparoscopic procedures in urology with majority of studies concentrating on nephrectomy\(^1\). Many drugs have been tried to decrease stress response during laparoscopic surgery like clonidine, high doses of opioids, β-blocking agent and dexmedetomidine. Dexmedetomidine decreases renin release and decreases BP. Dexmedetomidine infusion did not inhibit adrenal steroidogenesis in humans after major surgery\(^2\). We planned to evaluate the efficacy of dexmedetomidine in two different doses in reducing the stress response in patient undergoing laparoscopic pyeloplasty.

METHODS: After local ethics committee approval and informed patient consent, 90 ASA I and II patients were assigned to one of three groups: Group B patients received dexmedetomidine 1μg/kg body weight (BW) loading dose, then 0.7 μg/kg BW/hour for maintenance. Group C patients received dexmedetomidine 0.7μg/kg BW loading dose, then 0.5 μg/kg BW/hour for maintenance. Group A patients received normal saline (placebo) in the same volume and rate. Stress response were measured in the form of hemodynamic response (Heart rate HR and Mean Arterial Blood Pressure MAP), blood sugar and serum Cortisol.

RESULTS: The HR and MAP were found to be statistically significant (p < 0.05) and higher in group A as compared to group B and C throughout the intraoperative and postoperative period. The HR, MAP values were statistically insignificant and comparable throughout perioperative phase during the comparison of group B with group C. RBS at post intubation and extubation was statistically significant (p < 0.05) and higher in group A when compared with group B and Group C while it was statistically insignificant when group B was compared with group C. Serum Cortisol at postintubation, during midsurgery and 2 hrs after extubation was statistically significant (p < 0.05) and higher in group A when compared with group B and group C while it was statistically insignificant when group B was compared with group C.

Discussion: In our study, dexmedetomidine was used in two different doses and we found a statistically significant decrease in stress response in two groups when compared with control group but a insignificant difference in stress response when comparison was done between two doses hence the advantages of dexmedetomidine can be achieved with lower doses and possibility of bradycardia and hypotension due to higher doses can be diminished.

References:
**Introduction:** Angiotensin-converting-enzyme inhibitors (ACEIs) and angiotensin II receptor blockers (ARBs) are commonly prescribed medications. In the perioperative setting, these medications may exacerbate the hypotensive effects of anesthesia, and recent guidelines from the Canadian Cardiovascular Society (CCS) have recommended withholding ACEIs/ARBs for 24 hours before surgery [1]. This retrospective study documents the local practice of preoperative ACEI/ARB discontinuation, and examines the effects of discontinuation on the development of intraoperative hypotension in patients undergoing elective joint arthroplasty.

**Methods:** This study was approved by the local Research Ethics Board and all study participants consented to the use of their personal health information for research purposes. Consecutive patients who underwent total knee or total hip arthroplasty between January 2015 and December 2015 were retrospectively reviewed. Only patients taking ACEI/ARB medication were included. We divided patients into two groups: those who were instructed to discontinue their ACEI/ARB on the morning of surgery, and those who continued their medication. We compared the two groups' incidences of intraoperative hypotension requiring vasopressor support.

**Results:** Of 276 patients, 214 (78%) were instructed to discontinue ACEI/ARB therapy on the morning of surgery. There were no significant differences between the ACEI/ARB discontinuation and continuation groups with regards to baseline demographics, comorbidities, or surgery type (hip vs. knee). Intraoperatively, the ACEI/ARB discontinuation group had a decreased incidence of hypotension requiring vasopressor support (26% vs. 37%), although this difference was not statistically significant (p=0.079). Postoperatively, there was no difference between the groups in postoperative hypertension or other complications. In the multivariate logistic regression analysis, ACEI/ARB continuation (p=0.007), older age (p=0.020), and hip arthroplasty (p=0.001) were independent predictors of intraoperative hypotension. ACEI/ARB continuation remained an independent predictor of hypotension in the subset of patients who underwent surgery with spinal anesthesia (n=215, p=0.008).

**Discussion:** In patients undergoing elective total hip or total knee arthroplasty, ACEI/ARB continuation is an independent risk factor for the development of intraoperative hypotension requiring vasopressor support. ACEI/ARB discontinuation on the day of surgery did not lead to increased incidence of postoperative hypertension. Other risk factors for vasopressor use include age and hip arthroplasty. These findings support recent CCS guidelines, although randomized controlled trials are needed to further strengthen the current recommendations.
References:
Purpose:
To describe a case of cholinergic crisis due to reversal of neuromuscular blockade with neostigmine after a laparoscopic appendectomy.

Clinical Features:
Patient consent and ethics approval were obtained in accordance with local institutional guidelines prior to the submission of this case report. A 76 year old female underwent a laparoscopic appendectomy. She had hypertension and type 2 diabetes mellitus. She was 70 kg and 163 cm. There was no history or evidence of cerebrovascular disease or dementia. General anesthesia was induced with fentanyl 75 mcg, propofol 120 mg, and rocuronium 30 mg and maintained with air, oxygen and desflurane. After 30 minutes of surgery, ulnar train-of-floor revealed four twitches with fade. Intravenous neostigmine 2.5 mg and glycopyrrolate 0.4 mg were administered. With removal of volatile, the patient opened her eyes and moved her head from side to side. She was extubated but exhibited poor respiratory effort and wasn't following commands. A second, identical dose of reversal was given. She continued to produce low tidal volumes and became less responsive. She remained hemodynamically stable but due to desaturation was reintubated with propofol 50 mg and succinylcholine 140 mg. Subsequently, she became unresponsive despite a lack of sedation and had pin point pupils. She was moving all her limbs but her muscle activity was reminiscent of residual paralysis with sporadic twitches. She became persistently hypoxemic requiring intermittent alveolar recruitment maneuvers. She was sedated with propofol and ventilated in the recovery room. There were no lateralizing signs suggestive of a stroke and her metabolic workup was normal. Her chest X-ray revealed evidence of atelectasis. After 3 hours her muscle tone and ventilatory effort allowed for extubation. It took an additional hour for her mentation to recover. On discharge to the floor she continued to require oxygen supplementation by nasal prongs.

Conclusion: A presumptive and unifying diagnosis of a cholinergic toxidrome was made due to the neurologic, musculoskeletal, and respiratory signs that are consistent with this disorder. Interestingly, cholinergic crisis is described in the treatment of myasthenia gravis with anticholinesterase medications. However, there is a dearth of literature in the context of reversal of paralysis with neostigmine. We hypothesize that higher doses of anticholinesterases, especially in the elderly, stimulates central receptors resulting in meiosis, restlessness, confusion, or unresponsiveness. It also stimulates pulmonary secretions, bronchospasm and muscle weakness. Prospective studies are required to test this theory.

References:
References:
1. Anticholinesterase Poisoning. Open Anesthesia. 
Link: https://www.openanesthesia.org/anticholinesterase_poisoning_rx/


BACKGROUND
The performance of ultrasound guided regional anesthesia has expanded but is still limited by unfamiliarity with sono-anatomy. As a result anesthesiologists will refer to text books and videos on Youtube to remember how to perform blocks in a ‘just-in-time’ manner. The use of real-time reference to videos in a coaching manner has not been studies and is limited due to lack of appropriately designed videos and the difficult with having too many screens in the operating room. We propose that the use of augmented reality goggles may allow for the viewing of patient site, patient sono-anatomy and a reference/coaching video all at the same time in one field of view.

METHODS
This project was exempt from institutional ethics approval. We designed an augmented reality layout that used the Hololens device, open source femoral nerve block videos and a Sonosite ultrasound machine. The reference/coaching video was preloaded onto the augmented reality device. A second virtual screen depicted a static reference image. We streamed simulated ultrasound image from the Sonosite machine. The anesthesiologist then wore the Hololens device while simulating the performance of a femoral block on a manikin and using the SonoSite Ultrasound Machine. Following several iterations, we were able to have the reference video/coach respond to the following voice activated commands (play, pause, rewind 3 seconds, rewind 5 seconds, restart).

RESULTS
We have successfully developed a real-time voice activated augmented reality reference/coach for use when performing regional anesthesia blocks. We have been able to demonstrate that it is feasible to use augmented reality to depict the patient sono-anatomy, a reference coaching video, an illustrated anatomy image all in one field of view over the patient’s operative site. We are now investigating the efficacy of our system for impact on learning, safety and performance in a simulated clinical study. Our system may demonstrate the role of realtime augmented reality coaching in the absence of other peers.

References: