11th ANNUAL
GELFAN AND BELL
ANESTHESIA
CONTINUING EDUCATION
AND RESEARCH
SYMPOSIUM

Friday May 13th, 2022

This event is an Accredited Group Learning Activity (Section 1) as defined by the Maintenance of Certification Program of the Royal College of Physicians and Surgeons of Canada, and approved by the University of Calgary Office of Continuing Medical Education and Professional Development. You may claim a maximum of 3.25 hours (credits are automatically calculated).
Abstracts

Oral Presentations

**Symposium Learning Objectives:**
At the end of the program, the participants will be equipped to explain current anesthesiology related research and scholarly activities taking place in Edmonton over the past year, and strengthened professional collaborative bonds with their colleagues in and around the city of Edmonton.
Use and Discriminatory Ability of the Surgical APGAR Score

Presenter: Dr. Elliot Pittman¹
Additional Author(s): Dr. Kaylene Duttchen¹
¹Department of Anesthesiology & Pain Medicine, University of Alberta, Edmonton, Canada

Background: The Surgical Apgar Score (SAS) is a simple metric calculated at the end of surgery that provides clinicians with information about a patient’s post-operative risk of morbidity and mortality. The SAS differs from other prognostic models in that it is calculated from intra-operative rather than pre-operative parameters. The SAS was originally derived and validated in a general and vascular surgery population. Since its inception it has been evaluated in many other surgical disciplines, large heterogeneous surgical populations, and various countries.

Methods: A database and grey literature search was performed on 3 March 2020. Identified articles were reviewed for applicability and study quality with pre-specified inclusion criteria, exclusion criteria and quality requirements. Thirty-six observational studies are included for review. Data was systematically extracted and tabulated independently and in duplicate by two investigators with differences resolved by consensus.

Results: All thirty-six included studies reported metrics of discrimination. When using the SAS to correctly identify post-operative morbidity, the area under the receiver-operator curve or concordance-statistic ranged from 0.59 in a general orthopedic surgery population to 0.872 in an orthopedic spine surgery population. When using the SAS to identify mortality the area under the receiver-operator curve or concordance-statistic ranged from 0.63 in a combined surgical population to 0.92 in a general and vascular surgery population.

Conclusion: The Surgical Apgar Score provides a moderate and consistent degree of discrimination for post-operative morbidity and mortality across multiple surgical disciplines.

Learning Objective:
At the end of this session, participants will be able to review the current literature evaluating the performance of the Surgical Apgar Score (SAS).
Local infiltration analgesia technique for spine surgery (spLIA): technical description and initial experience

Presenter: Dr. Kyle McCombs
Additional Author(s): Vivian Ip, Kyle McCombs, Rakesh Sondekoppam, Michel Lavoie, Anil Walji

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

Keywords: Local infiltration analgesia, lumbar spine surgery, ERAS, opioid consumption

Objectives: Spinal surgery can cause severe pain where current opioid-sparing strategies such as epidural can be technically demanding. This is a technical description of a simple, surgeon-administered technique supported by a case series. We further explored the anatomical basis and safety of injectate deposition in the vicinity of the vertebral arch using cadaver dissections.

Methods: The spLIA technique was performed in a cohort of patients whose post-operative analgesic consumption and pain scores were noted. For the cadaveric investigation, the focus was on dye spread following retro-articular injected.

Results: Clinically, spLIA has shown a reduction in opioid consumption and pain score. In the cadaver dissections, the dye spread was predominantly on the paraspinal muscles.

Conclusion: Our case series demonstrated that it is beneficial in integrating surgeon-administered spLIA reduce opioid consumption in lumbar spine surgeries.

Learning Objectives: At the end of the session, participants will be able to identifying the benefits and technical considerations of Local Infiltration Analgesia for Spine Surgery.
Introduction: Regional nerve blocks (RNBs) are becoming a mainstay of postoperative analgesia for various orthopedic procedures. Traditionally, catheters are removed prior to discharge. However, some centers across North America continue catheters after hospital discharge.

Objectives: We aimed to assess the feasibility of continuing RNBs post-discharge after Total Shoulder Arthroplasty (TSA) and major ankle surgery. Specific outcomes included postoperative analgesia, the degree to which systemic narcotics are spared, and length of hospital admission.

Design and Methods: This quality improvement initiative aimed to create a fast-track pathway for patients undergoing TSA and major ankle surgery at the University of Alberta Hospital. A prospective cohort was selected for at home regional anesthesia (HRA). These patients were discharged on postoperative day 1 (POD) with indwelling never catheters, which were removed at home on POD3. Patients kept a pain journal and tally of narcotics used (as morphine equivalents) for assessment of RNB. The control group consisted of the current standard, retrospectively assessed by chart review of patients undergoing similar procedures. Groups were compared using unpaired t-test. Primary outcome was rate of discharge of patients on POD1, while secondary outcomes included pain scores to assess analgesic efficacy, narcotic consumption, and rate of return of narcotics.

Main Results: There were 29 patients in the control group and 24 patients in the HRA group, for a total of 53 patients. 22 (92%) from the HRA group were discharged successfully on POD1. The average day of discharge was 1.08 vs 1.62 (p<0.0001) for the HRA and control groups, respectively. Average morphine equivalents were reduced from 108.9 mg to 45.6 mg (p<0.0036) in HRA. Pain scores on POD1 were decreased in HRA, and did not differ between the two groups on POD2 (3.67 vs 1.82 (p<0.0062) and 3.05 vs 2.98 (p=0.92) respectively). Only 7 (29%) patients returned some or all of their remaining narcotics. There were no major complications in HRA.

Conclusions: The at home regional program is feasible in select patients at our institution, provides at least equivalent analgesia and is safe. Future work would entail developing a more robust opioid retrieval protocol and expanding the breadth of procedures that are amenable to an at home RNB.

Learning Objective: At the end of this session, participants will be able to assess the feasibility and continuing RNBs post-discharge after Total Shoulder Arthroplasty and major ankle surgery.
**Introduction:** Phenylephrine hydrochloride is a synthetic sympathomimetic agent similar to epinephrine and ephedrine. Its potent alpha-1- adrenergic-agonist properties lead to vasoconstriction and increase perfusion pressure. For this reason, phenylephrine is commonly used by anesthesiologists to increase blood pressure during anesthesia for surgical procedures.

The variability of the phenylephrine concentration will be analyzed following reconstitution of phenylephrine (10mg/mL) in 100mL polyvinyl chloride bags at three separate times in a standard operating day using high performance liquid chromatography.

**Design & Methods:** A one-month, single centre analytical observational study was conducted to assess the variability of phenylephrine concentrations. Thirty, 10cc polypropylene syringes were used to collect phenylephrine samples previously diluted (10mg/mL) into 100mL polyvinyl chloride bags by anesthesia providers. The samples were collected at three time points in a standard operative day; in the morning 07:00 (prior to clinical use), at 12:00 and at 15:00.

Samples were analyzed with liquid chromatography with tandem mass spectrometry (LC/MS) using a Waters Acquity (Waters, Milford, MA) UHPLC system coupled to a Waters XEVO triple quadrupole analyzer. A 5 µL aliquot was loaded onto the column at a flow rate of 0.50 mL/min and an initial buffer composition of 100% of 0.1% formic acid in water as mobile phase A. Mass spectra were acquired in positive mode of ionization. An internal standard for methyephedrine with a concentration of 0.050ng/µL was used to obtain calibration standards over a range of 0.0014ng/µL. Analysis was done manually using the MassLynx software V4.1 and QuantLynx V4.1 supplied by Waters.

Data was analyzed using repeated measures ANOVA modeling for within group and between group comparisons with time. The variation of measured compared to expected phenylephrine concentrations (percent error) was determined for each sample in comparison to the nominal concentration of 100ug/mL.

**Results:** There was a total of 30 samples (10 from 07:00am, 10 from 12:00 and 10 from 15:00). The average percent error for all 30 samples was 8.73%. There was a variation of <5% in measured compared to expected concentration for 12 (40%) of the samples, >5% and less than 10% for 6 samples (20%) while 12 samples (40%), 23% (7/30) had a concentration percent error that was greater than 10%. Measured concentrations were higher than expected for 24 (80%) samples, while 6 (20%) samples measured below the expected 100ug/mL. There were 3 samples which varied by more than +20% from the expected concentration. The sample with the lowest measured concentration varied by -12.5% of the expected concentration.

**Conclusions:** Phenylephrine's variability in concentration following reconstitution in 100mL 0.9% normal saline bags was statistically significant among anesthesiologists; however, the difference in concentration was not statistically significant over the course of a clinical day.

**References:**
Learning Objective: At the end of this session, participants will be able to evaluate the variability of Phenylephrine in clinical setting using a Repeated Measures ANOVA model.
Background: Enhanced recovery after surgery (ERAS) are evidence-based programs designed to promote patients' recovery throughout the peri-operative period. These initiatives identify key elements in the pre-operative, intra-operative, and post-operative phases that have been shown to reduce complications, and improve clinical outcomes. ERAS guidelines have been implemented across multiple specialties, including cardiac procedures. However, there are limited number of studies evaluating the effectiveness of ERAS elements for congenital cardiac surgical cases.

This study aims to review current peri-operative management strategies at a local institution, identifying specific patient populations that could benefit from commonly accepted ERAS components. These results may provide a basis for the establishment of a local ERAS protocol for congenital cardiac procedures.

Methods: This is a single-centre, retrospective cohort study that includes all pediatric patients (below age of 18) who underwent elective congenital cardiac surgery requiring cardiopulmonary bypass from November 2019 to November 2020 at the Mazankowski Alberta Heart Institute (MAHI) in Edmonton, Alberta. Patients’ clinical characteristics, surgical characteristics, ERAS parameters and overall outcomes will be collected from an electronic (ConnectCare) chart review.

Results/Data Analysis: A total of 425 patients are eligible for further chart review. Once chart review has been completed, further statistical analysis will occur. Student’s t-test, two-tailed Mann Whitney test, and either two-sided Fisher’s exact test or chi-square test will be used for parametric continuous, non-parametric continuous, and categorical data respectively. Multivariate logistic regression analysis will be used to identify predictive factors of key ERAS metrics. All statistical analysis will be completed using specialized software.

Potential Significance: This study may provide evidence supporting the efficacy of ERAS elements in improving outcomes for congenital cardiac patients. Thus, this could provide a basis for the implementation of a clinical trial evaluating the effectiveness of a specific congenital cardiac ERAS protocol at the MAHI.

Learning Objective: At the end of this session, participants will be able to assess the efficacy of Enhanced Recovery after Surgery elements in outcomes for congenital cardiac patients.
Three Dimensional Assessment of Right Ventricular Function in Patients Undergoing Left Ventricular Assist Device Implantation

Dr. Surita Sidhu¹
¹Department of Anesthesiology and Pain Medicine, University of Alberta

Hypothesis: Three/four-dimensional analysis of perioperative RV function in patients undergoing LVAD implantation using TEE-derived data may assist in the development of a reliable predictive RV failure risk score.⁶,⁷

Background: Left ventricular assist devices (LVADs) improve quality of life and survival in patients with end-stage heart failure. However, right ventricular (RV) failure occurs in 20-50% of LVAD recipients and leads to increased perioperative morbidity and mortality.¹ If RV support is required, 1 year mortality approaches 60%.² Although many attempts have been made to identify factors predisposing patients to postoperative RV failure in this population, no reliable model currently exists.³ Traditional RV assessment is done with an overall visual impression, along with the assistance of several validated measurable parameters. Accurate evaluation of the RV function by two-dimensional echocardiogram (2DE) is challenging due to the ventricle's triangular, crescent shape. Unlike the LV, there is not a good geometric surrogate model that can accurately derive RV volumes from 2D data.⁴ Cardiac magnetic resonance imaging (cMRI) is considered the gold standard of measuring RV volumes and ejection given its high resolution and ability to reconstruct near infinite cross sectional planes.⁵ We recently completed a study demonstrating that TomTec 4D RV-FUNCTION software analysis of datasets derived from transesophageal echocardiography (TEE) correlated well with cMRI. Although TomTec analysis of RV function has been validated for transthoracic echocardiography, our study is the first in the literature to demonstrate a correlation between assessment of RV function between TEE and cMRI. Three/four-dimensional analysis of perioperative RV function in patients undergoing LVAD implantation using TEE-derived data may assist in the development of a reliable predictive RV failure risk score.⁶,⁷

Objective: Primary Objective: Currently, no existing models accurately predict which patients would benefit from early institution of pharmacologic and/or mechanical right ventricular support post-LVAD implantation. The primary objective of this observational study is to determine whether right ventricular parameters derived from perioperative three dimensional echocardiography (3DE) are predictive of right ventricular failure within the 14 day period following implantation of LVADs.³ These parameters would be analyzed using TomTec 4D RV-FUNCTION software. Secondary Objectives: The secondary objective is to determine if any other perioperative or patient related factors correlate with the incidence of RV failure post-LVAD implantation. These would include institution of pharmacologic/mechanical right ventricular support, duration of mechanical ventilation, intensive care/hospital length of stay, major adverse cardiac, renal, and cerebrovascular events.

Design: This will be an observational study of patients undergoing LVAD implantation at the Mazankowski Alberta Heart Institute (MAHI) in Edmonton, Alberta. Patients scheduled for non-emergent LVAD insertion will be screened at all preadmission clinic (PAC) visits as well as preoperative day number 1 for inpatients. As staff anesthesiologists are directly involved in patient care both in the preadmission clinic (PAC) and intraoperatively, there is no additional requirement for pre consent access to the electronic medical record (EMR). Patients identified as potential study candidates will be approached for inclusion. Individual consent will be obtained for study participation and use of information for research purposes including extraction of RV volumetric data from 3D TEE as well as perioperative clinical data from the EMR. In addition, institutional health ethics review board approval will be sought. As placement of a pulmonary artery catheter, transesophageal echocardiogram, and 3D assessment of biventricular function are routine and standard of care, patients will be exposed to no additional risks beyond those expected for their surgery and anesthetic management. This explanation
and consent will be done in the PAC or preoperatively depending on the patient admission pathway. All patients presenting for cardiac surgery will receive a TEE unless there is a contraindication. The TEE procedure itself falls under the informed consent obtained for the procedure by the cardiac surgeon and the cardiac anesthesiologist. Given that there is no additional intervention beyond the 3D RV acquisition, it is also possible to consent post surgically for access to TEE and other data from the EMR. All patients will receive general endotracheal anesthesia, invasive vascular access, a pulmonary artery catheter, and a comprehensive transesophageal (TEE) study. This will include an acquisition of an RV-focused 3D 6 beat EKG-gated full volume dataset obtained at three points perioperatively. These will include 1) during the post-induction/pre-sternotomy period 2) within fifteen minutes of institution of LVAD flow and separation from cardiopulmonary bypass (CPB) and 3) post-sternotomy. A Phillips EPIQ echocardiography machine with an X7-2T or X8-2T TEE probe will be used for all image acquisition and datasets will be exported in DICOM format. Intraoperative anesthetic, ventilator, hemodynamic, and fluid management will not be protocol driven. The 3D TEE RV data set will be exported to the Tomtec 4D RV-Function software for offline analysis. Manufacturer guided steps for software interpretation will be performed by three to four raters. Values for RV strain, RV EDV, RV ESV, RVEF, RV fractional area change (FAC), and tricuspid annular planar systolic excursion (TAPSE) will be recorded and averaged. Additional details that will be extracted from the medical record to determine impact on the incidence of RV failure will include age, gender, body surface area (BSA), diagnosis, comorbidities, intraoperative hemodynamic data (CVP, PA systolic pressure (PASP), and PA diastolic pressures (PADP), PAPI [(PASP − PADP)/CVP], echocardiographic data (as outline above), and postoperative clinical outcome data. This will include the Interagency Registry for Mechanically Assisted Circulatory Support (INTERMACS) definition of RV failure. This includes one or more of the following criteria: the need for a RV mechanical support device (right ventricle assist device [RVAD]) or need for inotropic/inhaled pulmonary vasodilator for >14 days postoperatively. The right ventricular failure risk score (RVFRS) using 4 preoperative variables: vasopressors (4 points), aspartate aminotransferase ≥80 IU/L (2 points), bilirubin ≥2.0 mg/dL (2.5 points), creatinine ≥2.3 mg/dL (3 points) will also be calculated.

Patients/Participants: Inclusion Criteria: Patients will be eligible to be included in the study if they receive either a HeartMate III (Thoratec, Pleasanton, CA), HeartWare HVAD (HeartWare, Oakville CA), or Levitronix CentriMag (Levitronix LLC, Waltham, MA) LVAD. Exclusion Criteria: Patients will be excluded if: (1) hemodynamic data needed to calculate PAPi or comprehensive echocardiographic images are missing, (2) additional procedures affecting cardiac geometry and/or hemodynamic measurements, such as tricuspid, mitral, and/or aortic valve repair/replacement, were performed at the time of LVAD implantation; (3) sternal closure at the end of the procedure is not possible; or (4) RV mechanical support was introduced concurrently with LVAD implantation. Patients on preoperative inotropic support will be included in the analysis. Patients in which inadequate image quality required to obtain a 3D protocol will be excluded from statistical analysis. A patient with any known contraindication to TEE, or unexpected inability to advance probe into the mid-esophageal views, will be excluded.

Interventions: None, as this is an observational study.

Expected outcomes: Morbidity and mortality associated with RV failure post-LVAD implantation approaches 60% at one year. When based on reliable preoperative risk assessments, planned placement of a temporary right ventricular assist device in patients undergoing LVAD placement may attenuate the risk of RV failure. Identification of echocardiographic parameters that could reliably predict the risk of RV failure could have a profound effect on the perioperative course of these critically ill patients.

Learning Objective: At the end of this session, participants will be able to determine whether right ventricular parameters derived from perioperative three dimensional echocardiography (3DE) are predictive of right ventricular failure within the 14 day period following implantation of LVADs. Determine if any other perioperative or patient related factors correlate with the incidence of RV failure post-LVAD implantation.
**Autologous whole blood management for reduction of blood product transfusion in adult cardiac surgical patients: a pilot study**

Presenter: Dr. Angela Neufeld

1Department of Anesthesiology & Pain Medicine, University of Alberta, Edmonton, Canada

**Hypothesis:** Large volume intraoperative autologous whole blood (IAWB) transfusion (A) reduces administration of allogenic blood products and (B) leads to improved clinical outcomes in on-pump high risk adult cardiac surgical patients.

**Background:** Clinical experience at the Mazankowski Alberta Heart Institute has indicated that large volume intraoperative autologous whole blood (IAWB) transfusion reverses cardiopulmonary bypass related coagulopathy and potentially reduces allogenic and derivative transfusion. Reductions in allogenic and derivative transfusion may be associated with reductions in morbidity, mortality, and health care costs. In preparation for an upcoming multi-site randomized control trial to assess our hypothesis a pilot study will be performed to test the study protocol.

**Specific Objectives:**
(A) Assess recruitment/screening/eligibility/randomization processes; (B) assess capacity and resources to ensure conduct all trial processes; (C) assess for selection bias; (D) assess processes to ensure treatment fidelity; (E) assess for data completeness and variability; (F) assess challenges faced by personnel; (G) assess treatment effect.

**Methods:** *Design* - Single-centre prospective randomized controlled pilot study. Eligible participants will be randomized to receive intervention or control. Intervention consists of large volume IAWB transfusion; control is standard care (allogenic/derivative transfusion). Allogenic/derivative transfusion will be governed by a ROTEM®-based algorithm intraoperatively and a traditional laboratory value-based algorithm in the intensive care unit (first 24 hrs). Rotational thromboelastometry (ROTEM®) will be performed at baseline, post-protamine, and post-transfusion therapy.

**Sample size** - A total of 40 patients, 20 per group, will be run through the study protocol.

**Data Analysis (intention-to-treat)** - Primary Outcome: Number of allogenic blood products and derivatives transfused within the first 24hrs postoperatively - analyzed by Chi Square test.

Secondary Outcomes: ROTEM® values, 24hr chest tube output, time to extubation, ICU and hospital length of stay, incidence of postoperative: infection (30-days), myocardial infarction, stroke, acute lung injury, acute kidney injury, new requirement renal replacement therapy, and all-cause mortality (30-day) - analyzed by multivariate analysis of variance or T Test. P values of < 0.05 will be considered significant.

**Significance and Importance:** To establish that key components necessary for conducting the proposed main RCT all function well together. Preliminary data used to assess sample size assumptions.

**Learning Objectives:** At the end of this session, participants will be able to:
(A) Assess recruitment/screening/eligibility/randomization processes;
(B) Assess capacity and resources to ensure conduct all trial processes;
(C) Assess selection bias;
(D) Assess processes to ensure treatment fidelity;
(E) Assess for data completeness and variability;
(F) Assess challenges faced by personnel;
(G) Assess treatment effect.
**Sternotomies and PectoIntercostal Fascia Blocks in Fast-Track Cardiac Anesthesiology (SPIFFY)**

Presenters: Dr. Megan McLachlan and Dr. Emma Torbicki

Additional Authors: Dr. Gerry van Rensburg, Dr. Wing Lam

1Department of Anesthesiology & Pain Medicine, University of Alberta, Edmonton, Canada

**Study Design:** This will be a single-centre, double blinded randomized, placebo-controlled study examining the impact of bilateral PIF blocks on acute post-operative pain following fast track cardiac anesthesia patients undergoing median sternotomy.

**Hypothesis:** We hypothesize that placement of PIF blocks and catheters will decrease acute postoperative pain from midline sternotomy in fast track cardiac surgery patients compared to the current standard of care.

**Material, Equipment & Methods:**

**Study design:** This will be a single-centre, double blinded randomized, placebo-controlled study examining the impact of bilateral PIF blocks in fast track cardiac anesthesia patients undergoing median sternotomy.

**Inclusion Criteria:** Participants will be adult patients presenting to the Mazankowski Heart Institute for operations via full midline sternotomy, i.e.: coronary artery bypass grafting, and/or single valve repair or single valve replacement who are expected to be fast track candidates post-operatively. At our centre this includes patients scheduled for cardiac bypass grafting and/or single valve surgery requiring cardiopulmonary bypass.

**Exclusion Criteria:** Patients with any of the following characteristics will not be eligible for study enrollment:

- Unstable or fluctuating cardiac condition (acute MI, HF, tamponade, type A dissection, ongoing refractory arrhythmia, LVEF <40%, massive transfusion protocol, reinstition of CPB or other mechanical support)
- Alternative surgical approach (e.g. thoracotomy, mini sternotomy)
- Repeat sternotomy or emergency surgery
- Pregnancy or lactation
- Age <18
- Chronic pain
- Tolerance to opioids
- Active alcohol misuse disorder, IVDU or cannabis use >1g/d
- Allergy to local anesthetics
- Inability to provide informed consent
- High doses of steroids pre-operatively (>10 mg prednisone/day)
- Patients who are changed from fast track status intraoperatively (ex. bypass time greater than 3 hours, or aortic cross clamp time over 120 minutes)

**Randomization and study interventions:** Enrolled participants will be randomized in block fashion to receive bilateral PIF blocks with bupivacaine or placebo based on computer generated numbers. Withdrawal criteria: Patients who initially met randomization criteria but then had changes in status preventing them from being fast track candidates will be withdrawn from the study. Examples of these criteria include: return to OR in the first 24 hours post-operatively.

**Intraoperative management:** In the operating room patients may receive 0-0.05 mg/kg of midazolam, 0-0.5 mg/kg of ketamine and either fentanyl 3 mcg/kg or sufentanil 0.3 mcg/kg for induction of
anesthesia. Anesthesia will be maintained using a balanced anesthetic technique titrated to patient sedation index of 25 - 50, using isoflurane or sevoflurane and either fentanyl 2-3 mcg/kg/hr or sufentanil 0.3-0.4 mcg/kg/hr. Narcotic infusions will be discontinued when sternal wires are inserted. No long acting narcotics will be administered intraoperatively. Vasoactive agents and management of ventilation are left to the discretion of the attending anesthesiologist.

**Ultrasound guided PIF blocks:** PIF blocks will be placed at the conclusion of surgery following application of dressings. Patients will be in the supine position with the surgical drapes in place. The blocks are performed using a high frequency linear transducer with aseptic technique. Following skin preparation with chlorhexidine, the ultrasound probe is placed longitudinally 3 cm from the sternum at the level of the 4th-6th intercostal space. Using an in-plane approach, a 21G Pajunk® needle will then be advanced into the fascial plane between pectoralis major and the external intercostal muscles. After identification of the pectointercostal fascial plane peripheral nerve block catheters will be inserted and secured to the skin surface with tegaderm. This will be repeated on the contralateral side. For patients weighing over 70 kg, 20 mL of 0.5% ropivacaine will be administered in 5mL aliquots per side. This will be reduced to 15mL per side for patients weighing less than 70 kg. A CADD™ pump will be connected to each catheter and programmed to deliver 20 mL boluses of ropivacaine 0.2% starting at postoperative hour 2. To limit plasma levels of ropivacaine, the boluses will be staggered every 2 hours on alternate sides until hour 24. This means that one side will be bolused 20 mL at hour 2, then the other side will be bolused 20 mL at hour 4 and so on. The catheters will be removed 24 hours post-operatively.

The control group patients will receive the same intraoperative analgesia management. A PIF block will not be performed, instead, a peripheral nerve block catheter will be secured to the skin surface and connected to a CADD™ pump. There will be no infusion running through the control group catheters. As the catheters are taped to the skin surface the control group patients will not be exposed to the risks of peripheral nerve block placement.

The CADD™ pump information will be concealed to prevent biasing the post-operative care providers. The catheters will be removed from all patients at 24 hours postoperatively.

**Measurements:** Primary outcome: Cumulative opioid consumption in milligrams of morphine in the first 12 hours after surgery.

**Secondary outcomes:** Cumulative opioid consumption milligrams of morphine in the first 24, after surgery, time to extubation in minutes, Numeric Rating Scale pain score as measured every 6 hours for the first 24 hours post-operatively, ICU length of stay in hours, incidence of surgical site infection and incidence of local anesthetic systemic toxicity.

**Results:** Pending operational approval.

**Conclusions:** Pending.

**Future Plans:** Pending.

**List of Abbreviations:**
FTCA - Fast-track cardiac anesthesia
PIF - Pectointercostal fascia
NRS - Numerical Rating Score

**Learning Objective:** At the end of this session, participants will be able to examine the impact of bilateral PIF blocks on acute post-operative pain following fast track cardiac anesthesia patients undergoing median sternotomy.
Waste Management In The Operating Room

Presenter: Dr. Tara Sander
1Department of Anesthesiology & Pain Medicine, University of Alberta, Edmonton, Canada

Introduction: There are multiple options for waste management in the operating room. Unfortunately, waste does not always end up in the appropriate place and can lead to increasing cost of diverting waste from the operating rooms. Appropriate waste has not always been noted in the red medication waste bins in the Stollery Children's Hospital pediatric operating rooms. The objectives of this project are to show that education about appropriate waste management can divert waste appropriately and can potentially lead to cost-saving in the operating room.

Design and Methods: This is a quality improvement project regarding waste management in the operating room. The weight of red medication disposal bins will be measured in two pediatric operating rooms over a two-week period both before and after an education session about appropriate waste management in the operating room.

Intervention(s) and Outcome Measures: A presentation and discussion about the appropriate diversion of waste in the operating rooms was given to the pediatric anesthesiology group at the Stollery Children's Hospital. A discussion was held to formulate ideas that would promote appropriate diversion of waste in the operating room. In a subsequent two-week period the waste will be measured in the same operating rooms to determine whether the intervention was effective in reducing the amount in inappropriate waste in the red medication waste bins.

Results: Expected results are that the per kilogram waste over a two week period will be decreased after the education of anesthesiologists and other operating room staff in the pediatrics operating room. Conclusions: It is expected that education about appropriate waste management is useful in diverting waste to the appropriate place in a pediatric operating room.

Learning Objectives: At the end of this session, participants will be able to learn about appropriate waste management can divert waste appropriately and can potentially lead to cost-saving in the operating room.
Abstracts

Poster Presentations
Implementation of Erector Spinae Plane Block for Post-Operative Pain Management after The Nuss Procedure

Presenter: Dr. Jenelle Clark
Additional Author(s): Dr. Mancho NG
1Department of Anesthesiology & Pain Medicine, University of Alberta, Edmonton, Canada

Introduction: This study will compare the use of an erector spinae plane block plus a PCA pump versus the previous institutional data of post-operative PCA following a Nuss procedure for pectus excavatum for reduction in post-operative opioid consumption. The amount of opioid consumed will be collected from patient-controlled analgesia pumps and recorded in intravenous weight-based morphine equivalents in mg/kg/day for the first 3 postoperative days.

Design and Methods: The study is an observational cohort study prospectively comparing patients receiving the erector spinae plane block to a retrospectively matched cohort who used patient-controlled analgesia following the Nuss procedure. There will be no randomization or placebo groups. Intervention and Outcome Measures: Each patient in the study will receive bilateral erector spinae plane blocks using 0.25% Bupivacaine. The target level for the ESPB will be at the level of transverse process 4 (T4) identifying the trapezius, rhomboids, and erector spinae muscles on ultrasound. Once this has been confirmed, the block will be complete with a standardized dose of 0.3mL/kg per side to a maximum of 20mL per side of quarter percent (0.25%) Bupivacaine. Other objective measures will include average Numerical Rating Scale (NRS) for postoperative pain, time to discharge, frequency of opioid side effects (such as postoperative ileus, pruritus, and nausea/vomiting necessitating treatment).

Results and Conclusions: To assess the efficacy of the ESPB on post-operative pain we will be measuring several factors. We will be logging the qualitative responses of participants using the NRS pain scale at the 12-, 24-, 48-, and 72-hour mark. At these same time intervals, we will also be documenting the quantitative data of how much systemic opioid is required. If the block is effective, we expect to see a decrease in systemic opioid use in the post-operative period as well as a reduction in the NRS documented by patients. A final efficacy parameter to be measured will be the length of stay in hospital. If this block is effective in managing post-operative pain, the total length of stay in hospital for our participants should be lower than in the retrospective cohort.

Learning Objective: At the end of this session, participants will be able to assess the efficacy of the ESPB on post-operative pain.
Effect of Transversus Abdominis Plane block on postoperative opioid use in gynecologic oncology patients undergoing laparotomy with ERAS

Presenter: Joshua Foley¹
Additional Authors(s): Kristin Black², Gregg Nelson², Steven Bisch², Sophia Pin (University of Alberta), Michael Chong², Mathew Kokotilo¹ Bronwyn Burghardt².
¹Department of Anesthesiology & Pain Medicine, University of Alberta, Edmonton, Canada
²University of Calgary

Introduction: Abdominal surgery is an essential component of management of gynecologic malignancies. Perioperative care in this field of surgery has undergone many advances with the implementation of Enhanced Recovery After Surgery (ERAS) pathways. ERAS guidelines recommend the use of opioid sparing, multimodal analgesia to decrease side effects and improve patient recovery. Furthermore, use of opioids following surgery has been demonstrated to result in chronic opioid use in a significant proportion of patients. With the growing opioid pandemic, it is essential that surgeons continue to optimize perioperative pain management to avoid unnecessary opioid use.

TAP block use in abdominal surgery has been demonstrated to be safe and highly effective. In the literature on benign gynecology, TAP block use has resulted in reduction of pain scores and opioid use, however studies in gynecologic oncology have not shown similar results. The purpose of this study is to evaluate the effectiveness of TAP blocks in the gynecologic oncology patient population. This is a retrospective cohort study that will evaluate patients who underwent laparotomy for gynecologic oncology surgery with ERAS protocols in Alberta from November 2016 to June 2017, and January – December 2020. The time period of 2016-2017 was chosen as this was recently following introduction of the Alberta gynecologic oncology ERAS program.

The primary objective is to determine if TAP block use in patients undergoing laparotomy for gynecologic oncology surgery with ERAS protocols reduces opioid analgesia and PCA use.

The secondary objectives are to determine if TAP block impacts (a) patient length of stay, (b) postoperative pain scores, and (c) incidence of postoperative complications.

Conclusions: The results from this study will contribute to the literature on perioperative pain management in gynecologic oncology.

Learning Objective: At the end of this session, participants will be able to determine if TAP block use in patients undergoing laparotomy for gynecologic oncology surgery with ERAS protocols reduces opioid analgesia and PCA use.
Examining a novel regional anesthesia technique (superficial cervical plexus and pectoral block) for trans-subclavian TAVIs

Presenter: Dr. Derrick Matheson
Additional Author(s): Blane Achen

1Department of Anesthesiology & Pain Medicine, University of Alberta, Edmonton, Canada

Statement of purpose: The primary goal of this case study is to prove the feasibility of this novel regional technique for subclavian TAVIs, as well as to examine several patient outcomes in comparison to the standard general anesthetic technique.

Material and methods: The information for this case study will be gathered from a chart review, from approximately 10 patients who have consented to be a part of the study.

Equipment: Connect care for data gathering

Measurements:
• Time to discharge following procedure.
• Narcotic use post operatively.
• Any morbidity/complications encountered in post-operative period.
• Any mortality that occurs in post op period.

Results: Data not yet collected.

Conclusions: Not yet available.

Future Plans: As this study is too small a sample to generate statistically significant outcomes, once feasibility is proved a larger expanded study with more patients to statistically compare outcomes to general technique Examining the institutional cost of Regional vs. General technique, as well as environmental impact. Is there a benefit in procedure duration to regional technique, could more procedures be performed in a day with regional blocks?

Summary: Study not yet done, but show from a small sample size that the regional block technique is feasible for this procedure, and whether there was any unexpected positive or negative outcomes in regards to morbity, mortality and duration of stay in hospital.

Learning Objective: In this session, participants will be able to evaluating the feasibility of a novel regional anesthesia technique for trans-subclavian TAVIs.
Introduction: Located at the Royal Alexandra Hospital (RAH) in Edmonton, Alberta is the Orthopedic Surgery Center (OSC), a surgery center dedicated to orthopedic procedures including knee and hip arthroplasty. In April 2021, the OSC began to perform total shoulder arthroplasty (TSA). Given that this is a new procedure for this site, we wanted to look at the use of regional anesthesia for TSA surgical procedures.

Most commonly, an interscalene block (ISB) using local anesthetic is utilized to block most of the brachial plexus while sparing the ulnar nerve (C8-T1), providing adequate coverage for procedures involving the shoulder. Not all patients receive a regional anesthetic for a variety of reasons, therefore pain and other measures for patients undergoing a TSA can be compared. We hypothesize that the use of regional anesthesia will reduce the amount of opioid use in the perioperative and postoperative periods, as well as decrease subjective pain scores postoperatively.

Design and Methods: The study will be conducted as a retrospective chart review of all TSA surgeries performed in the first year, beginning on April 16, 2021. At present 141 TSAs have been performed, however another 6 weeks of data is required to complete a full calendar year. The control group will be those who did not receive a shoulder block.

Intervention(s) and Outcome Measures: The intervention of interest is the use of an interscalene block for total shoulder arthroplasty. Opioid use in the perioperative and postoperative period is the primary outcome of interest. Subjective pain scores in PACU and on the surgical ward, length of hospital stay, adjunct pain medication use, and time to physiotherapy intervention will be used as secondary outcomes. Further analysis of nerve blocks will include type and amount of local anesthetic and frequency of complications.

Results: 133 shoulder blocks have been evaluated at present. Shoulder blocks were administered in 83 patients. Further results will follow once all data is collected.

Conclusions: No conclusions can be made at present. This will be reported once data collection and analysis is complete.

Learning Objective: At the end of this session, participants will be able to define critical variables to assess the effects of regional anesthesia after total shoulder arthroplasty.
Implementing a Patient Blood Management Pathway for the Management of Preoperative Anemia

Presenter: Dr. Evan Ritchie¹
Additional Author(s): Dr. Matthew Kokotilo¹, Dr. Austin Ho¹, Dr. Michael Vargo¹
¹Department of Anesthesiology & Pain Medicine, University of Alberta, Edmonton, Canada

Foundations: Preoperative anemia (POA) is a well-documented problem in 25 to 40% of surgical candidates, and is associated with increased perioperative morbidity and mortality, as well as perioperative transfusion¹-⁵,¹⁰. The Royal Alexandra Hospital (RAH) currently lacks a formal strategy for POA management, but such pathways are considered standard of care both nationally and internationally⁶-⁹, ¹¹. We therefore aim to implement an internationally derived consensus-statement Patient Blood Management (PBM) referral pathway for the diagnosis and management of POA towards their surgical population.

Methods: This is a single center quality improvement initiative that will take the form of a Plan-Do-Study-Act (PDSA) cycle. Surgical patients with known anemia, estimated blood loss of >500mL, or a risk of perioperative transfusion >10% will be referred to Pre-Admission Clinic (PAC) and a PBM physician for further evaluation at least 1 week prior to their scheduled surgery. Screening blood work will be used to identify anemia based on WHO guidelines of hemoglobin <130 g/L in males and <120 g/L in females. Patients meeting this criterion who also possess a ferritin <30 or TSAT <0.20 will be considered iron deficient and treated preoperatively with an IV iron transfusion of 1000 mg. Patients who are anemic, but not iron deficient, will be evaluated for other potential causes of anemia, recognizing the time constraints of coordinating surgical scheduling with PAC consultation and their work up.

Objectives: Our primary objective is a pathway adherence rate of 80%. Secondary objectives include reporting this PBM algorithm’s efficacy at reducing levels of POA, as well as its impact on perioperative transfusion rates (both iron and RBC).

Data Analysis (Planned): Categorical variables (0 for no POA change, 1 for any change; 0 for no perioperative transfusion, 1 for perioperative transfusion) will be expressed as percentages. These values will be compared to literature-reported data for similar cohorts who have not experienced a PBM pathway preoperatively. Comparison using these percentages will occur using chi-squared and Fischer’s exact tests. Reporting of the average change in hemoglobin levels by an algorithm intervention will occur as a percentage. Continuous variables accounting for patient demographics will be presented as means with standard deviations. They will be compared using t-tests and analysis of variance to ensure consistency between cohorts.

AIM Statement: By July 1st, 2023, RAH will have a perioperative PBM pathway for anemic colorectal surgery patients (with the potential to expand to more surgical services). Eighty percent of this cohort will have successfully completed the pathway, and a preliminary evaluation of the efficacy of the pathway by secondary outcomes will be underway.

References
Learning Objectives: In this session, participants will be able to implement of a Patient Blood Management Pathway for the Management of Pre-Operative Anemia.
Introduction
One of the major challenges with regional anesthesia is managing pain during the transition from block to no block as the local anesthetic wears off. A form of hyperalgesia has been described consisting of generalized dull burning pain that occurs in the initial offset period from 8 to 48 hours after surgery known as “rebound pain”. It is thought to result in a paradoxical increase in delayed postoperative pain and opioid consumption that can defeat the goal of regional anesthesia and has been associated with increased healthcare utilization from ED visits for pain in the ambulatory setting.

Pain scores have generally studied during the active block period and in the immediate postoperative period while the block is still active. It has become apparent in recent years that rebound pain after a peripheral nerve block has been neglected in clinical research with limited information being available about the incidence of rebound pain or contributing factors that may be potentially modifiable. A recent large retrospective review of factors associated with rebound pain after peripheral nerve block was published in December 2020 that showed a 49.6% incidence of rebound pain after the offset of block as defined by increase in pain score from mild (NRS ≤ 3) to severe (NRS ≥ 7). This study was conducted within the Canadian population out of the QEII Hospital in Halifax, NS with the largest sample size to date. This study was limited by its retrospective design and use of only ambulatory patients.

Design, Methods and Outcomes Measures
In this prospective cohort study, NRS pain scores will be assessed before and immediately after a regional nerve block provided as standard of care in a wide range of surgical cases including inpatients and outpatients. Follow-up will be conducted in 12-24 hours to assess pain scores after the offset of the block. Intra-operative and post-operative opioid and adjunct analgesic use, pain descriptors and the patient’s past pain and medical history will be recorded to assess for possible risk or preventative factors associated with rebound pain.

Learning Objective: In this session, participants will be able to assess the effects of regional anesthesia on rebound pain.
Background: Cancer is a leading cause of death globally and represents a major public health problem. Primary surgery of solid tumours is the most effective treatment for patients. Unfortunately, metastatic recurrence occurs in many patients and contributes to a vast majority of cancer-related mortality. Perioperative factors, both surgical and anesthetic, may predispose cancer patients to increased likelihood of metastatic disease progression. Previous study of anesthetic drugs in vitro and in animal models has revealed varying effects on immunomodulation, cancer signalling pathways, and host defense mechanisms that protect patients from residual cancer cells post-operatively. For example, inhalational anesthetics have been shown to impair function of natural killer (NK) cells that target residual cancer, and to increase aberrant angiogenesis by pro-inflammatory effect on macrophages, which may increase susceptibility to metastases. In contrast, propofol-based total intravenous anesthesia (propofol-TIVA) has exhibited relatively immune-preserving properties by bolstering NK cell function and inhibiting inflammatory signalling on macrophages. Similarly, amide local anesthetics such as lidocaine have shown anti-inflammatory properties that may enhance host defense mechanisms against postoperative spread of residual cancer cells. We hypothesize that 1) propofol-TIVA vs. inhalational anesthesia and 2) intravenous lidocaine analgesia vs. placebo will improve disease-free survival (DFS) following major cancer surgery in patients with colorectal or non-small cell lung cancer (NSCLC).

Methods: As part of the VAPOR-C protocol, this hypothesis will be explored in an international multicentre randomised controlled trial that stratifies patients with stage I-III colorectal cancer or stage I-IIIa NSCLC into 4 groups: 1) sevoflurane anesthesia and lidocaine infusion; 2) sevoflurane anesthesia and placebo; 3) propofol-TIVA and lidocaine infusion; and 4) propofol-TIVA and placebo. The patients must meet specific inclusion criteria and will be excluded according to exclusion criteria. Administration of anesthetic will follow the VAPOR-C protocol, and be titrated to maintain adequate depth of anesthesia. Data will be collected using electronic case report forms. The primary endpoint is disease recurrence (local recurrence or distant metastasis), or death from any cause. Effect of anesthetic technique on disease-free survival, overall survival (OS), number of days at home and alive within 30 days (DAH-30), and chronic post-surgical pain (CPSP) will be evaluated with statistical analyses including stratified Kaplan-Meier method, Cox proportional hazards method, quantile regression, and logistic regression.

Results/Objectives: Primary objectives of this study are:
1. To determine if propofol-TIVA increases DFS compared with sevoflurane
2. To determine if IV lidocaine increases DFS compared to placebo
Secondary objectives of this study are:
1. To compare propofol-TIVA versus sevoflurane in regards to: OS, and DAH-30
2. To compare IV lidocaine versus placebo in regards to: OS, CPSP at 90 days, DAH-30

Conclusion: The VAPOR-C trial has been designed to test for superiority in disease-free survival (DFS) of propofol-TIVA over sevoflurane and IV lidocaine over placebo in patients undergoing major surgery for treatment of colorectal cancer or NSCLC. The hope is that this will provide valuable insights into anesthetic techniques in these cancer patients that will form an evidence-base that can be generalized into anesthetic guidelines and practice to enhance patient outcomes. Once data has been captured and analyzed it will be used to test our primary hypotheses: that propofol-TIVA increases DFS compared with sevoflurane; and that lidocaine increases DFS compared with sevoflurane.
Further analysis will provide insight to our secondary hypotheses: that propofol-TIVA prolongs overall survival compared with sevoflurane; that DAH-30 is higher in propofol-TIVA compared with sevoflurane; that lidocaine prolongs OS compared to placebo; that CPSP at 90 days is lower compared to placebo; and that DAH-30 is higher in lidocaine compared to placebo.

**Learning Objective:** In this session, participants will be able to assess the statistical effects of Propofol-TIVA anesthesia compared to other anesthesia methods.