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Poster Abstracts

Case Report

An Intraoperative Esmolol Infusion as an Opioid-Sparing Adjunct During Laparoscopic Surgery

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Introduction: Esmolol is an ultra-short acting beta-adrenergic blockade agent that has opioid-sparing properties. Patients who receive esmolol infusions during laparoscopic surgery consume less opioids in the perioperative period compared to patients who do not receive an esmolol infusion. Opioids have a significant negative adverse effect profile. The most frequently observed adverse effects include respiratory depression, apnea, hypotension, bradycardia, nausea, vomiting, constipation, sedation, and lightheadedness. Anesthesia professionals have developed a multimodal approach to reduce dependence on opioids for analgesia in the perioperative period. Multimodal analgesia uses different classes of drugs to target myriad receptors along the pain pathways. The purpose of this case report is to explore the research supporting esmolol for use as an opioid-sparing adjunct when administered as an infusion intraoperatively during laparoscopic surgery.

Case Presentation: An 83-year-old female, 160 cm, 63 kg, physical status 3, presented for a laparoscopic cholecystectomy. Pertinent medical and surgical history included COPD, hypertension, type 2 diabetes mellitus, coronary artery disease, and a coronary artery bypass graft. Pre-induction vital signs were BP 113/73 mm Hg, heart rate 71/min, RR 15/min, SpO2 95%, temperature 36.7 ºC, and verbal numeric pain rating scale (NPRS) score 0/10. General anesthesia was induced with esmolol 0.5 mg/kg (30 mg), lidocaine, and propofol; the neuromuscular blockade was accomplished with rocuronium IV; and the maintenance agent was sevoflurane. An esmolol infusion 0.05 mg/kg/min was initiated after induction of anesthesia. A 4-quadrant transversus abdominus plane block with bupivacaine 0.25%, 1:200,000 epinephrine, total 60 mL, and buprenorphine 0.3 mg, was performed prior to surgical incision. Neuromuscular blockade was reversed with sugammadex 200 mg IV. Hemodynamic parameters were within 15% of baseline during the surgical procedure. Postoperative vital signs were BP 124/60 mm Hg, heart rate 65/min, SpO2 100%, temperature 36.2 ºC. Verbal NPRS scores were 0-3/10 in the immediate postoperative period up to 2 hours after surgery. Buprenorphine 0.3 mg administered in the peripheral nerve block was the only opioid administered intra- and post-operative.

Discussion: To evaluate the potential benefit of an intraoperative esmolol infusion as an opioid-sparing adjunct during laparoscopic surgery, 1 systematic review and 4 randomized controlled trials were evaluated. The studies compared control groups to patients who received esmolol infusions during laparoscopic procedures. In all studies, patients who received esmolol infusions had lower opioid requirements throughout the perioperative course compared to the control groups. The precise mechanism whereby esmolol provides analgesia is unknown. Two hypotheses are described in the literature. One proposes that esmolol inhibits presynaptic G-protein-coupled potassium channels or presynaptic inhibition of neurotransmitter release through voltage-gated calcium channel regulation. A second hypothesis proposes esmolol modulates the stress response by decreasing the release of stress-related hormones such as norepinephrine. Decreased β1 and β2 adrenergic receptor expression results in attenuated noxious stimuli perception. Based on the case report patient's preoperative assessment, advanced age, and co-morbidities, she was an ideal candidate for receiving an esmolol infusion during laparoscopy surgery to reduce perioperative opioid requirements. Intraoperatively she received buprenorphine 0.3 mg administered in the peripheral nerve block and no opioids in the first 2-hour postoperative period with a verbal NPRS score 0-3/10. The use of esmolol as an opioid-sparing adjunct during laparoscopic surgery is supported by literature and its use is recommended in a multimodal analgesia regimen.

Anesthesia Considerations for MitraClip™ Procedure

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Introduction: Mitral valve regurgitation is a backflow of blood caused by the inability of the heart's mitral valve to completely close during systole. It is a recurrent problem of heart failure which causes a reduced ejection fraction and corresponds to an increased risk of death. Mitral and tricuspid valve regurgitation are prevalent in roughly 10% to 15% of the population. Mitral valve repair by way of the percutaneous MitraClip™ insertion is a safe, efficacious, and relatively new alternative for patients with severe mitral and tricuspid regurgitation who are considered to be high surgical risks. The purpose of this paper was to describe recommended best practices of anesthesia management for patients undergoing transcatheter MitraClip™ procedures. This is a significant topic because this procedure is somewhat new with a limited amount of relevant literature. Anesthesia professionals will likely begin to see this procedure performed more commonly in the future.

Case Presentation: An 82-year-old woman presented for transesophageal echocardiogram (TEE) evaluation of Mitra Clip™ placement. The patient had a history of hypertension, coronary artery disease, congestive heart failure, severe mitral regurgitation, moderate tricuspid regurgitation, atrial fibrillation, pulmonary hypertension, anxiety, gastroesophageal reflux disease, liver disease, ascites, and chronic renal disease. Although the patient was not considered a surgical candidate, she was considered a viable candidate for the MitraClip™ procedure. The procedure was done under general anesthesia. Norepinephrine was infused at 0.2 mcg/kg/minute for the entire procedure. The patient was stable hemodynamically and volume status was optimal throughout the duration of the case. After a discussion between the interventional cardiologist and the device representative, it was decided that only one MitraClip™ was necessary for the patient. Emergence from anesthesia was uneventful. The procedure lasted for 123 minutes. The patient was fully reversed with sugammadex, confirmed breathing spontaneously on minimal support, and extubated to a simple face mask. The following day, the cardiologist reported successful intracardiac echocardiography. It was confirmed that the mitral MitraClip™ was in a stable position. The patient was discharged the day after the procedure and had a follow-up appointment six weeks post-procedure.

Discussion: Most patients receive general endotracheal anesthesia (GA) with TEE and fluoroscopic guidance for the insertion of the MitraClip™ device. Perioperative and intraprocedural inotropic support and anesthesia management were the keys to the success of the placement, or "grasping," of the MitraClip™. There is no difference in safety using a GA approach compared to a deep sedation (DS) anesthetic approach. The surgeon must be aware that ventilator breath holds will not be available during a deep sedation technique. Providers have now adopted a more 'minimal' approach to the MitraClip™ procedure, making a central line nonessential for the procedure. Electrocardiogram, pulse oximetry, and arterial blood pressure monitoring are the hemodynamic monitors required. Ventilator breath holds are sometimes ideal during critical moments of the procedure to ensure safe and successful implantation of the clips. Regardless of the valve being operated on, once the MitraClip™ is grasped, it is imperative that the patient's blood pressure is increased to simulate their native physiologic blood pressure to evaluate any residual valve regurgitation after MitraClip™ placement.Another study underscored the importance of adequate preload. Too much volume can worsen the severity of valve insufficiency, and too little volume may consequently reduce the true severity of valve regurgitation. The crucial component of successful MitraClip™ placement is inotropic support and optimal preload conditions, which aid in the grasping of the clip as well as improving leaflet coaptation and increasing the likelihood of successful MitraClip™ implantation.

Effects of Preoperative Marijuana Use on Postoperative Pain Scores and Opioid Requirements

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Introduction: Marijuana use is becoming more commonplace, and it is not unusual for anesthesia providers to encounter patients who report taking marijuana. The purpose of this project is to determine whether preoperative marijuana use affects the pain scores or opioid needs of patients postoperatively. Understanding how marijuana affects pain is important so that anesthesia providers can appropriately care for patients and their pain control needs. By determining the effects of marijuana on postoperative pain levels and opioid requirements, better anesthesia care can be provided to patients.

Case Presentation: A 45-year-old female underwent a hand-assisted laparoscopic low resection and left colectomy with loop ileostomy for a malignant neoplasm of the colon. General endotracheal anesthesia was utilized, and the surgery lasted for approximately 4 hours. During the preoperative assessment, the patient denied opioid use and reported daily marijuana use with both oral and inhalational supplements. The patient was given hydromorphone 3 mg intravenously (IV), fentanyl 300 mcg IV, dexmedetomidine 70 mcg IV, and acetaminophen 1 g intraoperatively. Postoperatively, the patient received hydromorphone 1 mg IV in the post-anesthesia care unit, hydromorphone 1 mg IV after transfer to her inpatient hospital room, scheduled oral ketorolac every 6 hours, oral oxycodone was ordered as needed every 4 hours and was requested by the patient every 4 hours, and oral acetaminophen was given once on the day after surgery. The patient's pain score on a scale of 0-10 varied from a 4 to a 9 postoperatively on the day of and the day after surgery.

Discussion: Out of the articles that addressed how marijuana affects pain scores, the majority found that the patients who utilized marijuana had higher pain scores postoperatively. Out of the articles that addressed how marijuana affects opioid requirements, the majority found that the patients who utilized marijuana did not need more opioids postoperatively. The purpose of this project was to determine whether preoperative marijuana use affects postoperative pain scores and opioid requirements. The overall results garnered after analyzing the current literature indicate that marijuana use affects postoperative outcomes for patients. Specifically, a synthesis of the articles showed that preoperative marijuana use led to increased postoperative pain scores. In addition, it revealed that patients who use marijuana preoperatively may require increased amounts of opioids postoperatively. Therefore, it is essential for anesthesia providers to assess patients for marijuana use and formulate anesthesia plans of care that take into account that these patients tend to have higher pain scores and may need more opioids.

Emergence with Doxapram Hydrochloride After Anesthesia for Patients with Obstructive Sleep Apnea

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Introduction: Obstructive sleep apnea (OSA) can impact a patient's ability to safely recover from anesthesia after surgery. Patients with OSA have an increased risk of perioperative respiratory complications due to the residual central nervous system and respiratory depressant effects of certain anesthetics and opioids. Use of a respiratory stimulant such as doxapram hydrochloride during emergence can hasten recovery from anesthesia. Doxapram stimulates respiration increasing ventilation and improves respiratory stability in patients who may have respiration depression from physiologic abnormalities or induced by anesthetic agents. The purpose of this case report is to present the use of doxapram for respiratory recovery after anesthesia, discuss the mechanism of action and potential complications, and provide recommendations for use of the drug in clinical practice.

Case Presentation: A 52-year-old female, 98 kg, 162.5 cm, 37.1 BMI, physical status 2, presented for an elective hysteroscopy, dilation, and curettage for postmenopausal bleeding. Medical history: GERD, depression, and OSA; screening STOP-BANG score of 4/8 (≥ 3 is high risk for OSA). Airway assessment revealed Mallampati class I, normal neck range of motion, and normal external airway anatomy. Preoperative vital signs were HR 62/min, BP 116/76 mm Hg, RR 16/min, SpO2 97%, and 36.4 ºC. Anesthesia was induced with fentanyl 50 mcg, lidocaine 100 mg, propofol 200 mg; and neuromuscular blockade with rocuronium 5 mg and succinylcholine 140 mg IV. A 7.0 mm endotracheal tube was placed using direct laryngoscopy. Anesthesia was maintained with sevoflurane; acetaminophen 1 g IV was administered. Upon emergence, TOF was 4/4 with sustained tetany and no neuromuscular blocking reversal agent was administered. No spontaneous ventilation was initiated by patient despite end-tidal CO2 60 mm Hg and sevoflurane end-tidal concentration 0.2%. Doxapram 30 mg IV administered. The patient began spontaneous ventilation 7 min after doxapram administration, tidal volume 6 mL/kg, RR 10-12/min. She was extubated and transferred to PACU with oxygen 6 L/min via face mask. The patient was closely monitored in PACU for 1 hour for potential resurgence of respiratory depression and discharged home later the same day.

Discussion: Patients with OSA can present a challenge to anesthesia professionals due to the increased risk of perioperative respiratory complications. A thorough preoperative risk assessment and screening tools such as STOP-Bang and the apnea-hypopnea index can be used to identify suspected OSA and evaluate for potential perioperative risk. Routine screening for OSA can provide opportunities for recognition and risk reduction by allowing for the implementation of appropriate interventions. Patients with OSA are often classified as a difficult airway, which also increases the risk of adverse respiratory events. Another way to assist with mitigating these challenges with OSA patients can include implementing the administration of doxapram perioperatively or during emergence. Doxapram is a respiratory stimulant that enhances recovery following general anesthesia and is currently approved for use in patients with OSA, COPD, and apnea of prematurity. Doxapram produces respiratory stimulation mediated through peripheral chemoreceptors and the medulla oblongata. Clinical effects show an increase in tidal volume and respiratory rate. The information being presented provides an evidence-based solution to a clinical problem and can be used to further educate anesthesia providers about additional resources available in order to maintain safe practices for patients with OSA, given the increasing prevalence from a surge in obesity rates. According to the literature, benefits of doxapram administration include statistically significant increases in arousal, improved oxygenation, reduced incidence of pulmonary complications, and shortened recovery times in patients having outpatient surgery.

Perioperative Care of a patient with Acute Flaccid Myelitis Undergoing Pedicle Nerve Transfer of Lower Extremities

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Introduction: The purpose of pedicle nerve transfer surgery is to transfer a functioning muscle or motor nerve to restore the function of a nonworking muscle or nerve. The advantages of nerve transfer for patients are maintaining original muscle/joint biomechanics and requiring less rehabilitation.

Case Presentation: A previously healthy 9-year-old boy presented to the emergency department with left upper limb weakness, neck pain, headache, and a fever for 2 days. He developed right lower limb weakness, facial twitching, and difficulty breathing 2 days after admission. Enterovirus D68 serotype was positive. Patient transferred to PICU where he experienced hypertension and tachycardia likely due to autonomic dysfunction. Patient muscle weakness and respiratory status deteriorated requiring tracheostomy and chronic mechanical ventilation. Additional past medical history at the time of surgery included tetraplegia, trach/ventilator dependence, central sleep apnea, and a seizure disorder. After successful nerve transfers of the bilateral upper extremities, a decision was made to proceed with sciatic to superior gluteal nerve transfer and decompression of the right femoral nerve with sciatic to femoral nerve transfer.

Discussion: There are no previous reports in the literature regarding the use of TIVA for acute flaccid myelitis underdoing pedicel nerve transfer with neuromonitoring. TIVA was chosen given the literature demonstrating to the effects of inhaled anesthetic agents on neuromonitoring. Therefore, TIVA appears to be the anesthetic of choice for the first portion of pedicle nerve transfer surgery since Checkpoint nerve stimulator was used. Future studies are necessary in AFM patients undergoing this type of surgery to develop guidelines to manage those cases for successful outcomes.

Perioperative Management of Patients with Drug Eluting Stents Undergoing Noncardiac Surgery: A Clinical Case Report

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Introduction: Intraoperative management of high-risk patients consists of multi-disciplinary communication and coordination. With the rising prevalence of acute coronary syndrome (ACS), dual antiplatelet therapy (DAPT) comprised of aspirin and a P2Y12 inhibitor agent has been a mainstream treatment modality for ACS management. Percutaneous coronary intervention (PCI) with drug eluting stent (DES) involves prolonged use of anti-platelet agents for maintenance of coagulation, which disposes the patient to an increased risk of intraoperative bleeding or stent thrombosis and subsequent ischemic event in case therapy is interrupted. High-risk cardiac patients undergoing urgent noncardiac surgeries require judicious assessment, risk stratification, and diligent perioperative strategies. This case report involves risk-stratification and management of one such patient undergoing neoplasm excision of scalp melanoma while concurrently taking DAPT following DES placement.

Case Presentation: A 66-year-old male with history of coronary artery disease (CAD), hypertension, and morbid obesity (BMI 40.18 kg/m2), and a current smoker (30 pack years), presented for excision of a metastatic scalp melanoma along with biopsy of right neck sentinel lymph node. His home medications included Norvasc, Lipitor, metoprolol, lisinopril-HCTZ, aspirin 81 mg, and ticagrelor 90 mg. The patient had suffered a myocardial infarction (MI) 1 month previously and had 5 DES placed in his left anterior descending artery. Due to his increased risk of adverse cardiac events, his initial surgery date was delayed by 2 weeks and rescheduled while continuing to take DAPT. After a meticulous preoperative assessment, blood products were placed on hold, 2 large bore intravenous accesses were established, and the patient was intubated using a video laryngoscope upon standard induction. Albumin 5% was used for fluid loading with an additional 900 ml of crystalloid during the intraoperative period. Maintenance was provided with sevoflurane and sufentanil infusion. There was a single episode of hypotension that was managed with phenylephrine 100 mcg and the remainder of the intraoperative period was uneventful. Total blood loss was less than 100 ml and no cardiac arrythmias were noted. Upon complete reversal of neuromuscular blockade, the patient was extubated and transported to the postanesthesia care unit on a face mask with 8 liters oxygen per minute.

Discussion: Co-existing cardiac diseases pose additional challenges for the clinicians involved in the patient's perioperative management. Patients with coronary stents require DAPT for a prolonged period to avoid risk of stent thrombosis and recurrence of cardiac complications. Recommendation for delay of non-cardiac surgery after DAPT with stent placement varies from 3 months to a year depending on the type of stents and clinical urgency. The risk of ischemic events versus major bleeding also varies with patient conditions. If feasible, delay of noncardiac surgery is recommended for at least 30 days after BMS; 3 months after DES placement and DAPT continuation for a year to minimize the risk of intraoperative ischemia. This avoids further deterioration of the patient's condition while simultaneously reducing the risk of hemorrhage versus stent thrombosis intraoperatively. Some patients with coronary stents and DAPT may require time-sensitive surgical interventions for noncardiac conditions outside of the general recommendation timeline of DAPT. Short-acting intravenous bridge therapies can be used to replace the P2Y12 inhibitors for a short period of time prior to surgery. If the situation requires immediate control of major bleeding via ticagrelor reversal to minimize the risk of hemorrhage, a monoclonal antibody agent PB2452 with proven ticagrelor reversal within five minutes, which has been approved for breakthrough therapy, can be used. DDAVP and TXA have also proven their effectiveness in controlling bleeding related to antiplatelet agents. Individualized care regimen, cardiac optimization, and consensus decision-making play the most important role in avoiding intraoperative complications in this setting.

Pheochromocytoma and Preoperative Blockade

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Introduction: Pheochromocytomas are neuroendocrine tumors that originate from chromaffin cells in the adrenal medulla. These tumors secrete unopposed catecholamines and put the patient at an increased cardiovascular risk. Currently, the only treatment is surgical resection which can be done laparoscopically or via open technique. Optimization of blood pressure is a challenge in patients with a pheochromocytoma due to intraoperative swings of catecholamine levels. For diagnosed tumors, it is imperative that the patient receives an alpha blockade regimen at least two weeks before the tumor removal. If needed, a beta blockade can be added to optimize hemodynamic stability. Currently randomized controlled trials and case studies over the last decade validate medication choices for prevention of intraoperative hemodynamic instability. The purpose of this case study is to identify best evidence concerning selection of preoperative alpha blockade.

Case Presentation: Patient admitted to the intensive care unit (ICU) three days prior to surgery with respiratory failure. Past medical history included poorly controlled diabetes type 2, obstructive sleep apnea, hypertension, depression, anxiety, and a left adrenal mass measuring 5.5 centimeters. Blood pressure stable on phenoxybenzamine 60mg PO twice daily for the past 10 days. A central and arterial line were placed in the ICU; echocardiogram (echo) and labs (CBC, BMP, liver, and renal panel) were performed. An uneventful anesthetic induction occurred and the patient was turned into the right lateral decubitus position. Dobutamine and vasopressin infusions were utilized before tumor removal. After the suprarenal vein was clamped, epinephrine and norepinephrine infusions were used for hypotension. The patient remained intubated for 2 days to stabilize respiratory status and vasoactive drip requirement. The patient was discharged 7 days after the procedure. The patient's hemodynamic status remained stable prior to clamping the adrenal vein. The patient achieved alpha blockade with use of phenoxybenzamine for 10 days prior to the procedure. The providers successfully managed hypotension after clamping of the renal vein. Optimization of ventilator settings, inotropic and pressor support, and consistent alpha blockade from phenoxybenzamine facilitated successful case management.

Discussion: The purpose of this case study was to identify best scientific evidence concerning which alpha blockade was optimal in preoperative management for pheochromocytoma removal. Overall, data revealed that alpha blockade with preoperative administration of phenoxybenzamine as compared to medications used for selective blockade resulted in less intraoperative hypertension. Phenoxybenzamine is the most popular drug used in the United States to achieve alpha blockade for pheochromocytoma removal, indicating best evidence is being followed for hemodynamic stability during tumor removal. However, does intraoperative hypertension lead to worse outcomes postoperatively? In the future, additional high-level evidence randomized controlled trials are needed to demonstrate consequences of uncontrolled intraoperative hypertension and determine optimal long term postoperative outcomes. Results of this research could lead to a definitive choice on which medication is superior for preoperative use. Consideration for future research comparing amlodipine versus selective blockade must be recognized and considered as in resource-constrained countries like India, where providers choose selective blockade medications due to availability and cost. This was also reiterated in the retrospective cohort study, which reported the average cost of a 1-month supply of doxazosin to be about $25 whereas a 10-15 day supply of phenoxybenzamine ranged from $7100 to $7600. With this major cost difference between drugs, the true question for future research should be: Are the benefits of high-cost treatment modalities for intraoperative hypertension worth the cost difference?

Prolonged Apnea in a Malnourished Patient Following Succinylcholine Administration

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Introduction: Succinylcholine (Sch) has long had a place in emergent airway situations, but the ramifications of its use, specifically pseudocholinesterase (PchE) deficiency, are often overlooked. PchE deficiency can be acquired genetically or induced by physiological means such as severe heart disease, hepatic disease, renal disease, malignancy, malnutrition, and severe burns. The liver synthesizes PchE enzymes responsible for Sch metabolism, so hepatic derangements and malnutrition play an important role in the development of physiologically acquired PchE deficiency. In malnourished patients experiencing prolonged postoperative apnea after receiving succinylcholine, anesthesia professionals should consider malnutrition induced PchE deficiency as a differential diagnosis. The purpose of this case study is to illustrate the possible role of malnutrition-induced PchE deficiency resulting in prolonged apnea after use of Sch to secure the airway in a 78-year-old male who required a laser bronchoscopy procedure.

Case Presentation: A 78-year-old male, 25 BMI, physical status 4, with history of head and neck malignancy followed by chemotherapy, radiation, reconstruction, presented for laser bronchoscopy. Abnormal lab values: BUN 24 mg/dL, Hb 12.6 g/dL, Hct 39.1%, RBC 3.63 M/uL, platelets 112 K/uL. Assessment: coarse lung sounds bilaterally on auscultation, shortness of breath, cachectic appearance, oral incompetence, and limited neck range of motion. He had a gastrostomy for nutritional therapy but was removed 3 months earlier due to complications. In the OR, he was positioned and connected to standard intraoperative monitors. Propofol and fentanyl were used to induce general anesthesia, and muscle relaxation was achieved with Sch. Upon completion of surgery, the surgeon placed an endotracheal tube and emergence began. After 10 minutes, train-of-four (TOF) stimulation produced 0/4 twitches and post tetanic fade. After 15 minutes the patient opened his eyes, but had no respiratory effort or twitches on TOF, and became progressively hypertensive and tachycardic. He was immediately sedated with propofol bolus IV, and infusion. He remained intubated and was taken to PACU for recovery. Two hours later he met criteria for weaning and extubation. Sedation and mechanical ventilation were discontinued, and extubation was successful. He was discharged without subsequent problems or recollection of events.

Discussion: PchE deficiency leads to prolonged apnea following the administration of Sch, which can last for several hours. In a large systematic review, Andersson, et al concluded that malnutrition, hepatic, and renal disease were strongly associated with low PchE enzyme levels and prolonged duration of action of Sch. Grandone, et al present several studies correlating low PchE enzyme levels with poor nutritional status, citing low PchE levels as a sensitive indicator of chronic diffuse liver damage. Two separate case reports describe malnourished patients who previously received Sch without incident, but following a severe decline in nutritional status, experienced prolonged apnea after subsequent dosing. After aggressive nutritional therapy, PchE enzyme levels rose from 232 u/L to 1432 u/L. These reports resemble the presented case with a severe decrease in nutritional status just before surgery, resulting in prolonged apnea. Soliday, et al concluded that malnutrition and liver disease had a strong link to PchE deficiency, describing a 50% reduction with cirrhosis and chronic malignancies. In one study, 83% of the malnourished children examined with low PchE levels had degenerative changes in their livers. Malnutrition and liver disease affect one another and lead to reduced PchE levels, increasing the risk of prolonged muscle relaxation and apnea following Sch administration. Anesthesia professionals should be acutely aware of this correlation when selecting neuromuscular blocking (NMB) agents in the setting of malnutrition and severe hepatic disease.

Regional Anesthesia for Transcarotid Artery Revascularization and Hemodynamic Implications

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Introduction: Prior to the transcarotid artery revascularization (TCAR) procedure, carotid endarterectomy and transfemoral carotid artery stenting (TF-CAS) were the procedural options for carotid artery stenosis. The TCAR avoids the aortic arch with direct carotid access and combines the minimally invasive nature of TF-CAS with flow reversal for neuroprotection. Flow reversal with the neuroprotection system facilitates retrograde blood flow from the common carotid artery to the femoral vein, passing through a filter to prevent embolic events from loose plaque. During flow reversal, normotension is required to maintain cerebral perfusion. Hemodynamic management is critical during the TCAR procedure for patients receiving general or regional anesthesia. Few studies report patient outcomes comparing general and regional anesthesia techniques for TCAR. The purpose of this case report is to present current research on anesthesia management of the patient undergoing a TCAR procedure with focus on anesthesia options, hemodynamic management, and potential neurological changes.

Case Presentation: An 84-year-old male, 180 cm, 103 kg, physical status 3, with history of right carotid artery stenosis and visual disturbances for 3-4 months preceding surgery, underwent a right TCAR with regional anesthesia. Medical history included hypertension (HTN), smoking, coronary artery disease (CAD), 5-vessel coronary artery bypass graft (CABG), congestive heart failure (CHF), atrial fibrillation/flutter, sinoatrial node dysfunction, automatic implantable cardioverter-defibrillator, and transcatheter aortic valve replacement; he was neurologically alert and oriented. Preoperatively, he received a deep and superficial cervical plexus block. Intraoperatively, a second arterial line was placed, and oxygen 2 L/min was delivered via a Salter nasal cannula. Intraoperative medications: fentanyl 100 mcg in divided doses, dexamethasone 4 mg, acetaminophen 1 g, and cefazolin 2 g IV. A squeaky toy was held in a hand for communication and neurological monitoring. Surgeon infiltrated the surgical site with lidocaine 1%, 30 mL Heparin 9000 U IV was administered, ACT 389 sec. Phenylephrine 0.2-0.3 mcg/kg/min infusion was titrated to maintain SBP 140-160 mm Hg during carotid clamping and flow reversal. Calcium chloride 10%, 500 mg given in divided doses to support blood pressure. Protamine 20 mg IV was given at end of procedure. During surgery, patient was neurologically intact. Postoperatively, he was awake, alert, and had normal speech and no apparent neurocognitive deficits. Discharged home the next day.

Discussion: Neuroprotection via controlled hemodynamic management is pivotal for anesthesia management during a TCAR procedure. After venous and arterial sheath access is obtained, the surgeon will alert the anesthesia professional prior to clamping the common carotid artery (CCA) and initiating flow reversal. After cross clamping the CCA and initiating flow reversal, the contralateral carotid artery and vertebral arteries perfuse the ipsilateral brain via an intact Circle of Willis. Ensuring adequate cerebral perfusion pressure during flow reversal by maintaining blood pressure 140-160 mm Hg with vasopressors and heart rate above 70/min with anticholinergics is critical. Administer prophylactic anticholinergics, atropine, or glycopyrrolate to mitigate bradycardia associated with carotid sinus manipulation. Vasopressors, antihypertensives, and/or beta blockers may be necessary based on the patient's intraoperative hemodynamics. Changes in neurological status (change in or lack of response to command for squeezing toy) indicate compromised cerebral blood flow. Communicate neurological changes to surgeon who may change rate of flow reversal or rapidly complete surgery. Further management includes increasing blood pressure, increasing inspired oxygen concentration, and avoiding sedative agents. Future studies are needed to assess patient outcomes comparing general and regional anesthesia. Processed electroencephalogram and cerebral oximetry may be explored to assess cerebral perfusion during the procedure. Patients undergoing a TCAR surgical procedure require continual neuromonitoring and hemodynamic stability.

Sugammadex Use in Myasthenia Gravis Patients

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Introduction: Patients with myasthenia gravis (MG) have long posed a challenge to the anesthesia provider with respect to neuromuscular blockade (NMB). The pathophysiology of the disease predisposes this patient population to respiratory complications that become compounded when NMB is introduced in the intraoperative setting. For this reason, many anesthesia providers are reluctant to administer NMB to avoid any additional residual weakness. The discovery of sugammadex and its unique profile have reshaped the manner in which anesthesia providers approach NMB in the MG patient. This report will demonstrate that NMB can safely and effectively be reversed with sugammadex administration.

Case Presentation: A 53-year-old male presented for an elective interventional radiology ablation of a recurrent renal cell carcinoma. Significant history of this patient included: MG, obstructive sleep apnea with continuous positive airway pressure at night, obesity, gastroesophageal reflux disease, and a pacemaker. The patient was on 240 mg of pyridostigmine daily for MG management that was well controlled. It was decided by the anesthesia team to avoid NMB given the patient's MG condition. The patient experienced a very labile hemodynamic course intraoperatively. Hypotension was treated with boluses of ephedrine, phenylephrine, and vasopressin, while hypertension was combated with boluses of propofol, fentanyl, and increasing volatile agents. The patient was able to be extubated with positive pressure and transitioned to a face mask with supplemental oxygen. He returned to baseline vital signs and was transported to recovery without complication or report of weakness.

Discussion: Since the discovery of sugammadex, its value in anesthesia continues to be demonstrated time and time again. Sugammadex is a cyclodextrin compound that noncovalently binds and reverses steroidal neuromuscular blocking agents with greater affinity to rocuronium than vecuronium or pancuronium. Sugammadex encapsulates the steroidal neuromuscular blocking agent in a 1:1 ratio. This prevents binding to nicotinic acetylcholine receptors at the neuromuscular junction and ultimately results in immediate reversal. Compelling evidence exists supporting the use of sugammadex to reverse NMB in patients with MG. One systematic review evaluating 43 articles indicated a reduction in myasthenic crisis and hospital costs. A retrospective cohort study of 795 patients with MG undergoing surgery for thymectomy revealed similar findings. The most revealing results were shown in a randomized controlled trial with 117 MG patients, in which the use of sugammadex led to safe, reliable and predictable recoveries without evidence of residual curarization or respiratory depression. NMB should be considered in patients with MG when sugammadex is available. With the availability of sugammadex, NMB in MG patients can safely and effectively be reversed, while decreasing MG patients' vulnerability to respiratory complications in the postoperative period. Had NMB been utilized for this 53-year-old patient, maintenance of the anesthetic with less intravenous and volatile agents would have allowed for a more stable intraoperative hemodynamic profile, while providing adequate working conditions for the proceduralist.

The Effect of Intraoperative Dexmedetomidine on Postoperative Cough in Adult Patients Undergoing Thyroid Surgery

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Introduction: Coughing upon emergence from anesthesia after thyroid surgery can lead to incisional bleeding, cervical hematoma, reoperation, and cardiac arrest. Coughing lifts the thyroid cartilage that can loosen ligations and cause bleeding while violent neck movements can cause the cauterized infrahyoid muscle to bleed. For reasons that remain unknown, thyroid surgery, especially in females, is associated with a higher incidence of postoperative cough compared to other head and neck surgeries. Anesthetic approaches that attenuate cough can prevent postoperative complications after thyroid surgery. Dexmedetomidine, a potent alpha-2 agonist, reduces cough on emergence without associated respiratory depression or increased emergence time, making it a helpful adjunct for the anesthetic management in adult thyroid surgery. The purpose of this case report is to examine the effect of intraoperative dexmedetomidine on postoperative cough after adult thyroid surgery.

Case Presentation: A healthy 64-year-old, 79.9 kg female, non-smoker, physical status 2, presented for thyroidectomy due to a thyroid nodule, worsening cough, and throat discomfort. Airway exam revealed Mallampati class 2 airway, intact dentition, normal range of motion, and normal exterior neck anatomy. The patient was premedicated with midazolam and general anesthesia was induced with dexmedetomidine 20 mcg, propofol, fentanyl, and lidocaine IV. Neuromuscular blockade was achieved with a defasciculating dose of rocuronium and succinylcholine IV. Direct laryngoscopy with a Macintosh 3 blade revealed a Cormack-Lehane grade 1 view of the vocal cords. A 7.0 mm nerve integrity monitor endotracheal tube was placed under direct visualization. Maintenance was achieved with sevoflurane and intermittent propofol and fentanyl IV boluses. Operating time was 2 hours. On emergence, dexmedetomidine 10 mcg IV was administered. An awake extubation was performed upon achieving tidal volumes greater than 250 mL, a regular respiratory pattern and rate, stable vital signs, normal end-tidal carbon dioxide, and swallowing reflex. Extubation was smooth with no coughing, bleeding, or oozing from incision site. On follow-up 45 minutes post-extubation, the surgical site was intact, no bleeding or hematoma present. The patient and nurse denied coughing during the recovery period.

Discussion: Dexmedetomidine is a safe and effective pharmacological agent that attenuated the incidence of cough following thyroid surgery without respiratory depression compared to remifentanil or lidocaine in 4 of 5 randomized controlled trials. Dexmedetomidine 0.5 mcg/kg followed by an infusion at 0.4 mcg/kg/hr is equal in effectiveness to a 2% lidocaine 1.5 mg/kg bolus and infusion at 1.5 mg/kg/hr at reducing extubation cough incidence and severity. Dexmedetomidine 0.5 mcg/kg is a superior agent for attenuating cough incidence ($P < .001$) and severity ($P < .001$) when it is combined with a low-dose remifentanil infusion compared to a low-dose remifentanil infusion alone. Dexmedetomidine 0.6 mcg/kg/hr for the last 15 minutes of surgery lowers cough incidence ($P < .015$) and severity ($P < .022$) on emergence compared to saline placebo. The overall effects of dexmedetomidine administration are sedation, sympatholysis, analgesia, and cough suppression without respiratory depression. There are 3 methods of implementing dexmedetomidine into an anesthetic plan for adult thyroid surgery based on current research: 0.5 mcg/kg over 10 minutes at the end of surgery in combination with a low-dose remifentanil infusion, 0.6 mcg/kg/hr for 15 minutes at the end of surgery, or a 0.5 mcg/kg loading dose on induction and a continuous infusion at or above 0.4 mcg/kg/hr until the last 30 min of surgery. More research is needed to determine the optimal dose and timing of administration. Based on the results of studies included in this report, the use of dexmedetomidine to attenuate cough in adult thyroid surgery is recommended.

The Effects of Cannabis on Perioperative Pain

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Introduction: The intended purpose of this scholarly project is to assess the relationship, if any, between cannabis or marijuana use and its effect on perioperative pain. Marijuana is becoming more socially acceptable as more states legalize its use. As such, anesthesia providers can expect to see an increase in patients utilizing marijuana in the perioperative period. Currently, cannabis is legal for medical use in 36 states and recreational use in 16 states, including the District of Columbia. Additionally, there was an increase in the national rate of cannabis use in those aged 12 and older from 10.9% in 2008 – 2009 to 14.5% in 2016 – 2017. Perioperative pain control is a concern among anesthesia providers, patients, health organizations, and billing organizations. If cannabis use in the perioperative period increases pain, it is essential for the anesthesia provider to know. The anesthesia provider will need to consider the potential effects of marijuana on intraoperative pain and adjust the overall management for this subset of patients.

Case Presentation: Briefly, a 62-year-old male presented for lumbar 2 through 5 laminectomies, foraminotomy, posterior column osteotomy, dorsal internal fixation, and fusion. Upon completing the anesthetic pre-evaluation, the patient reported current, every-day marijuana use including the morning of surgery. The decision was made to proceed with the scheduled surgery after discussion with the anesthesia care team and the surgeon. Past medical history included hypertension on Lisinopril, anxiety medicated with marijuana use and Lexapro, and mild chronic obtructive pulmonary disease (COPD) due to current every day smoking of both tobacco and marijuana. Preoperatively, the patient received acetaminophen, famotidine, roxicodone, and celecoxib. In total, the patient received 30 mcg of sufentanil, 100 mcg of fentanyl, 1 g of methocarbamol, 28 mcg of dexmedetomidine, and 2.5 mg of dizepam. Although his pre-anesthetic and intraoperative courses were uneventful, postoperatively the patient reported significantly increased pain scores, required rescue analgesia in the postanesthetic care unit, and ultimately was admitted to the surgical recovery floor for pain management instead of the planned discharge to home.

Discussion: In one meta-analysis and multiple retrospective studies, the use of marijuana was associated with an increase in perioperative pain scores and opioid consumption. Additionally, the use of marijuana was associated with an increase in need for rescue opioids in the immediate postoperative phase, duration of opioids, pain at rest and with movement, incidence of hypotension, and an increase in sleep disturbances in the postoperative phase when compared to patients that do not use marijuana. Patients that use marijuana were also less satisfied with their pain management than those who do not use marijuana. The search is limited due to the primarily retrospective and observational nature of these studies as well as lack of randomized control trials in this area. Anesthesia providers should have a heightened awareness of the potential impact on perioperative outcomes in patients that use marijuana and incorporate this knowledge into their anesthetic plan.

The Use of Ketamine to Prevent Postpartum Depression In Cesarean Section Patients

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Introduction: Postpartum depression (PPD) is a problem that affects 10% to 15% of mothers and is the most common complication of childbirth. Untreated PPD in the mother can lead to suicidal ideation and death of the mother and/or child. Ketamine is an NMDA receptor antagonist that has been used for anesthesia and analgesia since the 1960s, but in the last 20 years has become more popular in treatment-resistant depression because of its rapid antidepressant effects. Anesthesia providers have the opportunity to choose which medications to use to keep the patient comfortable as the cesarean section is being performed. The purpose of this project is to examine if administering ketamine to patients undergoing cesarean section can help to prevent PPD. Available literature points towards ketamine administration being successful in preventing PPD and safe in breastfeeding women. Anesthesia providers should be aware of the risks and benefits of giving ketamine in this situation.

Case Presentation: Patient is a 22-year-old G1P0 with a history of anxiety and depression. The patient received an epidural that was placed earlier in the day for vaginal delivery; however, the fetus was having non-reassuring fetal heart tones and so the decision was made by the OBGYN for the patient to undergo caesarean. The epidural was re-dosed about 10 mins prior to incision with 10mls of 3% chloroprocaine and 15mls of 2% lidocaine with 1:200000 epinephrine. Upon incision the patient began to wince and complain of sharp pain. Throughout the procedure, ketamine 30mg IV was given to help with pain, propofol 115mg IV was given to help decrease awareness and anxiety, and ondansetron 4mg IV and ketorolac 15mg IV were also given as well as 5mg of morphine via the epidural. The patient was assessed day 1 and day 7 post-op using the Edinburgh Postnatal Depression Scale (EPDS) which is a 10-item questionnaire that can help to determine whether a post-partum patient is currently experiencing depression. The patient was made aware that she had received ketamine during her caesarean. Patient denied hallucinations, dizziness, nausea, vomiting, and was able to breastfeed in the PACU after caesarean. EPDS scores at day 1 and day 7 post-op were negative for PPD. Patient voluntarily took the EPDS questionnaire and gave permission for non-identifiable details of her childbirth experience to be written about.

Discussion: The present literature shows that ketamine given during the perioperative time of a cesarean section may be helpful in preventing PPD for 1 week postoperative and longer. More studies need to be done on the exact timing and dosing of ketamine in this population. Evidence suggests that 0.25mg/kg of ketamine is too low of a dose to cause clinically significant decreases in PPD. Data suggest that 0.5mg/kg of ketamine may be the optimal dose to be given to prevent PPD. Ketamine infusions given via patient controlled intravenous analgesia (PCIA) may have more benefit than a one-time dose. More research needs to be done to determine the best route and timing of ketamine administration to have the least amount of side effects in the mother and baby and to still have antidepressant effects.

The Use of Liposomal Bupivacaine in an Erector Spinae Plane Block

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Introduction: The use of regional anesthetic techniques has had a major expansion and utilization during the last decade fueled in part by the opioid addiction epidemic. The erector spinae plane (ESP) block is one of the newest regional anesthetic nerve block techniques that promises to provide analgesia for thoracic, abdominal, and spinal surgeries. Liposomal bupivacaine is a specific local anesthetic formulation that promises to increase the analgesic duration provided by regional nerve blocks to up to 72 hours. This case report presents a patient in which liposomal bupivacaine was used as the infiltration agent in an ESP. A review of the literature and the implications of current literature on future practice is included.

Case Presentation: A 57-year-old female underwent a right laparoscopic radical nephrectomy. After induction, a right-sided ESP block was performed at the T8 level using 10 mL (133 mg) of 1.3% liposomal bupivacaine and 10 mL (50 mg) of 0.5% plain bupivacaine. A total of 150 mcg of intravenous (IV) fentanyl was administered during the intraoperative period for additional pain control. During the 3-hour postoperative period, an additional 200 mcg of IV fentanyl and 1 mg of IV hydromorphone were administered. The patient remained in a surgical ward for a total of 4 postoperative days and additional doses of IV morphine and oral acetaminophen were administered. Numerical pain rating scale (NPRS) scores ranged from 0-9/10 throughout the hospital stay and the patient was subsequently discharged home verbalizing acceptable pain control and no complications as a result of the ESP block.

Discussion: Current evidence that describes the use of liposomal bupivacaine in ESP blocks is low in both quantity and quality, existing mainly in the form of case studies, case reports, and retrospective cohort studies. There is a vast amount of moderate level evidence demonstrating that the ESP block is a safe and effective regional block with significant opioid sparing properties. However, high-quality evidence does not support the superiority of liposomal bupivacaine at increasing the duration of analgesia provided by regional nerve blocks.

Transesophageal Echocardiography Use for Orthotopic Liver Transplantation

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Introduction: This scholarly project observes a high-risk patient undergoing an orthotopic liver transplantation (OLT). Hemorrhage, acute cardiac dysfunction, fluid shifts, and other intraoperative pathologies associated with OLT present many challenges for the anesthesia provider. Therefore, timely identification, evaluation, and intervention of intraoperative pathology are necessary to maintain hemodynamic stability. Traditionally, intra-arterial and pulmonary artery catheters (PACs) were used as hemodynamic monitors. Recently, however, transesophageal echocardiography (TEE) has been used for noncardiac surgery to assess hemodynamic status. The objective of this project is to identify the benefits gained from using TEE during OLT in addition to traditional hemodynamic monitoring techniques (CVP/PAOP) and how these findings affect fluid and medication management.

Case Presentation: A 50-year-old female underwent general anesthesia for OLT. The patient's medical history included cirrhosis, ascites, portal hypertension, portal vein thrombosis, thrombocytopenia, anemia, obesity, and coronary artery disease. Surgical history included splenic embolization and coronary artery bypass graft. The patient was transported to the OR, and standard monitors were applied. Initial vital signs were as follows: BP 148/75, HR 89, SpO2 92%, RR 24. The patient underwent an uneventful anesthetic induction and intubation. Sevoflurane was used to maintain anesthesia. A radial arterial line and an internal jugular introducer with a PAC were placed. Epinephrine and norepinephrine infusions were used to treat intraoperative hypotension. 1.5 L of 5% albumin, 6 U of packed red blood cells (PRBCs), 5 U of fresh frozen plasma (FFP), and 1 U of platelets were administered. Along with intraarterial blood pressure monitoring, CVP/PA pressure monitoring was used to estimate volume status and treat hypotension. Profound hypotension was treated frequently with vasopressors, fluids, and blood products throughout the case. The patient remained intubated and was transported to the intensive care unit (ICU) postoperatively. Forty-eight hours postoperatively, the patient remained intubated. Due to acute kidney injury, a continuous furosemide infusion and subsequent dialysis were required.

Discussion: The reviewed literature provided ample evidence that TEE for OLT can be used to make new intraoperative diagnoses, many of these being difficult to identify by other means. Common findings included intracardiac thrombus (ICT), ventricular dysfunction, and multiple embolic pathologies. Shillcutt et al found that 88% of participants in their study had some form of abnormal TEE finding during OLT. TEE findings were also found to impact fluid and medication administration. Hofer, et al found that vasopressor (56%), vasodilator (63%), and fluid management (50%) were all impacted by TEE findings in OLT patients. While evidence was provided to exhibit the efficacy of TEE as an intraoperative monitor, sufficient evidence was not provided to support better patient outcomes based on TEE assessments. This is largely due to a lack of quality observations and controlled research during OLT. The most significant evidence supporting better outcomes was from a retrospective observational cohort study that compared TEE, PAC, and a combined therapy group. The authors found that the patients undergoing OLT with both TEE and PAC had the lowest hospital length of stay (LOS), 30-day mortality, and infusion of fluids. This suggests that the addition of TEE with traditional monitors may be the safest method of hemodynamic monitoring. While the assumption that timely diagnosis of intraoperative findings leads to better outcomes may be reasonable, higher-powered studies are necessary to verify this assumption. Until beneficial outcomes have been validated, the use of TEE cannot be recommended as a comprehensive intervention for every OLT. However, it should be used based on the anesthesia provider's judgment along with other monitoring tools.

Ultrasound-Guided Spinal and Epidural Placement on Circumvention of Failure with Classical Approach

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Introduction: Shortcomings of the classical palpation technique in neuraxial placement lead to increased patient discomfort and possible failure or unsuccessful placement. This case report attempts to highlight the possible negative impact of blind needle insertions and promote a shift in clinical approach to spinal and epidural placement via ultrasound, using objective qualifiers (number of needle sticks, redirection, and time to placement) as proving points for change. This report investigates ultrasound-guided neuraxial placement success and how it compares to the classical palpation approach to spinals and epidurals when observing the aforementioned objectives, tying in an individual case experience with the literature review and contrasting to how the case could have been approached with the associated evidence.

Case Presentation: An 81-year-old male, 6'2", 101.1 kg, presented for a total knee arthroplasty via a spinal anesthetic. Medical history included levoscoliosis and dextroscoliosis of the spine, degenerative disc degeneration and loss of disc height at L1-L2 and L3-L4, foraminal narrowing, and hyperlipidemia. Using the iliac crest as a guide, 3 ml of lidocaine 1% was injected into the L3-L4 intervertebral space. A 27-gauge pencil-tip needle was unsuccessfully passed into the intrathecal space. After several attempts at needle redirection, the procedure was passed onto a seasoned anesthesia provider who, after additional attempts, passed the procedure onto a third provider. The third provider was successful in placing the spinal via a left paramedian approach, utilizing a 22-gauge 5-inch Quincke needle. Cerebrospinal fluid return was visualized and 1.8 ml of 0.75% Bupivacaine administered intrathecally. Sensory level block was tested for with a T6 block achieved. Time from anesthesia start to time of placement of the spinal anesthetic was 26 minutes and required 10 needle insertions. After the surgery was completed, the patient was transported to the Post-Anesthesia Care Unit (PACU), 99% SpO2 on room air, BP 124/79, HR 87, without complaints of pain. A lower limb peripheral block was placed post-operatively and the patient was later admitted to an inpatient surgical floor.

Discussion: Literature reviews indicate ultrasound first-attempt success was greater compared to a blind spinal technique. From a literature review involving 8 studies and 624 patients, ultrasound identified lumbar intervertebral space more accurately. Thirteen studies correlated ultrasound-measured depth and needle insertion depth within 3 mm. Median number of needle passes and number of attempts were 0.34 times that of the classical group. One study noted that spinal injection and total procedure time for parturients was longer in the classical group, and in patients with a BMI of 35-43 kg/m2 there was a higher first-attempt success rate with fewer needle passes. In patients with abnormal anatomy, ultrasound improved first-pass success with lower pain scores for spinals. This case report aligns with the literature review as the patient had difficult anatomy that lent to ultrasound assistance, and implementation of ultrasound would have reduced the time needed for spinal placement, number of needle sticks, and patient discomfort. Conclusions drawn indicate that initial approach to difficult anatomy may benefit from ultrasound guidance, and anesthesia providers should have a low threshold for abandoning the classical technique in lieu of ultrasound-guidance. Recommendations for practice are to ensure competency, not only in the classical method for neuraxial placement, but ultrasound proficiency as well. Directions for future research should highlight the benefit of access to both the classical landmark palpation and ultrasound-guided techniques, with the latter preferentially efficacious in neuraxial anesthesia for patients with a high BMI or difficult anatomy. Research should focus on exploring the benefits of ultrasound-guidance.

Evidence Based Practice

Acute Pain Management Using Pharmacogenetic Markers to Optimize Perioperative Acute Pain Treatment: A Current Review

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Background/Discussion/Question: Can CRNAs use pharmacogenetic testing to reduce adverse effects experienced by patients receiving opioids? Opioid administration is affected by interindividual variability in dose efficacy. Approximately 20% to 30% of patients treated with opioids suffer minor adverse effects, and as many as 11% experience serious adverse effects such as respiratory depression, hypotension, and bradycardia. Approximately 14% of the general population are at high risk for increased dysfunctional CYP2D6 or OPRM1, the enzymes primarily responsible for the metabolism of opioid medications. This project provides a synthesis of the current literature on pharmacogenetic principles and research to develop evidence-based recommendations for integrating pharmacogenetics into the practice of acute pain management by CRNAs and other clinicians.

Methods/Evidence Search: A literature review was conducted using PubMed, OVID, Google Scholar, Cochrane Library, and Agency for Healthcare Research and Quality (AHRQ). The search terms used are pharmacogenetics, acute pain, pain treatment, opioids, and analgesics. Initial results included 27 articles. Two reviewers screened titles and abstracts for relevancy. The remaining full-text articles were screened for inclusion criteria; articles not relevant to the PICO question were excluded. Inclusion criteria included: English, full text available, the years 2011-2022, 19+ years old, human studies.

Synthesis of Literature/Results/Discussion: Studies reviewed revealed the majority of the population has one or more actionable pharmacogenetic polymorphisms. Systematic review and meta-analyses indicated that 118G allele carriers have lower sensitivity to opioid analgesics, including both opioid-induced analgesic effects and side effects, together with less satisfactory pain management than 118AA homozygotes. In CYP3A4, *1G carriers had higher sensitivity to opioid-induced analgesia than *1/*1 homozygotes. This review highlights basic concepts about single-nucleotide polymorphisms (SNP) and how the knowledge can be put to use by anesthesia providers. SNPs play a significant role in the variability seen with the use of opioids in day-to-day clinical practice. Patients at high risk with dysfunctional CYP2D6 or OPRM1 account for ~14% of the population and are best managed with nonopioids. Patients at medium risk with subnormal CYP2D6 or OPRM1 account for ~48% of the population and can be managed with dose monitoring. Patients at low risk with functional CYP2D6 and OPRM1 account for ~38% of the population and should be availed of opioid therapy.

Conclusion/Recommendations for Practice: The utilization of pharmacogenetic (PGx) testing to increase the effectiveness of medication-based treatments across health care is under way. This review of the literature revealed that the body of research on the use of pharmacogenetic information to enhance the treatment of acute pain is growing, revealing a need to educate clinicians in the application and use of this technology to optimize acute pain treatment. Recommendations include further large clinical studies in diverse populations to maximize generalizability of results. Also, an increase in the use of PGx testing in patients that are at increased risk of inadequate acute pain management or adverse effects due to known risk factors such as history of inadequate analgesia, type of surgery, sex, gender, ethnicity, and co-morbidities. Increased use of testing will also allow for collection of data on the rates of adverse events and treatment comparisons.

An Educational Module Explaining the Use of Quadratus Lumborum Blockade to Decrease Opioid Usage During Colorectal Surgery: A Quality Improvement Project

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Background/Discussion/Question: The United States has experienced an opioid epidemic, and the perioperative period has been identified as a source of access to opioids. Regional anesthesia offers patients another method for pain management during the perioperative period while addressing many negative issues associated with opioids. Continued research into regional anesthesia is discovering new nerve blocks for specific procedures. This investigation aims to identify the quadratus lumborum (QL) block as a superior method to decrease opioid usage in patients undergoing colorectal surgery and present the information to CRNAs and SRNAs as an adjunct to their practice to reduce opioid usage and improve patient outcomes.

Methods/Evidence Search: This evidence-based practice project was guided directly by the PICO question, Does the use of regional anesthesia in patients undergoing colorectal surgery lead to decreased opioid usage? Furthermore, does QL blockade offer superior pain management than transverse abdominus process (TAP) blockade? Therefore, a search was conducted to synthesize data associated with the opioid epidemic, side effects associated with opioids, regional anesthesia, and TAP and QL blocks, using Cumulative Index to Nursing and Allied Health Literature, PROQUEST, and MedLine databases. The key searches along with Boolean operators developed for the practice question were "regional anesthesia" using quotation marks to keep this phrase together, AND "quadratus lumborum" OR “Transverse Abdominus Process" OR "pain" OR “colorectal surgery.” The information was then synthesized to articles specific to pain, opioid administration, and regional anesthesia related to colorectal surgery.

Synthesis of Literature/Results/Discussion: The review concluded that existing data encourages TAP blocks as the regional anesthetic of choice for pain management for patients undergoing colorectal surgery. However, the data show that QL blocks would be more efficacious for this patient population and would decrease opioid administration. The information explaining why TAP blocks are more common in current practice is related to a learning curve associated with performing the QL block and complacency amongst anesthesia providers. Other information explained includes the time taken to perform regional anesthesia. Due to the efficacy of the QL block and the direct impact on early recovery and decreased opioid administration, continued research in the field of regional anesthesia will support the implementation of this block. Future research should aim to set a standard of practice utilizing regional anesthesia, with a greater degree of cost savings as well as higher quality evidence and patient response.

Conclusion/Recommendations for Practice: There are many modalities to reduce opioid administration in patients during the perioperative period. As research continues in this field, many new methods will be identified. Anesthesia providers are at the forefront of this issue and have identified regional anesthesia as a primary method to improve patient outcomes while decreasing opioid administration. Research continues to find new methods of regional anesthesia to provide better patient outcomes—specific examples include utilizing QL blocks instead of TAP blocks for patients undergoing colorectal surgery. Overall, regional anesthesia requires enthusiastic anesthesia providers who are open to implementing new methods into practice. These preliminary findings anticipate successful outcomes and demonstrate the strengths of QL blockade over existing pain management methods. This study aims to persuade CRNAs to utilize the QL block to decrease opioid administration during the perioperative period for patients undergoing colorectal surgery.

An Educational Module on a Formalized CRNA Preceptorship Workshop to Enhance Teaching and Communication Skills

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Background/Discussion/Question: CRNA preceptors have minimal exposure to adult learning principles and educational theory and have not received instruction related to precepting. The clinical experience can have a direct impact on student development in self-awareness, critical thinking skills, and professionalism. In order to educate and train students, preceptors need to be knowledgeable about the various methods of supervision and learning processes. The goal of a formalized preceptor training program is to enhance existing precepting skills of experienced providers by providing evidence-based teaching principles. This evidenced-based practice project aims to answer the question: Will a formalized preceptorship workshop increase the knowledge, perception and attitude of the CRNA preceptor on teaching and learning strategies, effective communication and a positive preceptor-preceptee relationship?

Methods/Evidence Search: The databases utilized in the search included: Pubmed, The Cumulative Index to Nursing and Allied Health Literature, and ProQuest. Inclusion criteria for the chosen studies included studies that are written in English with full-text availability. All studies reviewed are related to a preceptorship within nursing or nurse anesthesia. Exclusion criteria included studies greater than 20 years old and studies that are based on precepting in a different job field. The search keywords: preceptor, preceptee, preceptorship, nursing, nurse anesthesia, student registered nurse anesthesia, education, and training were entered in varying combinations throughout the search process. Thirteen articles were chosen for this review based on the inclusion and exclusion criteria. The study designs of the articles are mixed methods, qualitative, and descriptive.

Synthesis of Literature/Results/Discussion: There are four key themes formulated from the review of the articles. The first theme assesses the preceptors' perception of their role and their needs. Bengtsson and Carlson found that preceptors want concrete tools on effective teaching of students and an understanding of preceptorship. The second and third themes include teaching strategies and learning needs. Meyers et al evaluated the perception of new RNs and found that learning occurs from receiving feedback, having a nurturing relationship with their preceptor, and a positive orientation environment. A study by Forneris and Peden-McAlpine determined that preceptors felt that their precepting skills were enhanced after the initiation of a contextual learning intervention. Effective communication is the fourth theme and was ranked by SRNAs as highly important. A preceptor should be knowledgeable in effective adult teaching strategies, have an understanding of the learning needs of students, and have effective communication skills. It was found that factors that negatively effect students' education are a disempowering preceptor-student relationship and not utilizing teaching strategies. Whether a preceptor training program increases preceptors' knowledge of teaching and learning strategies needs further explanation. Future research should focus on screening of preceptors, preparation and reward for preceptors.

Conclusion/Recommendations for Practice: The role of the preceptor is to support the student during the transition from the classroom into clinical practice through enhancement of critical thinking and problem-solving skills. Preceptors are expected to provide an effective learning environment and facilitate a constructive clinical learning experience. An effective preceptor should possess the skills to provide constructive feedback, have knowledge about various teaching and learning principles, and be able to evaluate student outcomes. The themes discussed in the articles can be used in the development of a formalized preceptorship workshop to help improve the preceptorship experience and assist in the preparation of preceptors. The standardization of a preceptor program will help new and experienced preceptors effectively transfer high quality patient care and patient safety skills to SRNAs.

An Evidence-Based Practice Module on the Utilization of Haloperidol as a Pharmacological Compliment for Postoperative Nausea and Vomiting Prophylaxis in Adult Surgical Patients

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Background/Discussion/Question: Postoperative nausea and vomiting (PONV) commonly influence the perioperative experience of general anesthesia patients. Current guidelines suggest the use of combination therapy for PONV prophylaxis; however, there is diminished application in practice. A potentially efficacious and under-utilized medication currently being studied in combination with antiemetics is haloperidol, which initially debuted as an antipsychotic. The main foci of this dissemination are to analyze the available literature featuring haloperidol's PONV prophylactic potential in adults and to decipher whether anesthesia provider knowledge on the topic improves. This evidence-based project provides a segue to enhance anesthesia practice by diminishing PONV using haloperidol and following a process that mirrors the PONV evidence-based practice recommendations.

Methods/Evidence Search: The databases utilized in the search include MEDLINE, the Cumulative Index to Nursing and Allied Health Literature, the Directory of Open Access Journals, and the International Anesthesia Research Society/Anesthesia & Analgesia. The search keywords included variations of haloperidol, postoperative nausea and vomiting, prophylaxis, and combination therapy. Exclusion criteria were meta-analyses, literature reviews, and systematic reviews. Inclusion criteria were publications within the past 14 years, full text, and randomized clinical trial designs. Research focused on haloperidol in PONV prophylaxis when used in combination with other antiemetics and as a sole agent. Literature studied featured haloperidol, droperidol, dexamethasone, and ondansetron for PONV prophylaxis. The following PICO question was developed: In anesthesia providers, does an educational module on the utilization of haloperidol as a compliment for PONV prophylaxis in adult surgical patients increase anesthesia provider knowledge, usage, and attitude?

Synthesis of Literature/Results/Discussion: The studies discussed haloperidol administration in pharmacological combination for PONV treatment. In 2019, Dağ et al investigated haloperidol's efficacy as a sole agent using different doses, 0.25mg, 0.5mg, 1 mg or 2mg, in adult female surgical patients. This is the most recent and applicable research. Benevides et al evaluated haloperidol with dexamethasone and ondansetron in 2013. Four studies analyzed haloperidol with dexamethasone, and two studies evaluated haloperidol with ondansetron. Joo et al and Wang et al studied haloperidol with dexamethasone in 2015 and 2012 respectively, and Feng et al studied haloperidol with ondansetron in 2009. All studies showed a decreased incidence of postoperative vomiting when haloperidol was administered with dexamethasone and ondansetron, and when used alone. More than 85% of the literature highlighted that haloperidol provided a protective effect against postoperative nausea when used in combination treatment and as a sole agent. All subjects receiving haloperidol did not exhibit significant adverse effects, increased sedation level, or a greater pain medication requirement. Future research should aim to study the efficacy of haloperidol in PONV prophylaxis when utilizing a multimodal analgesia plan of care. Research demonstrates that PONV negatively affects surgical patients despite the use of available antiemetic treatments.

Conclusion/Recommendations for Practice: All studies showed a decreased incidence of postoperative vomiting when haloperidol was administered solely or in combination with other antiemetics, dexamethasone, and ondansetron. According to published guidelines by the British Journal of Anesthesia and the International Anesthesia Research Society, which is supported by the American Society of Anesthesiologists (ASA), combination PONV prophylaxis is modeled as a goal of perioperative care. Within these guidelines, haloperidol is featured as a prophylactic antiemetic that showcases its capacity for inclusion in anesthesia practice. Current guidelines demonstrate that combination PONV prophylaxis is a goal of perioperative care, but adherence using haloperidol has been noted as an issue in current practice. This evidence-based practice guideline brings awareness of haloperidol in different

surgical settings and treatment combinations, which can be appealing for anesthesia providers who share the goal of optimal PONV prophylaxis. PONV is considered a common postoperative adverse event that warrants prevention.

Barriers to CRNAs Providing Medication-Assisted Treatment (MAT)

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Background/Discussion/Question: From 1999-2018, over 450,000 people died from drug overdose. The gold standard treatment for opioid use disorder (OUD) patients is medication-assisted treatment (MAT). Access to MAT is a challenge, especially for rural populations where 72% of rural counties lack a Buprenorphine-waived provider. CRNAs are the primary providers of anesthesia in rural America and have the opportunity to increase access to MAT. Unfortunately, the American Association of Nurse Anesthetists (AANA) noted only 6 CRNAs were providing MAT as of February 2020, limiting access to MAT. This survey aimed to identify and produce solutions to the barriers that CRNAs have in becoming MAT waived. By reducing these barriers to providing MAT, more CRNAs may become interested in this role, leading to an increase in access to MAT for the OUD population.

Methods/Evidence Search: A review of the literature was completed using Pubmed, the Cumulative Index to Nursing and Allied Health Literature, and EbSCOHost. The term "MAT" and "Barrier" were used in an advanced search of these resources. The review was limited to publications between 2017-2021 and full-text availability. The search revealed 144 articles, which was further scrutinized to include 17 articles relevant to the topic. From these articles, 4 main barriers were discovered, including CRNA awareness of MAT, lack of prescriptive authority, cost and resources of starting a clinic, and education of the OUD population. This information was then used to create a survey through REDCap and was distributed via 2 social media sites, "CRNAs & SRNAs" and "The Nurse Anesthesiology Group." The survey asked questions regarding the participants' demographics, baseline knowledge of MAT, willingness to provide MAT, and perceived barriers to providing MAT.

Synthesis of Literature/Results/Discussion: The survey had 527 responses, including 483 CRNAs and 44 SRNAs across 45 states. Only 16 of the 483 CRNA respondents currently provide MAT. The results found that 88.6% of CRNA respondents have never received education on MAT. When asked the meaning of the acronym, MAT, only 56.1% of CRNAs and 48% of SRNAs correctly answered the question. Less than 25% of CRNAs and roughly 16% of SRNAs knew the Substance Abuse and Mental Health Services Administration (SAMHSA) time requirement to become MAT-waived. Only 51.1% of CRNAs and 36% of SRNAs knew that the primary drug that CRNAs prescribe for MAT is buprenorphine. Of the CRNA and SRNA respondents, 42.2% and 77.2% respectively, were likely or very likely to participate in MAT education. Specifically, CRNAs with 0-3 years of experience were most likely to complete MAT education if offered. The number one barrier to CRNAs becoming MAT waived was lack of education. Lack of prescriptive authority was the second highest barrier, followed by the extensive cost of starting a private practice, and finally lack of financial incentive.

Conclusion/Recommendations for Practice: Over 40 states have reported increases in opioid-related mortality since the start of the pandemic. Fortunately, the survey revealed 16 CRNAs are currently providing MAT, which is more than previously recognized, but many more are needed to save the lives of OUD patients. To overcome these barriers to CRNAs providing MAT, solutions were formulated from the survey. The majority of SRNA respondents stated they were likely or very likely to electively enroll in the training. Incorporating this area of study into CRNA programs may increase CRNA involvement in MAT while expanding education on this topic. Legislative efforts at the state or federal level to lift restrictions on prescriptive authority could increase the number of CRNAs providing MAT. More research is needed to explore the total costs of opening a practice, including ancillary expenses and reimbursement for CRNAs providing MAT. Research into whether MAT-waived providers could partner with established medical centers, clinics, or hospitals could solve the financial barrier.

Benefits of Methadone in Complex Spine Surgery

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Background/Discussion/Question: Spine surgery is associated with high rates of postoperative pain, which are linked to increased opioid consumption, elevated pain scores, and the development of chronic pain. High postoperative pain scores within the initial 72-hour period contribute to the development of chronic pain. The cost of chronic pain is between $560-600 billion yearly in health care costs and lost productivity. The following analysis explores intraoperative methadone for reduction of postoperative pain and its negative sequelae by asking the question: In patients undergoing spine surgery, does intraoperative methadone result in less postoperative pain during the initial 72-hour period when compared with traditional opioids?

Methods/Evidence Search: PubMed, Embase, Medline and the Cumulative Index to Nursing and Allied Health Literature databases were searched. Search criteria were methadone + spin* (2011-2021), anywhere in the document. All clinical trials, meta-analyses, randomized controlled trials, reviews, systematic reviews, and scholarly papers in the English language were searched. Exclusion criteria were languages other than English, animal subjects, and reports published before 2011. This produced 775 records after duplicates were removed. Titles were scanned for relevance, sorting from most to least relevant. Due to high volume from Medline and Embase, Boolean operators for these databases were enhanced to methadone + spin + surg* in all fields, allowing for 634 further exclusions. This resulted in abstract and title screening of 141 items; 118 exclusions were made due to lack of relevance. The resulting 23 reports were sought for full assessment. Three reports were not retrievable, and 20 were fully assessed. Of those, 10 were excluded due to further lack of relevance. Ten reports were included for the final review.

Synthesis of Literature/Results/Discussion: Of the 6 studies that compared methadone to a traditional opioid, 2 showed reduction of postop pain scores at 24H, 3 showed it at 48H, and 3 showed it at 72H. A reduction in postoperative opioid use was found in the methadone groups at 24H in 2 studies, 48H in 3 studies, and 72H in 4 studies. Each study varied in dosage, opioid control, and anesthetic protocol. The side effect profile of methadone was similar to that of standard opioids in all studies. Postop respiratory depression/delayed extubation was not higher with methadone in any study. In a large single-facility safety study of 1478 patients, the rate of reintubation was 1.5%, a figure that is on par with moderate-high risk surgery. Further, 30.1% of patients experienced postoperative arrhythmias with sinus tachycardia being the most common, and no patients experienced polymorphic ventricular tachycardia. No significant increase in PONV or QT prolongation in patients who did not have a QT prolongation at baseline was found. Several studies suggested that methadone reduces incidence of hyperalgesia via NMDA antagonism in the setting of opioid tolerance.

Conclusion/Recommendations for Practice: This review suggests that intraoperative methadone reduces postoperative opioid consumption and lowers postoperative pain scores in spine surgery patients. Based on the studies, methadone may be considered in ASA I-IIIs with no liver/kidney dysfunction or baseline cardiac arrhythmias. Standard postop monitoring is recommended. Larger sample sizes with higher ASA scores would help assess the safety and efficacy of methadone in more diverse populations. Provider education on methadone and its benefits would help increase its use. Dose-response studies are recommended to realize the most effective dosing of methadone while limiting side effects. Logistical partnership with pharmacy to make methadone readily accessible should be considered.

Cadaver-based Simulation in Ultrasound-Guided Regional Anesthesia Luxury or Necessity? A Systematic Review

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Background/Discussion/Question: The Council on Accreditation (COA) for Nurse Anesthesia Educational Programs and the Residency Review Committee (RRC) for anesthesiologists outline that training of novice practitioners in ultrasound-guided regional anesthesia (UGRA) relies on the principle of "minimum clinical experience," also referred to as the "see one, do one, teach one" model, where skills and procedures are learned through initial observation and then practiced on patients. Alternatives to the current training standards for practice of UGRA focus on the use of cadavers for simulation. The type of simulation tool utilized depends on multiple factors including availability, cost, and institutional restrictions. Cost effectiveness of cadaver utilization is the primary concern. Thus, it is necessary to explore the effectiveness of cadaver-based simulation for teaching UGRA.

Methods/Evidence Search: The purpose of this evidence-based project was to answer the following clinical question: Do anesthesia providers benefit from use of cadaver-based simulation over other simulation training modalities to improve anatomy identification, needling technique, and gain proficiency in regional anesthesia? Inclusion criteria included novice, experienced, nurse anesthetists, anesthesia residents, and anesthesiologists incorporating simulation-based training into learning UGRA. Exclusion criteria involved anesthesiologist assistants and simulation-based training not involved in learning UGRA. The search strategy utilized the Google Scholar, PubMed, and Cumulative Index to Nursing and Allied Health Literature. Seven cohort studies, one randomized control trial, and one systematic review were included for critical analysis.

Synthesis of Literature/Results/Discussion: The resulting articles included 5 cohort studies, 1 qualitative study, and 1 randomized controlled trial. The studies included participants with varying levels of proficiency: 42 anesthesia residents in their 1st through 3rd year of clinical training, university students in medicine, 57 students of nursing and allied health and physical therapy with no prior exposure to regional procedures, and practicing anesthesiologists. Seven of the manuscripts examined found marked benefit to using Thiel embalmed cadavers for simulation when teaching UGRA. Mcleod, et al and Kessler, et al developed benchmarks to measure success in completion of a regional anesthesia technique; the literature review further elaborated on the translation of Thiel embalmed cadaver usage to the clinical setting given the flexibility of the cadaver, tactile feedback, and visualization under ultrasound. However, none of the studies evaluate clinical competency on patients after UGRA simulation, although there are self-reports of perceived confidence. After comparing over 20 cadavers, Thiel embalmed cadavers offered greater metrics of success when used for teaching in the eventual application of regional anesthesia. There is also demonstrated utility of using meat-based models for simulation for certain types of blocks without considering anatomic variance given their cost permissiveness.

Conclusion/Recommendations for Practice: Use of cadaver-based simulation for training learners of regional anesthesia improves familiarity with anatomy visualized on ultrasound, as well as needling technique ability that has not significantly proven to be transferable to clinical practice. Novice providers may benefit initially from use of meat-based models for simulation, keeping in mind it is not reproducible in the clinical setting or to a variety of nerve blocks; additionally, it does not offer sonoanatomy recognition. The model chosen for simulation-based training should be in line with the practitioner's level of proficiency. There are many considerations for schools and practitioners when deciding on how best to provide options for simulation clinical skills. Thiel embalmed cadavers are an ideal, cost-effective tool for gaining proficiency in regional anesthesia because they offer durability and maintain integrity of target structures, even withstanding hundreds of needling attempts over weeks, and also improve sonoanatomy recognition. It is necessary to offer a cost-prudent and effective means

of training providers in regional anesthesia. An alternative simulation-based training for the novice practitioner accompanied with live-model scanning to assist in sonoanatomy recognition can be a cost-effective and practical means to educate practitioners seeking to gain UGRA proficiency.

Comparing the Quadratus Lumborum Block and the Transverse Abdominal Plane Block for Abdominal Surgery

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Background/Discussion/Question: The use of regional anesthesia has grown in popularity since point of care ultrasound has become widely available. Blocks are used to decrease pain and reduce the need for other analgesia, such as narcotics. In abdominal surgery, minimizing narcotics can be especially important to aid return of bowel motility and function, as well as preventing nausea and vomiting. A commonly utilized block for abdominal surgeries is the transverse abdominal plane (TAP) block. While the TAP block only provides somatic coverage to the abdominal wall, the newer quadratus lumborum (QL) block is hypothesized to also provide a visceral pain relief. This literature review sought to answer whether the QL Block, in comparison with the TAP Block, results in decreased postoperative pain in adult (non-parturient) patients undergoing major abdominal surgery.

Methods/Evidence Search: A systematic review of literature was performed using PubMed, MEDLINE-Ovid, and Scopus databases. Articles were limited to within 5 years. Keywords and MeSH headings included: quadratus lumborum, transverse abdominal plane, pain or analgesia, and surgery. Boolean operators combined search terms to include only publications with both blocks for comparison. A total of 95 records were screened after removing duplicates. Articles were further excluded for ineligible populations, interventions, or comparisons. Exclusion criteria included pediatric patients and parturients due to physiological alterations in these populations. If no study or trial was performed, the articles were not included. Only randomized controlled trials were evaluated for the final review. Twelve records published between 2018 and 2021 were sought for retrieval, and all were included in the final review.

Synthesis of Literature/Results/Discussion: Of the 12 randomized controlled trials performed in the articles reviewed, 8 found the QL block to be more effective than the TAP block in reducing postoperative pain in abdominal surgery. The other 4 trials generally found no significant difference between the 2 blocks, although 1 trial showed lower pain scores at 48 hours postoperatively in the QL group. None of the trials demonstrated the TAP block as superior to the QL block. Surgeries performed in these trials included both laparoscopic and open procedures. Lower pain scores (using a visual analogue scale) were the primary metric utilized as evidence of the QL block's superior pain relief in most studies. Lower narcotic requirement was also used as evidence of superior pain control. Patients who were randomized to the QL block group also tended to have longer times to 1st narcotic requirement and lower overall narcotic consumption throughout the postoperative period. Two studies specifically noted higher patient satisfaction in the QL block groups. In 2 other studies, the patients randomized to the QL block were out of bed sooner, demonstrated faster return of bowel function, and had a shorter length of stay. One study measured cortisol levels in participants and found that the patients in the QL group even had a less extreme stress response to surgery.

Conclusion/Recommendations for Practice: Based on this review, anesthesia providers aiming to achieve superior pain relief in patients undergoing major abdominal surgery should consider using the QL block over the more traditional TAP block. Proficient practitioners can perform either block in approximately equal time. While the QL block is considered more technically challenging, studying the anatomy of both blocks and becoming adept in their technique will allow anesthesia providers to offer the best possible option of pain relief to patients. Providers can expect significantly lower narcotic consumption and faster mobilization of their patients postoperatively. Further study may illuminate whether similar results are shown in parturients for obstetric surgery, such as cesarean section. Additional research should examine the ideal choice of pharmacological agent, dosing, and adjuvants for best outcomes.

Development of a Pediatric Pain Protocol for Musculoskeletal Injuries in the Emergency Department

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Background/Discussion/Question: Pediatric patients experience significant pain with musculoskeletal injuries. No consensus exists on the best practice for treating pediatric musculoskeletal pain in the emergency department. Approximately 25% of pediatric extremity fractures do not receive any pain medication in the emergency department. The William Beaumont Army Medical Center Emergency Department (WBAMC ED) lacked a pain management protocol for pediatric musculoskeletal injuries. This project aimed to identify current best practices and develop an evidence-based protocol for treating pain related to these injuries. The following PICO question guided this project: "In pediatric patients with orthopedic injuries, what are evidence-based interventions that effectively decrease pain upon arrival to the WBAMC ED?"

Methods/Evidence Search: Systematic literature searches were conducted in PubMed, Cumulative Index to Nursing and Allied Health Literature, and Cochrane Database of Systematic Reviews. Key terms searched were pediatric pain, emergency room, emergency department, orthopedic, musculoskeletal, protocol, and extremity injury. Exclusion criteria were non-emergency department, non-acute pain, non-orthopedic pain, musculoskeletal, adult population, non-pharmacological treatment. The search included articles published in the past 10 years. The authors reviewed 1824 articles. Sources were analyzed based on reviewing the title, abstract, and full text. Nine randomized controlled trials and one observational study were included in the final analysis. Evidence sources were grouped and analyzed by the study interventions.

Synthesis of Literature/Results/Discussion: Six evidence sources evaluated the effectiveness of intranasal or nebulized medications. Intranasal ketamine and intranasal fentanyl were effective and comparable in decreasing pediatric pain. Intranasal or nebulized fentanyl was comparable to intravenous morphine in decreasing pediatric pain. Combination therapy with oral ibuprofen and intranasal fentanyl or intranasal ketamine demonstrated effective pain control. Three studies evaluated oral medication for pediatric musculoskeletal pain. Oral ibuprofen was demonstrated superior to oral acetaminophen and equipotent to oral narcotics. Ketorolac and tramadol demonstrated effectiveness but were excluded from the protocol based on site preference. Based on the available data, the protocol recommends the administration of oral ibuprofen and intranasal fentanyl or intranasal ketamine. If pain persists, the protocol recommends additional intranasal medication, intravenous morphine, or intravenous fentanyl. If these interventions do not control pain, the protocol recommends anesthesia consultation. Continuous monitoring for 15 minutes after each intervention was included in the protocol based on reported adverse events in the literature.

Conclusion/Recommendations for Practice: The evidence-based protocol provides guidance to WBAMC ED physicians, with the goal of decreasing pain scores in pediatric patients presenting with orthopedic injuries. The authors recommend implementation of the protocol to validate its effectiveness in reducing pain scores in the subject population.

Dexamethasone Dosing for the Prevention and Treatment of Postoperative Nausea and Vomiting

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Background/Discussion/Question: Postoperative nausea and vomiting (PONV) is a common problem related to general anesthesia and surgery. PONV decreases patient satisfaction, increased length of stay in the post anesthesia care unit (PACU) or hospital resulting in increased costs, and can increase surgical complications such as wound dehiscence, aspiration, or increased intracranial pressure. Antiemetic drugs including dexamethasone (dex) may be given intraoperatively to mitigate this problem. Great variability of dexamethasone dosing exists among anesthesia providers. Therefore, the aim of this review is to assess current literature for ideal dosing of dexamethasone to aid in the prevention of PONV.

Methods/Evidence Search: PICO question: "In adult patients receiving general anesthesia, what is the efficacy of administering dexamethasone low dose (less than 8mg) vs high dose (greater than or equal to 8mg) for the prevention and treatment of PONV?" A comprehensive literature search of PUBMED, Cumulative Index to Nursing and Allied Health Literature, and Embase was conducted with keywords: dexamethasone, doses, naus*, PONV/naus/emesis. Seventy-two articles were retrieved, 8 duplicates were removed, 64 were screened for eligibility, and 9 were included in the review. Inclusion criteria: free full text, abstract, general anesthesia, adults, and 5-year time limit. Exclusion criteria: ineligible population, dex dose absent, dex used as an adjunct for regional anesthesia or analgesia, case reports, access issues, research bias, non-English articles, and ongoing research.

Synthesis of Literature/Results/Discussion: A synthesis matrix aided with the identification of 3 themes: high, low, and weight-based dosing. Two articles exhibited weight-based dosing of dex 0.1mg-0.2mg/kg to be effective in the treatment and prevention of PONV. Two articles recommended low dex doses, less than 8mg, while another article specified a dex dose of 4 mg to be ineffective pertaining to the treatment and prevention of PONV. Three articles specifically found 8 mg to be adequate while another article deemed 10mg of dex to be more effective. Reviewed articles established the efficacy of high dose dex in the prevention and treatment of PONV leading to improved patient satisfaction and decreased hospital and PACU length of stay, thus minimizing healthcare costs and negative adverse complications.

Conclusion/Recommendations for Practice: The strength of the recommendations is limited because the review is limited, but the evidence suggests high dose dex administration after induction of general anesthesia aides with PONV. Due to synergistic effects, PONV was reduced when dex was used concomitantly with other antiemetics and a multimodal pain approach. While results suggest high-dose dex lessens the effects of PONV, further research is recommended to ensure a complete response (no PONV, retching and vomiting, or no use of rescue antiemetics within 24hrs after surgery) and a precise dose. Patients with diabetes mellitus, parturients, or those with any contraindications to glucocorticoids should also be included in further dex studies pertaining to PONV.

Does Prophylactic Tranexamic Acid Decrease Postpartum Hemorrhage in Women Undergoing Vaginal or Cesarean Delivery?

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Background/Discussion/Question: Postpartum hemorrhage (PPH) is a leading cause of maternal morbidity and mortality. Tranexamic acid (TXA) is an antifibrinolytic that has shown to be effective in the treatment of postpartum hemorrhage. However, evidence supporting its routine prophylactic use remains inconclusive. Several randomized control trials (RCTs) have reported that prophylactic TXA use resulted in less postpartum blood loss with no increase in severe adverse effects. However, the majority of these RCTs were small single-center studies. Included in this review are the results of new large multicenter studies assessing the impact of TXA on maternal blood loss-related outcomes after vaginal and cesarean delivery. In women undergoing vaginal or cesarean delivery, does the prophylactic use of tranexamic acid compared with no TXA or placebo decrease the incidence of postpartum hemorrhage?

Methods/Evidence Search: A review of literature was performed using PubMed, Cumulative Index to Nursing and Allied Health Literature, and EMBASE. Title and abstracts were searched in all databases using the keywords “prophylactic,” “tranexamic acid,” and “postpartum hemorrhage” using the Boolean operator “AND.” Articles that were reviewed were randomized control trials published after 2017 and included an abstract. A total of 66 records were identified with 42 remaining after duplicates were removed. Exclusion criteria included use of agents other than tranexamic acid and standard uterotonics, inherited bleeding disorders, multiple gestation, preeclampsia, seizure disorders, and previous history of postpartum hemorrhage. The result yielded eight randomized control trials including a total of 20187 women. Three studies examined vaginal delivery and 5 studies examined cesarean delivery.

Synthesis of Literature/Results/Discussion: Five out of the 8 studies showed a statistically significant decrease in blood loss and incidence of postpartum hemorrhage. All 8 studies did not show any increase in incidence of major adverse events such as thromboembolism or seizure. Two studies reported increased nausea and vomiting in the TXA group. While the overarching theme is that prophylactic TXA decreases blood loss and PPH, many of these studies are of relatively low sample size ($n < 150$), spurring the need for large, high-powered trials to replicate the results. The TRAAP1 trial ($n = 4079$) showed no statistically significant difference in blood loss or the incidence of PPH in vaginal delivery. The TRAAP2 trial ($n = 4551$) examined the same effect in cesarean delivery and showed a small, albeit statistically significant decrease in blood loss and incidence of PPH. A large trial by the Maternal Fetal Medicine Unites (MFMU) network ($n = 10995$) showed TXA did not reduce the incidence of blood transfusion during cesarean delivery. The results of these large trials contrast with the results of smaller trials. The timing of administration of TXA differed among the studies which may affect its efficacy. In trials reporting a decrease in blood loss, TXA was given prior to incision in cesarean delivery or prior to delivery in vaginal delivery. In trials showing no decrease in blood loss, TXA was administered after incision or after delivery.

Conclusion/Recommendations for Practice: Many studies reporting the effective results of TXA were small, single-center, low-quality trials which may provide unreliable results. The TRAAP and MFMU trials are large-powered studies which reliably assess the effects of TXA on PPH. TXA was not associated with an increase in thromboembolic effects but was associated with an increase in nausea and vomiting. The timing of administration may play a factor as TXA was administered after incision or delivery in the large, multi-center trials. In conclusion, as a proposed prophylactic agent to prevent PPH, the level of evidence is conflicting and currently insufficient to recommend the routine use of TXA to prevent blood loss after vaginal and cesarean deliveries. While several small studies showed promising findings that TXA reduced blood loss and incidence of PPH, recent large-powered, multicenter studies did not demonstrate these findings. Further investigation and larger clinical trials with better design that examine the timing of administration are warranted.

Effect of Intraoperative Corticosteroid Use on Sugammadex Reversal in Rocuronium Induced Neuromuscular Blockade

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Background/Discussion/Question: Sugammadex is a unique neuromuscular reversal medication that has been widely used since its approval by the FDA in 2015. Sugammadex has a strong binding affinity with rocuronium, an aminosteroid nondepolarizing neuromuscular blocker. Binding of sugammadex with rocuronium causes a decrease in plasma concentration of rocuronium which consequently leads to reversal of the neuromuscular blockade. Due to their similar steroid structure to rocuronium, hormonal contraceptives have also been shown to interact with sugammadex, reducing its effectiveness. Corticosteroids such as dexamethasone and methylprednisolone are commonly used intraoperatively and have a similar structure with rocuronium. The aim of this review is to investigate the possible interaction of corticosteroids and sugammadex and its effect on the neuromuscular blockade reversal times.

Methods/Evidence Search: A comprehensive literature search using PubMed, Cumulative Index to Nursing and Allied Health Literature, Embase, Web of Science, and CLIO was performed. Search terms included dexamethasone, sugammadex, methylprednisolone, hydrocortisone, and delayed emergence. Articles published between 2016 and 2021 were included. Initial search of the databases identified 498 articles. From these articles, 489 were excluded due to duplications, their irrelevance to the topic, or non-human studies. Inclusion criteria consisted of studies that only used rocuronium as a paralytic and patients undergoing general anesthesia that were orally intubated. Exclusion criteria consisted of sample size less than 40, lack of comparison group, and patients undergoing general anesthesia with LMA placement.

Synthesis of Literature/Results/Discussion: Research articles that used adult patients showed that intraoperative use of dexamethasone had no clinically significant impact on neuromuscular blockade reversal with sugammadex. The use of methylprednisolone, however, did show an interaction with sugammadex causing a delayed emergence which was statistically significant. Studies have shown that interaction of sugammadex with rocuronium, hormonal steroids, dexamethasone, and methylprednisolone resulted in a decrease in corticosteroid plasma concentrations. Delayed emergence and delayed time to extubation was also seen more readily with the pediatric population. Evidence shows that corticosteroid interaction with sugammadex and its effect on neuromuscular blockade reversal may be concentration dependent.

Conclusion/Recommendations for Practice: The anesthesia provider should be cognizant that use of intraoperative corticosteroids can interact with sugammadex in a concentration dependent manner and may cause a delay in emergence. Further studies with the pediatric population are necessary to understand corticosteroid use and their effects on sugammadex. Further studies may also examine the decrease in dexamethasone plasma levels with sugammadex administration and its correlation with PONV.

Efficacy of Erector Spinae Plane Block for Postoperative Analgesia in Patients Undergoing Lumbar Spine Surgery

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Background/Discussion/Question: Lumbar spine surgery can be very painful, especially in the postoperative period. Poorly controlled postoperative pain can cause delayed mobilization, prolonged hospital stay, thromboembolic events, increased hospital costs, chronic pain syndromes, and decreased patient satisfaction. Common anesthesia practice for spine surgery includes multimodal analgesia with opioids. Adverse effects of opioids include nausea, constipation, respiratory depression, ileus, postoperative drowsiness, and risk for opioid dependence. The erector spinae plane block (ESPB) can anesthetize the ventral and dorsal rami of the spinal nerves and produce an extensive sensory block for patients undergoing spine surgery. The ESPB can be performed at ease with low complication rate. The purpose of this research is to see if ESBP can reduce postoperative pain and opioid consumption.

Methods/Evidence Search: A systematic review of literature was performed utilizing the databases PubMed, Medline, and Cumulative Index to Nursing and Allied Health Literature. Search strategy involved the key words spine surgery, lumbar spine surgery, lumbar spinal stenosis, spondylolisthesis, erector spinae block, erector spinae plane block, ESP*, ESPB. Keywords were combined using Boolean operators “OR” and “AND.” Articles reviewed were full-text English articles published after 2016 that included an abstract. A total of 44 records were found with 33 remaining after duplicates. Exclusion criteria included procedures other than lumbar spine surgery, percutaneous spine surgery, patients with scoliosis, not the adult population, animal or cadaver studies, and studies with multiple comparative interventions. Articles included were RCTs that compared ESPB with no block evaluating postoperative analgesic effect in adult patients undergoing lumbar spine surgery. The primary outcome was postoperative pain scores and postoperative opioid consumption. After screening, 9 randomized control trials were included.

Synthesis of Literature/Results/Discussion: Nine studies involving 608 patients were eligible for the study. An ESPB was performed preoperatively at T10 or vertebral level of surgery using 20ml 0.25%-0.5% bupivacaine or 0.3-0.375% ropivacaine unilaterally. One study performed the block postoperatively. All studies showed those who received an ESPB had a statistically significant reduction in opioid consumption in the first 24 hours postoperatively compared to the control group without a block. First analgesic demand time was significantly shorter in the control group compared to the ESPB participants. Numeric pain rating scale and visual analog scale were lower in the first 24 postoperative hours in the group that received the ESPB. Two studies noted that modified observer’s assessment of alertness/sedation score within 20 min after extubation was higher and duration in the post-anesthesia care unit was shorter in the ESPB group. Intraoperative anesthesia requirement was lower in ESPB group and bowel function returned quicker postoperatively. One study did find no statistically significant difference in mobility scores. ESPB can be incorporated to multimodal anesthesia approach to improve patient satisfaction and post-operative pain relief.

Conclusion/Recommendations for Practice: Erector spinae plane block should be part of a multimodal analgesic approach for patients undergoing lumbar spine surgery. ESPB can reduce postoperative pain scores improving patient satisfaction and reduce opioids enhancing recovery after surgery. By reducing opioids patients can have increased return of bowel function and reduced postoperative sedation. ESPB is safe to perform with evidence showing no increased risk of complications. Further studies are needed to compare the efficacy of ESPB at T10 level or level of surgery. Further studies are needed as well to compare single-shot vs multi-level injection ESPB.

Electronic Cigarettes and Their Implications on Anesthesia Management

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Background/Discussion/Question: More people are using electronic cigarettes today, either in an effort to stop smoking traditional cigarettes or for pleasure. Although many believe them to be better overall, electronic cigarettes contain a variety of substances and byproducts that are accompanied by detrimental effects. The purpose of this project is to bring awareness to the danger of electronic cigarettes, providing practitioners with a baseline knowledge of how to identify and address problems associated with vaping. The question of focus for this project is: In patients undergoing surgery, what anesthetic considerations should be noted in those who use electronic cigarettes as compared to those who do not use electronic cigarettes to maximize lung function and decrease respiratory complications in the perioperative period?

Methods/Evidence Search: The Cumulative Index to Nursing and Allied Health Literature and Medline Complete were systematically searched through the Texas Christian University Mary Couts Burnett Library for relevant literature pertaining to the topic. The search terms vape, anesthesia, and electronic cigarettes were used, generating a total of 17 results. Limits were applied including “English language,” “within 5 years,” “peer reviewed,” and “humans,” yielding 12 results. PubMed was also systematically searched using the same search terms and limitations, providing an additional 18 results. Best evidence articles were chosen by searching for systematic reviews (SR), meta-analyses, and randomized controlled trials (RCT), yielding 5 included studies total.

Synthesis of Literature/Results/Discussion: Electronic cigarette or vaping associated lung injury (EVALI) is a critical disease process that changes what we know about the timeline of pulmonary changes caused by cigarettes. Chemicals and flavorants added to the cigarette liquid are suspected to cause bronchiolitis obliterans. The use of electronic cigarettes disturbs pulmonary gas exchange, puts patients at increased risk for airway obstruction and spasms intraoperatively, and causes intrapulmonary changes that are detrimental. Patients who smoke electronic cigarettes are also at risk for increased doses of opioids and neuromuscular blockers, increased tissue hypoxia, and epithelial injury. Additives to the cigarettes include tetrahydrocannabinol (THC), nicotine, and other compounds that cause a host of cardiovascular and respiratory effects that vary between mild to complete failure of the system. Anesthesia providers should thoroughly assess all patients for use of electronic cigarettes, and counsel users to stop smoking them. Current research consistently identifies a lack of knowledge concerning the long-term effects of using electronic cigarettes. Future research should be aimed at identifying the cause of EVALI, and the preeminent method to manage electronic cigarette users to optimize lung function and decrease pulmonary complications perioperatively.

Conclusion/Recommendations for Practice: Judicious assessment of electronic cigarette usage should be performed in the preoperative period, and cessation should be encouraged. Anesthesia providers must be vigilant and alert in the intraoperative period with potential problems with oxygenation status, difficulty in ventilating, and hemodynamic changes that may arise as a result of electronic cigarette usage. Bronchodilators should be on hand and airway management accomplished with the use of lidocaine to attenuate irritability, coughing, and laryngospasm during airway manipulation. Deep anesthetic levels should be maintained and manipulation of the airway should be avoided during the second stage of anesthesia. Further research is necessary to truly understand the effects of vaping and the best intraoperative management of patients who use electronic cigarettes.

Erector Spinae Plane Block vs Transversus Abdominis Plane Block in Patients Undergoing Abdominal Surgery: A Systematic Review

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Background/Discussion/Question: Postoperative pain associated with abdominal surgeries impairs physical function, delays recovery, prolongs hospital length of stay, and decreases quality of life. The objective of this systematic literature review is to appraise the latest scholarly work and evaluate the findings comparing erector spinae plane (ESP) blocks to transversus abdominis plane (TAP) blocks efficacy on acute pain management in patients undergoing abdominal surgery. The following question will be answered: In adult surgical patients undergoing abdominal surgery, does the administration of a bilateral ESP block compared to a TAP block lead to an overall decrease in opioid administration and improved pain score during the post-operative period?

Methods/Evidence Search: The Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) checklist was used to guide the systematic review. The following databases were searched for scholarly literature related to the literature review by two investigators independently and were last searched March 2022: Cumulative Index of Nursing and Allied Health Literature, Google Scholar, PubMed, and the Cochrane Library. The following terms were used to help locate articles: “erector spinae,” “ESP block,” “transversus abdominis,” “TAP block,” “versus,” “and,” “compared,” “surgery.” Articles were screened for inclusion criteria (human, 18 years of age or older, abdominal surgery, ASA Classification I-IV, intervention: ESP block or TAP block) and were critically appraised using the evidence synthesis tool published by Johns Hopkins Nursing. Risk of bias was assessed for using the Cochrane risk-of-bias for randomized trials. All outcomes were noted including pain scores, patient satisfaction, and additional administration of pain medication.

Synthesis of Literature/Results/Discussion: A total of 398 participants were included in the systematic review. Of the 398 total participants, 20 patients were dedicated to a control group which received no intervention in the study conducted by Tulgar et al. Of the remaining 378 participants, 189 were enrolled in the ESP group and 189 were enrolled in the TAP group. Based on the authors’ conclusions in 6 of the 7 articles reviewed, ESP blocks provided superior pain management when compared to the TAP plane blocks. Results from one study showed no difference in pain scores between ESP blocks versus TAP blocks in patients undergoing laparoscopic cholecystectomy. Future research is needed to determine optimal local anesthetic mixtures and volumes. Future studies should include the presence of a larger sample in which a control group is utilized. In addition, double blinded clinical trials are warranted. The anesthesia providers performing the blocks should remain consistent throughout the study to help eliminate variability in successful block placement. The provider collecting the results should be blinded to which intervention the patient received. Additionally, sensorial coverage of block distribution should be assessed to help determine the efficacy of the block on each patient.

Conclusion/Recommendations for Practice: The ESP block is an easy, predictable, and minimally invasive regional anesthetic technique and is a safe option for anesthesia providers to utilize to help manage acute pain. The ESP block can be utilized in a multimodal analgesic plan for the management of acute pain in patients undergoing abdominal surgery. The ESP block can be placed preoperatively to promote sufficient time for the block to take effect prior to the patient arriving to the post-anesthesia care unit (PACU). In addition, a catheter can be placed to allow for continuous local anesthetic administration to prolong pain management. Based on the results of this literature review, the ESP block provides superior acute pain management associated with abdominal surgery, provides longer duration of analgesia, extends the time to initial request for other pharmacological analgesics, and lowers the requirements for additional analgesic medications when compared to the TAP block.

Evidence-Based Practice Guidelines for Electroconvulsive Therapy Anesthesia Protocol

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Background/Discussion/Question: There is a perceived need by the anesthesia department in an academic, urban medical center to create a multidisciplinary, evidence-based practice (EBP) guideline that details anesthetic care for electroconvulsive therapy (ECT). ECT has grown in recent years both in adults and adolescents. The problem statement for this project is: "There has been an increase in the number of patients receiving ECT at the project site. With this increase, an ECT protocol is needed to drive safe anesthesia care." After the protocol is established, an educational session will take place for Certified Registered Nurse Anesthetists (CRNAs) and student registered nurse anesthetists (SRNAs) to ensure providers are educated on this procedure.

Methods/Evidence Search: In order to create a robust protocol, a literature review was completed utilizing PubMed, Cumulative Index to Nursing and Allied Health Literature, and EMBASE. Thirty-six articles were utilized and compiled into the literature review, with all articles rated as a level IV-V. Input was given from a multidisciplinary team of anesthesia providers and psychiatrists to create a guideline. The guideline contains sections on operating room setup, medications for the procedure and potential adjuncts, sequence of ECT events, preoperative tasks, intraoperative tasks, postoperative tasks, hemodynamic changes, comorbidity considerations, potential drug interactions, and indications for ECT. To evaluate knowledge an anonymous pretest was administered to CRNAs and SRNAs. A presentation of the guideline was given followed by a post-test.

Synthesis of Literature/Results/Discussion: The literature review demonstrated a need for EBP guidelines for anesthesia care of patients undergoing ECT. Benson et al recommend ECT as a first-line treatment in psychotic depression or acute, life-threatening catatonia and as a second-line therapy of treatment resistant depression. When providing anesthesia for ECT procedures, it is important to consider the sequence of events, medications, and how to lower the patient's seizure threshold. Literature suggests utilizing methohexital and succinylcholine. Haeck et al recommend hyperventilation with a goal EtCO2 of 30 mmHg to enhance seizure activity. While these tasks are being completed, it's important to communicate with the psychiatrist to ensure the appropriate sequence of events are completed. Following this procedure, patients have a high incidence of headache and nausea, so adjuncts should be administered. Finally, it is important to consider the hemodynamic changes that can occur during the initiation of a seizure. Bryson et al suggest an average increase in SBP of approximately 45 mmHg. Descriptive statistics showed the average scores increased in both the CRNA and SRNA groups after the presentation. The CRNA group average increased from 59% to 75%, and the SRNA group average increased from 56% to 84%. The increase in average scores is evidence that the guideline improved CRNA and SRNA knowledge at this facility.

Conclusion/Recommendations for Practice: Electroconvulsive therapy is a unique procedure that differs from any other case. The anesthesia care for these patients has a direct impact on the initiation of a seizure. If the psychiatrist is not able to initiate a seizure, then the procedure is not successful. The anesthetic nuances of this procedure make it imperative that an EBP protocol is published for the anesthesia department at a large, urban, academic medical center. This will ensure that providers utilize the most up-to-date practices while ensuring care is delivered in a systematic approach, providing optimal patient outcomes.

Hospital Cost Comparison Between Sugammadex and Neostigmine with Glycopyrrolate

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Background/Discussion/Question: Hospital administrators and pharmacists often select drugs for the formulary solely on acquisition cost. Additional costs must be considered. For the neuromuscular blocking (NMB) agent reversal drugs, time from administration of the drug to the patient leaving the OR is a cost factor. Inadequate NMB reversal may cause pulmonary complications resulting in higher hospital costs. The purpose of the evidence-based project is to provide hospital administration and anesthesia professionals with a comparison of NMB reversal drugs to include the cost of acquisition, operating room time, and respiratory complications. The PICOT question is as follows: For a hospital, is there a difference between neostigmine and glycopyrrolate and sugammadex for reversal of neuromuscular blockade in adults ≥ 18 years of age on total cost (acquisition cost + OR time + adverse effects)?

Methods/Evidence Search: PubMed, Embase, and Google Scholar were systematically searched for relevant publications using search terms sugammadex, neostigmine, surgery, and cost singly and in combination. Studies were limited to publication within the last 10 years and must have included hospital cost. A total of 98 publications were retrieved. After removal of duplicates, reading titles and abstracts for relevance, and assessing entire studies, 5 studies were directly pertinent to the posed PICO question.

Synthesis of Literature/Results/Discussion: Neostigmine and glycopyrrolate and sugammadex are NMB reversal agents. Based solely on cost per vial, neostigmine and glycopyrrolate are often less expensive than sugammadex. There are more costs to a drug than merely its per vial price. Five studies evaluated the costs of acquisition, OR time, and pulmonary complications between neostigmine and glycopyrrolate and sugammadex. Of the studies that reported the effect of NMB reversal agent on OR time, 3 reported greater OR efficiency with the use of sugammadex that translates into lower cost. Residual neuromuscular blockade was a prominent occurrence in patients who had NMB reversed with neostigmine and a resultant greater incidence of postoperative respiratory complications. Sugammadex is the more cost-effective NMB reversal agent when costs of acquisition, OR time, and pulmonary complications are included in the analysis. Future research could target cost savings of pairing quantitative neuromuscular monitoring with accelerometry sugammadex to further reduce OR time and respiratory complications from residual neuromuscular blockade in specific patient populations. Increasing accessibility of quantitative NMB monitoring devices to provide a better form of neuromuscular monitoring would also allow for medications to be used more appropriately and in a more cost saving manner.

Conclusion/Recommendations for Practice: Anesthesia professionals frequently face the decision of selecting the appropriate drug for NMB reversal. Unfortunately, hospital administrators and pharmacists may have made the decision for them based on acquisition costs. A recommendation is for anesthesia professionals to evaluate the effect of NMB reversal agent on OR discharge time to determine cost savings. A decision analysis model supports the superiority of sugammadex in time to reversal of NMB and greater reliability with fewer adverse events. Anesthesia professionals may face pressure from hospitals to use the lower cost drug but fail to address benefits of sugammadex or adverse effects associated with neostigmine and glycopyrrolate. Overall, when the anesthesia professional faces the dilemma of using sugammadex or neostigmine and glycopyrrolate for the purpose of saving hospital dollars, the data refutes the belief that sugammadex is too expensive compared to its alternative reversal agent. Research reveals patient type and procedure influences true drug cost.

Implementation of a Standardized Handoff Process for Patients Transferring from Intensive Care Unit to Operating Room

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Background/Discussion/Question: Safe handoffs have been shown to improve patient safety. A thorough high-quality handoff requires many working parts. Intensive care unit (ICU) handoffs are often unstructured and characterized by poor teamwork, multiple distractions, and void of procedures performed during a patient's hospital stay. Patient transfers from the ICU to the operating room (OR) are highly complex and often characterized by unsafe practices. Our institution did not have a formalized handoff process in place for critically ill patients transferring from the ICU to the operating room. The purpose of this project was to implement a standardized face-to-face handoff utilizing a communication tool between ICU staff and anesthesia staff for the patient transferring from the ICU to the OR or procedure area.

Methods/Evidence Search: The four literature databases, Cumulative Index to Nursing and Allied Health Literature, PubMed, Cochrane, and Web of Science were searched using keywords from the following PICOT question: Do critically ill patients (P) in which a standardized handoff process is used between healthcare providers (I) compared to similar patients who are transferred without a standardized handoff process (C) have better outcomes and fewer errors (O) during and following the transfer period (T)? The first search included keywords handoff or handover and were combined with medical errors and outcomes. A second search included keywords handoff or handover and were combined with medical errors and intensive care unit. Lastly, the keywords handoff or handover were combined with operating room and intensive care unit. Specific limiters assisted in refining the search and included a date range of 2016-2021, full text, randomized controlled trials, and systematic reviews.

Synthesis of Literature/Results/Discussion: Three randomized controlled trials and two prospective quasi-experimental intervention studies were critically appraised. Parent et al (2018) demonstrated that the use of a standardized handoff curriculum led to an increase in perceived ICU provider preparedness and workflow. Salzwedel et al (2013) showed that a checklist for post-anesthesia patient handover led to an increase in items handed over and improvement in the quality of patient handover. Salzwedel et al (2016) found the use of a standardized checklist for handover between the anesthesia providers and the ICU team led to a statistically significant improvement in the quality and quantity of information transmitted. Mukhopadhyay et al (2017) found that a handoff protocol with a script and checklist between anesthesia, surgery and ICU caregivers led to an increase in key caregiver involvement during handoff and a reduction in information omission. Zou & Zhang (2016) found that the use of a standardized nursing handoff form (NHF) was associated with a reduction in handoff related errors. These five studies demonstrated that the use of a standardized handoff process with checklists improved the quality of patient care by increasing the quantity and quality of information handed over. Based on this evidence, a formalized handoff process for critically ill patients in a complex healthcare setting is necessary.

Conclusion/Recommendations for Practice: Based on these findings it is recommended that a handoff tool should be utilized for the transfer of patient care from the ICU to the OR or procedure room. Standardizing communication through a formal face-to-face handoff process improves the safety of the critically ill patient. This low-cost handoff tool will reduce omissions of essential clinical information about patients, prior to transfer to the OR or procedure room.

Improving Perioperative Care of Individuals with Neurodevelopment Disorders

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Background/Discussion/Question: Neurodevelopmental disorders (NDD) are multifaceted conditions characterized by impairments in communication, behavior, and/or motor skills resulting from abnormal brain development. NDD include attention deficit hyperactivity disorder (ADHD), autism spectrum disorder (ASD), intellectual disabilities, and communication disorders; 1 in 59 children are diagnosed with ASD. NDD have no cure and patients experience higher rates of hospital admissions. Mismanagement of NDD patients may lead to poor post-operative outcomes, increased hospital cost, and decreased satisfaction. Many pediatric anesthesia providers use evidence-based protocols to optimize care of NDD patients, but these protocols have not transitioned into adult anesthesia. The purpose of this project is to increase knowledge of anesthesia providers regarding perioperative management of adult NDD patients.

Methods/Evidence Search: Education on pharmacological and non-pharmacological interventions for patients with NDD was synthesized from review of the topic from Cumulative Index to Nursing and Allied Health Literature, EBSCO, Medline, and Pubmed. Keywords searched included autism spectrum disorder, neurodevelopmental disorder, anesthesia, perioperative, interventions. The education on pharmacological and non-pharmacological interventions for NDD patients in the perioperative period was organized into a PowerPoint presentation. This educational presentation was presented to Certified Registered Nurse Anesthetists (CRNAs) at an academic level I trauma center and student nurse anesthetist students (SRNAs) enrolled in the third year of the nurse anesthesia program. Prior to the educational presentation a QRS code was provided to the participants via email to complete a pre-education questionnaire on Google Forms. Immediately after the presentation another QRS code was provided to participants to complete a post-education questionnaire on Google Forms. Impact of the education was evaluated using paired t-tests.

Synthesis of Literature/Results/Discussion: From the literature review, interventions included in the education presentation were individualized coping plans, environmental adaptations, preoperative sedation with ketamine and midazolam, and dexmedetomidine utilizing the least invasive routes like oral administration. A total of 39 participants responded to the pre-education questionnaire and 35 responded to the post-education questionnaire. A knowledge deficit was identified in the pre-test questionnaire regarding pharmacological and non-pharmacological intervention recommendations for patients with NDD. In the pre-education questionnaire 47% of participants correctly answered questions regarding recommendations for this population. The post-education questionnaire showed increased competency, with 80% of participants answering correctly the same questions presented before the education. Before delivery of the education 30.2% of CRNAs and SRNAs felt comfortable caring for patients with NDD; after the education this increased to 57.1% and 14.3% of participants expressed they still felt uncomfortable caring for this population. Two tailed t-test results gave a *P* value of 0.00 indicating a statistically significant difference in the pre- and post-questionnaire scores.

Conclusion/Recommendations for Practice: A pre-education questionnaire confirmed the knowledge gap in adult anesthesia providers regarding best care interventions for patients with NDD during the perioperative period. An NDD perioperative care educational presentation was developed and delivered to anesthesia providers. The education increased providers' knowledge and confidence in providing quality, safe, and efficient care for this population. Limitations to the study is that the implementation population is relatively small; expanding the education to a larger group would be beneficial. Another limitation is that the education was provided one-time. A project with a larger population of anesthesia providers may solidify this evidence further. Next steps may include development and implementation of evidence-based interprofessional perioperative protocols for management of adult patients with

NDD, followed by an assessment of the impact on the management of these patients.

In an OR Far, Far Away... Airway Management in Simulated Microgravity

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Background/Discussion/Question: Internationally, space programs are shifting their focus toward longer duration manned missions, such as NASA's Artemis missions to the moon. Longer duration missions are associated with an increased risk of medical emergencies which may require crew members to manage an airway during spaceflight. Airway management is a difficult skill when performed in normogravity (NG) conditions, while microgravity (mG) adds an additional layer of complexity. Given the extreme remoteness and limited resources of any space mission, determining which airway devices are least negatively affected by mG is crucial. The aim of this literature review was to analyze existing literature on the effects of mG on successful airway device placement rates.

Methods/Evidence Search: The PICO question "Among people attempting to obtain an artificial airway, what is the effect of simulated mG compared to NG on successful airway device placement rates?" was used to guide a search of the Pubmed, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Embase and SCOPUS databases. Keywords used included microgravity, spaceflight, weightlessness, airway management, tracheal intubation, laryngoscopy, supraglottic, as well as MeSH terms, Emtree terms, and CINAHL subject headings. Searches were not limited by publication date. 117 articles were retrieved. After duplicates were removed, 72 reports were screened. Exclusion criteria were not being a study or systematic review, non-human subjects, studies of surgical airways or non-invasive ventilation, studies not performed in mG, and reports not in English. Two reports were unable to be retrieved. Six reports were included: 1 systematic review and 5 studies which tested airway devices including multiple supraglottic airways (SGA), direct laryngoscopy (DL) and video laryngoscopy (VL).

Synthesis of Literature/Results/Discussion: Across all devices, mG was associated with lower success rates and longer times to ventilation compared to NG, especially if the manikin was free-floating. Of the devices tested, all types of SGA were least negatively affected by mG and had the highest success rates and fastest times to ventilation; the I-GEL was the SGA most negatively affected by mG. DL and VL were most negatively affected by mG and had the lowest success rates and slowest times to ventilation. It is unclear which was most negatively affected by mG, as only 2 studies tested both, and 1 showed VL was most negatively affected while the other showed the opposite. In NG, VL improves success rate and times in both difficult environments and for novice operators. VL did appear to improve the success rates of novices in mG, and the intubating experience of the operator mattered little, with both experts and novices performing similarly to their NG baseline. The method of simulating mG used may bias results: 3 studies simulated mG with submerged set-ups and 2 studies simulated mG with parabolic flight. Parabolic flight creates a more accurate representation of mG but only for the duration of free fall, typically less than 30 seconds. Studies that use parabolic flight may be under-estimating the success rates of all airway devices tested as they define failure as inability to place an airway during that period.

Conclusion/Recommendations for Practice: It is possible to obtain an airway in mG, although it will likely have a longer time to first ventilation and require more than one attempt, as success rates are lower than in NG. As in NG, positioning of patient and operator is crucial to increase the likelihood of success and decrease time to ventilation. In mG, optimal positioning would be to restrain both the patient and operator. Without restraints, any forces exerted by the operator result in a force equal but opposite direction, making successful device insertion difficult. SGAs may be a good first-line airway management device as they are least negatively affected by mG. If endotracheal intubation is required and the operator is not an expert in airway management, VL may be the best technique as it improves the success rate of novices in mG. Further research is required to clarify the effect of mG on DL and VL, both with novice and expert operators. Additional recommendations for further research include potentially using SGAs as a conduit to endotracheal intubation.

In the Laboring Patient, Does Programmed Intermittent Epidural Bolus Result in Increased Labor Analgesia Compared to Continuous Epidural Infusions?

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Background/Discussion/Question: Epidurals are routinely used for pain relief in laboring patients. Some parturients require manual boluses for adequate analgesia. Concerns around prolonged labor, need for intervention at delivery, and degree of motor blockade impeding pushing during second stage labor have been linked to the use of epidurals. Traditionally, continuous epidural infusion (CEI) techniques were used to dose epidurals. As medical equipment has evolved, a newer technique called programmed intermittent epidural bolus (PIEB) has gained popularity. The purpose of this review is to analyze if PIEB is superior when compared to CEI for labor analgesia. Superiority is defined as increased maternal satisfaction, decreased pain score, decreased number of "top-offs," or amount of local anesthetics used.

Methods/Evidence Search: Current literature was reviewed to answer the following PICO question: In the laboring patient, does programmed intermittent epidural bolus, when compared to continuous epidural infusions, result in superior labor analgesia? A comprehensive search of the literature was conducted using the PubMed, Medline, and Cumulative Index to Nursing and Allied Health Literature databases. The following key search terms were used in combination: programmed intermittent epidural bolus or continuous epidural infusion, PIEB and CEI, automated mandatory bolus or continuous epidural infusion, automated intermittent bolus or continuous infusion, and intermittent bolus or continuous epidural. Articles had to be published within the last 5 years for inclusion. Nine studies were chosen for analysis.

Synthesis of Literature/Results/Discussion: Of the 9 included studies, 8 showed a reduction in the number of top-offs using a PIEB regimen when compared to CEI. Four studies measuring local anesthetic consumption found a reduction in the PIEB group, even with additional top-offs. One study found 2.1 times greater need for anesthesia administered top-offs with CEIs. Three studies analyzed duration of second stage labor, and 2 studies found a reduction in the duration of second stage, which potentially also contributed to the amount of local anesthetic consumption. Out of the 7 studies that reported it, 5 found a decrease in pain score and improved maternal satisfaction with a PIEB regimen. Of the 2 studies that saw no difference in both outcomes, there was no correlation to needing fewer top-offs but rather top-offs worked and management of decreased analgesia was satisfactory.[BDR1] Pain score was reduced by nearly 35% in 2 out of the 7 studies with PIEB regimen. No studies were able establish a relationship between regimen and instrumentation[BDR2] or cesarean delivery. Out of the 4 studies that measured motor blockade, 1 study found increased motor blockade with a CEI regimen. Although not statistically significant, 1 study that found increased motor blockade resulting in impaired pushing was endorsed by blinded obstetricians in patients with a high volume PIEB regimen.

Conclusion/Recommendations for Practice: This review suggests utilizing a PIEB regimen for labor analgesia is superior to a CEI regimen. Literature has shown PIEBs are associated with improved pain scores and maternal satisfactions with some studies estimating a 35% reduction in pain scores. There is also evidence that PIEBs can reduce the amount of local anesthetic consumption even if additional top-offs are administered. There is strong evidence that shows a reduction in top-offs with PIEBs. CEIs required 6 times greater patient-controlled boluses and 2.1 times greater top-offs in a study compared to parturient receiving PIEBs. [BDR3]Shorter duration of second stage labor may also attribute to this reduction but further research is needed. There are conflicting results about degree of motor blockade in both regimens and should be analyzed further. No literature saw any difference in instrumental [BDR4]or cesarean delivery between regimens. This can help anesthesia providers when choosing a regimen and discussing concerns with a parturient.

Intracuff Lidocaine for Emergence Coughing

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Background/Discussion/Question: Coughing upon the emergence from general endotracheal anesthesia (GETA) is a common complication that occurs in up to 76% of patients. Coughing induces a multitude of physiologic alterations that can extend a patient's hospital length of stay, increase costs, and escalate morbidity and mortality. Prevention strategies have been extensively researched but several interventions carry risk or are inappropriate for certain patient populations. This project explores the effectiveness of intracuff lidocaine as the solution to this problem. An analysis, critique, and synthesis of relevant evidence-based research was guided by the following clinical question to develop recommendations for practice: In patients undergoing GETA, does the utilization of intracuff lidocaine compared to standard cuff inflation decrease the incidence of coughing during the emergence period?

Methods/Evidence Search: The Texas Medical Center Library Health Sciences Resource Center online portal provided access to databases utilized for the literature review including Cumulative Index to Nursing and Allied Health Literature, Embase, Ovid Medical Literature Online (Medline), PubMed, and ScienceDirect. Databases were searched using a combination of indexed terms, search terms, and Boolean operators with varying results. Indexed terms included "lidocaine," "xylocaine," "lignocaine," "cough" "endotracheal anesthesia," and "airway extubation." Search terms included "intracuff" and "emergence." A snowballing technique was also employed. All studies relevant to intracuff lidocaine and emergence coughing were included except for those published before 2000 or written in a non-English language. Ultimately, 19 studies were extracted and carefully evaluated on their level of evidence, design quality, internal validity, and relevance and usefulness utilizing criteria outlined by the Johns Hopkins Nursing Evidence-Based Practice (JHNEBP) model.

Synthesis of Literature/Results/Discussion: The effect of intracuff lidocaine on the incidence of emergence coughing was observed in a total of 1544 patients undergoing a variety of surgical procedures among 17 randomized controlled trials (RCT). Two systematic reviews and meta-analyses were also identified and used as supportive information to prevent duplication of data. Each RCT detailed inclusion and exclusion criteria as well as standardization protocols for induction, maintenance, and emergence of anesthesia and other miscellaneous items. Varying volumes of 2%, 4%, and 10% lidocaine were used as the primary intervention and compared against a control of either air or saline. Sodium bicarbonate was used as an adjunct to hasten the rate of diffusion across the cuff membrane in 10 RCTs. Alternative techniques, such as sprays and endotracheal tube (ETT) lubricants, were also included as additional experimental groups. The aggregated outcome among 14 RCTs with statistically significant data ($P < .05$) show an overall reduction in the incidence of emergence coughing. This outcome is especially true in those that used prefilled cuffs, 4% or 10% lidocaine, and/or evaluated patients undergoing surgery longer than 2 hours. Secondary outcomes demonstrated a statistically significant reduction in postoperative sore throat and no evidence of increased risk of laryngospasm, bronchospasm, dysphonia, or agitation ($P < .05$).

Conclusion/Recommendations for Practice: Coughing may induce life-threatening physiologic alterations that subject patients to additional risks that impact their length of stay, cost burden, and quality of life. Overall, the evidence supports the use of intracuff lidocaine, with or without sodium bicarbonate, as an adjunct to reduce coughing upon the emergence of GETA. The current recommendation for practice applies to adult patients undergoing GETA with a duration of greater than 2 hours. This recommendation is advantageous in patients with high risk for wound dehiscence, deleterious alterations in hemodynamics, threats to cavity pressures, or major surgeries of the head, neck, and abdomen. Do not use amide local anesthetics in patients with a known hypersensitivity, and administration should always be accounted for in total local anesthetic dosing. Limitations in the research provide opportunities for the future including further investigation of high lidocaine

concentrations, combination therapies, additional ETT materials, and cost-effectiveness analyses.

Intraoperative Near-Infrared Spectroscopy Monitoring: Another Monitoring Sticker or Useful Tool to Predict Clinical Outcomes?

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Background/Discussion/Question: Near-infrared spectroscopy (NIRS) is utilized in operating rooms to measure cerebral oxygenation during cardiac surgery requiring cardiopulmonary bypass. NIRS measures oxygenated hemoglobin and deoxygenated hemoglobin to determine tissue extraction and the balance between oxygen delivery and consumption. NIRS is utilized intraoperatively to determine changes in perfusion that could signal clinical problems such as hemorrhage, cardiac events, and lack of blood flow to tissues. The purpose of this review was to determine the significance of NIRS data and the effect of NIRS monitoring on clinical outcomes. This review examined the question, "In pediatric congenital heart disease patients, does NIRS monitoring compared to no NIRS monitoring reduce morbidity and mortality in the perioperative setting?"

Methods/Evidence Search: A review of literature was performed using the databases Pubmed, CINAHL, and Embase. Key words included: NIRS, pediatric, surgery, cardiac, morbidity. Truncated search and Medical Subject Headings (MeSH) thesaurus terms (such as heart, congenital, and perioperative) were used to prevent omission of relevant articles. Boolean operators were used to combine search terms and articles published before 2016 were excluded. Forty-two duplicate articles were removed. One hundred and sixteen articles were screened. Articles were excluded if NIRS monitoring was not an independent variable of the study (30), the surgical population was not relevant due to being adult patients or non-cardiac surgery patients (34), or the article did not focus on the perioperative period (39). Articles were stored and organized in the EndNote application and a PRIMSA diagram was created to organize the literature review. Ten articles met eligibility requirements for inclusion in the literature review.

Synthesis of Literature/Results/Discussion: NIRS is a non-invasive tool used to predict morbidity and mortality in pediatric cardiac surgery patients. Ten articles found a correlation between NIRS trends and clinical outcomes. Intraoperative monitoring with NIRS can predict cerebral tissue oxygenation, renal function, lactate levels, low cardiac output syndrome (LCOS), and neurodevelopmental outcomes, and monitor limb ischemia. Cerebral tissue oxygenation during pediatric cardiac surgery was found to be an accurate biomarker for patient survival and neurodevelopmental outcomes (using the Baylay Scales of Infant Development and Mental Developmental Index). One article found that NIRS may predict renal dysfunction, while another article found no correlation. Circulating lactate levels and mean arterial pressure were found to correlate with NIRS levels during cardiopulmonary bypass (CPB) and predict morbidity and mortality. Lower NIRS levels predicted development of LCOS6. Limb ischemia can be determined by NIRS monitoring of limbs, as evidenced by the case study that monitored tissue oxygenation of an ischemic limb after arterial line placement compromised perfusion. Three articles found that NIRS desaturation intraoperatively and in the immediate 24-hour postoperative period predicted longer length of ICU stay, longer period of mechanical ventilation, and longer overall hospital length of stay.

Conclusion/Recommendations for Practice: NIRS monitoring provides real-time data of cerebral tissue oxygenation during CPB that can impact clinical outcomes. Future research may determine the impact of NIRS monitoring on intraoperative decision-making. Anesthesia providers can utilize NIRS to determine if the patient has imbalances of oxygen delivery and consumption due to changes in blood flow or increased oxygen demand. NIRS trends often deliver data about decreased tissue oxygenation before vital signs indicate a problem. This data may drive clinical decisions such as fluid or blood resuscitation, electing to remain on mechanical ventilation, and patient disposition. Additionally, NIRS may be utilized to monitor perfusion to limbs after IV infiltration or compromised perfusion (ie: thrombosis). Although this review focused on pediatric cardiac surgery patients, NIRS monitoring may be a valuable non-

invasive tool for adults or pediatrics undergoing various surgeries and procedures for clinical decision-making and prediction of outcomes.

Intravenous Dexmedetomidine to Enhance a Caudal Block under General Anesthesia

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Background/Discussion/Question: Caudal anesthesia is often used as an adjunct to general anesthesia to help decrease general anesthetics, intraoperative/postoperative pain, and opioid consumption. It is well known that adding dexmedetomidine to the caudal injection can prolong the analgesic effects of the caudal block. However, it has not been well established if the use of intravenous dexmedetomidine as an adjunct to a caudal block will have similar effects as neuraxial dexmedetomidine in a caudal block. The purpose of this poster is to discuss intravenous dexmedetomidine as an adjunct to enhance a caudal block via prolonging the duration of action of the block and/or increasing the efficacy. Does administering 1mcg/kg intravenous dexmedetomidine enhancing a caudal block in pediatric patients result in decreased general anesthetic exposure, opiate consumption, and improved/prolonged analgesia?

Methods/Evidence Search: PubMed, EMBASE, and Cochrane Library were systematically searched for relevant literature. A time-frame limiter was put in place of 10 years ranging from 2012 to 2022 in hopes of obtaining the most current and recent research available. Medical subject heading terms used encompassed intravenous dexmedetomidine and caudal. After applying the limiters "age 0-6 years" and "English only," EMBASE retrieved 34 results. An identical search in PubMed and Cumulative Index to Nursing and Allied Health Literature Complete supplied 13 citations and 2 citations respectively. Cochrane Library was searched in the same manner with the exception of the age limitation and resulted in 21 citations. Of the 70 results collected, after filtering through duplicates and nonapplicable articles, 4 articles were found appropriate for the topic of IV dexmedetomidine as an adjunct to caudal blocks in pediatric anesthesia. The 4 articles reviewed include 3 randomized controlled trials (RCT) and 1 systematic review and meta-analysis.

Synthesis of Literature/Results/Discussion: IV dexmedetomidine (1µg/kg bolus) decreases end-tidal sevoflurane requirements by 30% to 60% when paired with ropivacaine caudal anesthesia. Patients had longer mean durations to first analgesic request with caudal (~14 hr) and IV (~10.8 hr) 1µg/kg dexmedetomidine compared to control groups (~6.6 hr) that did not receive any dexmedetomidine. In studies that used a bupivacaine-like caudal, postoperative pain was decreased with IV dexmedetomidine. This was not seen in studies with ropivacaine caudal blocks. The majority of patients in all studies had a decrease in heart rate. The literature showed a correlation between IV dexmedetomidine and decreased heart rate, not cause and effect. It is unknown if this is solely due to the alpha 2 agonism or in conjunction with increased analgesia. IV dexmedetomidine is opioid sparing and does not cause neurodegeneration, which makes it an ideal adjunct for pediatric anesthesia to help lower potentially neurotoxic anesthetics and enhance analgesia when utilized with a caudal block. Research is needed to establish IV dexmedetomidine dose-response curves for caudal anesthetics, benefits of dexmedetomidine intravenous bolus dosing versus infusion as a caudal adjunct, effects of IV dexmedetomidine on varying local anesthetic caudal blocks, and superiority of lowering general anesthetic requirements via dexmedetomidine IV versus caudally.

Conclusion/Recommendations for Practice : IV dexmedetomidine has sedative, analgesic, and neuroprotective properties which can reduce volatile anesthetic and opioid requirements when used in conjunction with a caudal block. The benefits often outweigh the treatable risks (bradycardia and hypotension). Because caudally administered dexmedetomidine (1mcg/kg) showed its superiority to intravenous dexmedetomidine for prolonged analgesia and postoperative pain control, IV dexmedetomidine should be considered as a secondary anesthetic option. Based on the reviewed evidence and should dexmedetomidine not be caudally administered, it is recommended to consider 1mcg/kg IV dexmedetomidine (over 10 minutes) in conjunction with a bupivacaine caudal block for patients less than 3 years undergoing general anesthesia longer than 3 hours, as these patients are at

increased risk for neurodegeneration from general anesthetics.

Is Dexmedetomidine or Remifentanil the Superior Agent in Decreasing Surgical Complications and Anesthesia Adverse Effects in Head and Neck Surgery?

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Background/Discussion/Question: It is imperative to provide safe perioperative care for patients in head and neck surgery to avoid side effects and complications. Delayed recovery, increase cost of care, intraoperative bleeding, and emergence agitation are complications to be mitigated in this patient population. Remifentanil (remi) and dexmedetomidine (dex) are anesthetic adjuvants used for anesthesia. Remi is a short-acting opioid, whereas dex is an alpha-2 agonist with minimal effect on respiration. The research question is: Among adult patients undergoing general anesthesia for head and neck surgeries, does the administration of dexmedetomidine intraoperatively compared to remifentanil decrease surgical complications and anesthesia adverse effects on emergence? The purpose of this review is to compare hemodynamics, postoperative analgesia and complications, recovery time, and emergence agitation.

Methods/Evidence Search: A review was performed using Pubmed, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Medline, and Google Scholar. Keywords used in Pubmed were remifentanil, dexmedetomidine, emerg*, and recover using the Boolean operator "AND." Keywords used in CINAHL were remifentanil, dexmedetomidine, and hemodynamics also using the Boolean operator "AND." Keywords used in Medline were dexmedetomidine, remifentanil, extub, thyroidectomy, nasal, tympano, tracheal extub, extubation, and nausea. Articles that were reviewed were published after 2016, included an abstract, and studied adult patients 19 years old and older. A total of 99 records were identified with 72 remaining after duplicates were removed. Exclusion criteria included procedures not head and neck, not adult population, without dex or remi administration, and animal studies. Twenty-two full-text articles were screened for eligibility with exclusion criteria of limited focus on dex and/or remi, unavailable comparison between dex and remi, and prior to extubation administration doses of remi and dex. The result was 8 studies for review.

Synthesis of Literature/Results/Discussion: The 8 studies reviewed the administration of dex and remi infusions starting at induction until extubation. There were outcomes at which dex and remi had similar intraop bleeding, coughing during extubation, surgical field conditions, inhaled anesthetic and propofol consumption, and length in the post anesthesia care unit (PACU). However, dex had greater efficacy compared to remi with less use of antiemetics and postoperative nausea and vomiting (PONV), less postop analgesics, lower heart rate and mean arterial pressure post extubation, and lower bispectral index during the case and extubation to prevent hemodynamic and surgical complications while still maintaining respiration. Two major themes to highlight are "dex is inferior to remi in recovery time and/or providing adequate surgical conditions" and "emergency agitation has higher prevalence in dex compared to remi" by the frequent mention of delay in eye opening, verbal response, extubation, higher postop sedation, and emergency agitation with dex. Although remi had a faster extubation and recovery postop, the outcomes revealed increased PACU analgesics, sore throat, PONV, administration of cardiac medication, and exposure to opioid induced hyperalgesia. With the many similarities that dex and remi share, dex provides a lesser degree of postoperative complications and thus is the superior agent.

Conclusion/Recommendations for Practice: With the various head and neck surgeries performed and the administration of dex and remi as the most frequent agents used to decrease adverse effects perioperatively, it is critical for anesthesia providers to be informed of the superior agent that provides safe and favorable outcomes. Dex is an alpha-2 agonist with minimal effects on respiration providing hemodynamic stability, decreased PONV, and less postop antiemetics and analgesics. Remi is a short-acting opioid agonist that is easily titratable and provides faster extubation and postop recovery. However, its side effects should deter its administration. Although dex's shortcomings are emergence agitation, delayed eye opening, and higher postop sedation, the postop recovery will not increase

surgical complication risk. Therefore, based on this review, providers should consider administering dex instead of remi to adult patients undergoing head and neck surgeries, as dex is the safer, more effective agent in decreasing complications.

Is Melatonin the Next Benzodiazepine?

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Background/Discussion/Question: Anxiety is a well-known problem affecting up to 80% of patients during the perioperative period. Benzodiazepines may cause cognitive problems such as trouble remembering and concentrating and may impair coordination and physical movement, warranting researchers to seek alternative options for premedication. The purpose of this literature review is to compare the effectiveness of melatonin to benzodiazepines as premedication to treat perioperative anxiety in adult surgical patients.

Methods/Evidence Search: A systematic review of the literature was performed utilizing the databases PubMed, Cumulative Index to Nursing and Allied Health Literature, and Medline. Keywords included: melatonin, benzodiazepine, anesthesia, and anxiety. Full-text English language articles published between 1999 and 2020 were included. One hundred and ten articles were found and after 26 duplicates were removed, 84 articles remained for title and abstract screening. Inclusion criteria consisted of a melatonin-benzodiazepine comparison group, perioperative adult patients receiving anesthesia, and anxiety assessment outcome. Exclusion criteria consisted of pediatrics, non-surgical, and lack of a benzodiazepine comparison group. After screening, 13 articles underwent a full-text review. Ten articles were included in the final review: 9 randomized control trials and 1 systematic review. Data from these studies were abstracted and synthesized utilizing a synthesis matrix to identify themes.

Synthesis of Literature/Results/Discussion: The appraised literature selected offered results that demonstrated a similar reduction in preoperative anxiety in adult surgical patients given premedication with melatonin compared to benzodiazepines (6 studies compared midazolam, 3 studies compared alprazolam). Two articles found melatonin exhibited greater anxiolysis than midazolam in the early postoperative period; however, 3 articles found no difference. One study found melatonin and alprazolam combination therapy provided superior anxiolysis to either drug alone. The results were statistically significant as evidenced by the State-Trait Anxiety Inventory Scales (STAI), Visual Anxiety Scales (VAS), and Beck Anxiety Index (BAI) scores noted in each article. Six articles reported melatonin lacked an amnesic effect. Seven articles showed benzodiazepines compared to melatonin produced more cognitive and psychomotor dysfunction post-premedication as evidenced by Digit Symbol Substitution Test (DSST), Word Fluency Test, and Trail Making Test (TMT) scores. Postoperatively, two articles found no difference in cognitive and psychomotor dysfunction between melatonin and midazolam, whereas 2 articles showed significant dysfunction only with midazolam. Overall, premedication with melatonin reduced preoperative anxiety similar to benzodiazepines without amnesia effects and with reduced cognitive and psychomotor dysfunction.

Conclusion/Recommendations for Practice: Melatonin premedication is similarly effective to benzodiazepines and may be utilized as an adjunct or alternative to ease preoperative anxiety in adults undergoing anesthesia. Melatonin may be considered a valuable alternative, particularly in same-day surgery, because it lacks amnesic effects and has less cognitive and psychomotor dysfunction associated with benzodiazepines, making it ideal for patients who will require post-op discharge teaching. Melatonin 0.05 mg/kg appears to be an adequate dose. There are several more elaborative cognitive tests than the DSST and TMT used by these studies. Further research should uniformly study the impact of different doses of melatonin on perioperative cognitive and psychomotor performance since the ideal premedication profile provides anxiolytic and sedative properties without psychomotor or cognitive derangement.

Optimal Conditions for Awake Fiberoptic Intubation: Topical LA vs Airway Nerve Blocks

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Background/Discussion/Question: Awake fiberoptic intubation (AFOI) is regarded as the gold standard for the endotracheal intubation of patients with an anticipated difficult airway. In the general population, Cormack and Lehane laryngoscopy grades 3 and 4 has an incidence of about 10%, difficult intubation 1%, and difficult bag-mask ventilation 0.08%-5%. A difficult airway can lead to adverse outcomes such as anoxic brain injury, cardiac arrest, surgical airway, or death. Several anesthetic techniques exist that allow for success in attenuating airway reflexes and facilitating AFOI. A recently published literature review concluded there is a lack of evidence to recommend an ideal anesthetic plan for AFOI. This review investigates the literature to compare if airway nerve blocks or topical local anesthetics provide the most optimal awake fiberoptic intubating conditions.

Methods/Evidence Search: The PICO question of interest: "In adult surgical patients, do airway nerve blocks compared to topical local anesthesia provide optimal fiberoptic intubation conditions?" A search was performed using Scopus, Embase, and PubMed. Keywords used were: airway nerve block, difficult airway management, awake fiberoptic intubation, lidocaine, nebulizer, atomizer, and topical local anesthesia. Years of publishing were limited to 2016 to 2021, and 631 articles were identified through database searching. One hundred and ninety-nine articles were excluded due to duplication, 403 articles were then excluded after title/abstract were screened, and 21 articles were excluded after a full text review was conducted. The remaining 8 articles provide relevant information regarding awake fiberoptic intubation, topical local anesthesia, and airway nerve blocks.

Synthesis of Literature/Results/Discussion: Awake fiberoptic intubating conditions were superior with airway nerve blocks compared to topical local anesthetic techniques. Intubation time was the primary outcome that defined "optimal intubating conditions" in 4 out of 8 of the articles reviewed, with airway nerve blocks having the fastest intubation times at 120 seconds on average compared to 230 seconds for nebulized lidocaine. Other outcomes that defined optimal intubating conditions, such as incidence of coughing/gagging during intubation, patient-reported comfort during intubation, and ease of intubation, were found to also be superior with airway nerve blocks. Hemodynamics were similar during intubation with both airway nerve blocks and topical local anesthetics. Both topical local anesthetics and airway nerve blocks showed to be successful in performing an AFOI. All articles in this review had no statistically significant rates of complications, such as laryngospasm or LAST.

Conclusion/Recommendations for Practice : Airway nerve blocks are a superior option when developing an anesthetic plan for optimal AFOI conditions when compared to nebulized lidocaine. When choosing an anesthetic plan, leading with the best technique to successfully intubate, especially with an anticipated difficult airway, is crucial. Yet, an anesthesia provider's "best technique" is limited to the skillset of the provider. With several options available for easy-to-administer topical local anesthetic techniques, airway nerve blocks are generally falling out of favor due to lack of provider experience and comfort with regional airway techniques, which require more skills. Continued education in airway nerve blocks is recommended. Further research should investigate the comparison of airway nerve blocks to other topical local anesthetic techniques other than nebulized lidocaine.

Patch-22: The Sphenopalatine Ganglion Block, a Safe Alternative to Epidural Blood Patches in Post-Dural Puncture Headaches

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Background/Discussion/Question: Post dural puncture headaches (PDPH) are an unintended side effect of spinal and epidural anesthesia that can be incapacitating for a patient in the postoperative period. These patients can experience severe headaches that are worse when they are upright, causing nausea, dizziness, neck pain, and visual changes. The "gold standard" treatment involves the use of an epidural blood patch (EBP), which is another invasive regional procedure. The EBP presents with similar risks to the original technique that created the insult. Patients and clinicians might be cautious of further injury and might delay the initiation of this invasive treatment. This focused review of literature sought to examine the efficacy of sphenopalatine ganglion blocks (SPGB) as a safer less invasive treatment compared to an EBP.

Methods/Evidence Search: The PICO question guiding the literature review: "Does the use of sphenopalatine ganglion blocks in patients with post-dural puncture headaches lead to higher patient satisfaction compared to patients that receive epidural blood patches?" Evidence was gathered from PubMed, Cumulative Index to Nursing and Allied Health Literature Plus, and Embase. The search terms used were "sphenopalatine ganglion block," "post-dural puncture headache," and "epidural blood patch." A total of 109 peer-reviewed articles were initially screened for possible inclusion and ultimately 9 met the inclusion criteria. Inclusion criteria included articles published between 2016 and 2022 that focused on patients of adult age who acquired a post-dural puncture headache. The studies analyzed included randomized controlled trials, retrospective studies, systemic reviews, and database analyses. Publications excluded were pediatric cases, articles with insufficient detail, and articles that were out of the scope.

Synthesis of Literature/Results/Discussion: The literature review highlighted that the SPGB is an effective tool that can be administered safely with minimal side effects. These side effects are largely transient within the first 20 minutes post treatment and include a bitter taste, nostril burning, and oropharyngeal numbness. The EBP side effects include a second dural puncture, back pain, facial palsy, meningeal irritation, and subdural hematomas (necessitating surgical intervention). The key themes in the literature demonstrate that with the administration of the SPGB patients report a quicker onset in the relief of post-dural puncture headache symptoms. Furthermore, when SPGBs were administered earlier, it resulted in a significant reduction in hospital stay and symptom reoccurrence compared to later administration of this block. However, when measured against the EBP, patients reported no significant difference in pain relief after the first day post-treatment. The literature shows that the administration of the SPGB is effective in lowering the need for an EBP but does not eliminate the need for a potential blood patch.

Conclusion/Recommendations for Practice: With the current review of the literature, it is apparent that there is a role for both the EBP and SPGB in practice. Although the EBP has a higher initial success rate, it also is accompanied by more serious side effects. The SPGB is a viable alternative if the patient refuses the epidural patch altogether. The use of a more algorithmic approach to treatment is the recommendation of this review. When patients present with headache symptoms post neuraxial anesthesia, the initiation of early SPGBs has been shown to provide low-risk, low-cost, immediate pain relief. If the patient is persistently symptomatic, they can progress to either a second regional nerve block or an EBP based on severity. This model will afford the clinician time to evaluate the severity of symptoms before escalation into another invasive procedure. This algorithm will also provide early, middle, and late treatment options as the patient progresses in their care, increasing patient satisfaction and pain relief.

Pectoralis Nerve Block (Type II) and Breast Cancer-Related Surgery

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Background/Discussion/Question: Breast cancer is the most diagnosed form of cancer in the United States. Nearly 95% of stage I and II diagnoses and 88% of stage III diagnoses undergo some form of surgical treatment with acute postoperative pain being an unfortunate side effect. Regional anesthesia has the capability to provide pain relief, limit narcotic use, and reduce nausea and vomiting. Amongst the available options for regional anesthesia, the PECS II block has gained popularity due to its straightforward placement and low complication rate. The following research question was identified: in adult female patients undergoing general anesthesia for breast cancer-related surgeries, does the administration of a pectoralis nerve block (type II) compared to not administering a pectoralis nerve block (type II) decrease opioid consumption and pain scores within the first 24 hours postoperatively?

Methods/Evidence Search: The Texas Medical Center Library Health Sciences Resource Center was utilized to access databases such as PubMed, The Cochrane Library, and EMBASE. Key medical subject heading terms included breast cancer, breast surgery, pectoralis nerve block, pecs block, and postoperative pain. The snowballing technique was employed by reviewing the reference lists of articles to ensure all relevant studies were included. Results were condensed by applying filters for publication date, language, and study type. Utilizing these search phrases, PubMed yielded 40 results, The Cochrane Library yielded 86, and EMBASE yielded 52. Three meta-analyses and 9 randomized controlled trials were included in this review. Inclusion criteria consisted of women ages 18-70, American Society of Anesthesiologists (ASA) physical status I or II, undergoing general anesthesia for breast cancer surgery. Exclusion criteria included hypersensitivity to local anesthetics, infection at the site, coagulopathy, and body mass index > 30 kg/m2.

Synthesis of Literature/Results/Discussion: Apart from one study, all PECS II blocks were performed intraoperatively after induction of general anesthesia. Most studies utilized ropivacaine, with concentrations ranging from 0.2% to 0.5%. Approximately 10 mL of solution was administered between pectoralis major and pectoralis minor muscles and 20 mL of solution between pectoralis minor and serratus anterior muscles. Primary outcomes included intraoperative opioid consumption, total opioid consumption 24 hours postoperatively, and postoperative pain scores. Severity of postoperative nausea and vomiting was a secondary outcome assessed by all studies, however there were no reports of a statistically significant reduction with administration of the PECS II block. Three of the four studies measuring intraoperative opioid consumption reported significantly reduced use after placement of the PECS II block ($P < .05$). Total postoperative opioid consumption was measured by eight randomized controlled trials and all but one reported a significant decrease in consumption ($P < .05$). All randomized controlled trials in this discussion assessed postoperative pain scores. Variability in assessment intervals made it difficult to compare results; however, the addition of the PECS II block consistently and significantly ($P < .05$) reduced pain scores in the first 4 hours postoperatively.

Conclusion/Recommendations for Practice: Evidence supports the utilization of PECS II blocks as an adjunct to general anesthesia in women ages 18-70, ASA physical status I or II, undergoing breast cancer-related surgeries. The PECS II block can be performed post-induction with either ropivacaine, bupivacaine, or levobupivacaine with acceptable concentrations ranging from 0.2-0.5%. While this recommendation is vague, the current literature is not developed enough to allow for specific recommendations regarding type or dosage of local anesthetic. The PECS II block consistently reduced intraoperative opioid consumption, opioid consumption during the first 24 hours postoperatively, and pain scores for at least 4 hours postoperatively. Contraindications to PECS II block placement include hypersensitivity to local anesthetics, coagulopathy, pre-existing nerve damage, and infection at the site. The recommendations of this discussion are of moderate strength.

Post-Discharge Phase of Care for Cesarean Delivery: Continuation of Enhanced Recovery After Surgery Multimodal Analgesia Therapy

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Background/Discussion/Question: Cesarean deliveries (CD) account for a third of all births in the United States. Postoperative pain is a critical issue with poor outcomes for both mother and baby if not appropriately managed. Studies report 80% of post-CD patients filled opioid prescriptions with 0.35% of opioid-naiive women becoming persistent opioid users. Enhanced recovery after surgery (ERAS) protocols for CD have shown to provide effective analgesia and decrease opioid administration. Use of scheduled acetaminophen 1000 mg and ibuprofen 400-800 mg every 8 hours, alternating between both medications every 3 to 4 hours, has resulted in 50% reduction in inpatient pain scores. The goal of this project is to highlight benefits of ERAS on post-discharge pain and advocate for less opioid dependence in post-CD patients at a community subsidiary hospital of a larger urban academic medical center.

Methods/Evidence Search: A literature search on PubMed and Cumulative Index to Nursing and Allied Health Literature databases yielded a total of 36 quality improvement studies, systematic review and meta-analyses, cohort studies, and randomized control trials. Applying the Johns Hopkins level of evidence, 49% and 21% of articles were classified as level 1 and 2 respectively. ERAS protocols demonstrated savings of $7,600 per patient after gynecological surgery, significant reduction in inpatient opioid exposure, and expedited patient recovery. These findings were summarized and disseminated to obstetricians and peripartum nurses via an educational module to promote continuation of scheduled non-opioid medications as well as encourage reduction in discharge opioid prescription. In addition, the lack of an opioid return repository at this site prompted a need to provide patient education on proper opioid disposal methods This was accomplished by distributing a flyer to patients at the obstetrician clinic during their postpartum follow-up appointment.

Synthesis of Literature/Results/Discussion: Post-cesarean pain managmement after discharge is very relevant in the present state of the health care industy where maternal health continues to have poor outcomes and a burgeoning opioid epidemic. Drug-related deaths accounted for 11.4% of pregnancy associated deaths, with drug overdose rising to one of the top-10 causes of maternal deaths during the first year postpartum. This clearly indicates a need to improve approaches to pain management in this patient population. ERAS protocols have the potential to provide effective pain control using multimodal therapy while reducing opioid-related side effects, thus curtailing healthcare expenditures. These methods also help decrease adverse effects related to opioids such as neonatal sedation and decreased mother-baby bonding. Future research and improvement projects at this site could be directed at advocating for decreased discharge opioid tablets prescribed by all physican-groups. Policy research and grant applications to establish an opioid return program at the outpatient clinic is an additional aspect that could be explored further.

Conclusion/Recommendations for Practice: The overall results of this project demonstrate support for continuing the ERAS protocol in post-CD patients. Evaluation of patient education on opioid disposal was not performed in this project and could potentially be another aspect to be investigated in prospective studies. An analysis of unused discharge opioid prescription from patients at their follow-up appointment could provide obstetricians information to support a decrease in their prescriptions to combat the opioid epidemic. Future projects may develop an opioid return program at this particular instituition to help reduce misappropriation of unused prescription in the public.

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Reduction of Shivering by Administration of Intrathecal Dexmedetomidine for Parturients Who Received Spinal Anesthesia for Cesarean Section Deliveries.

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Background/Discussion/Question: Hormonal factors may influence thermoregulatory responses during labor and delivery and attribute to many parturients shivering. Neuraxial anesthesia further complicates thermoregulation by central impairment of thermoregulatory control. Shivering causes discomfort, can result in impaired pulse oximetry and electrocardiogram monitoring, increases demand for oxygen, and may also play a role in reduced wound healing. Many interventions are used to reduce shivering; however, no gold standard has been established. Dexmedetomidine (DEX) is a highly alpha-2 adrenoreceptor agonist with strong effects on the central nervous system. It has been postulated that intravenous DEX can reduce shivering; however, intrathecally it is not well known. This study aims to evaluate the effects of Precedex as a neuraxial adjuvant on perioperative shivering during cesarean sections.

Methods/Evidence Search: PICO quesiton: In parturients who received spinal anesthesia (SA) for a cesarean section delivery, did the administration of intrathecal DEX decrease the incidence of shivering postoperatively compared to parturients who did not receive intrathecal Precedex? A comprehensive electronic search of PubMed, Embase, and Cumulative Index to Nursing and Allied Health Literature was performed to retrieve articles published within the last 5 years. Key terms used for the search included Precedex, dexmedetomidine, shivering, parturients and cesarean section. Included studies met the following criteria: (1) surgery type: cesarean section; (2) anesthesia type: SA, epidural anesthesia (EA), or combined spinal-epidural anesthesia (CSEA); (3) administration time: during the anesthesia; (4) administration method: intrathecally, and (5) results describing effects of DEX on shivering. Abstracts were assessed and 156 articles were identified; 143 articles were eliminated because they did not satisfy the inclusion criteria. Thirteen articles were included in the final analysis.

Synthesis of Literature/Results/Discussion: All articles revealed that intrathecal DEX prevents shivering in cesarean section deliveries (CSDs) after SA. Studies also showed that intrathecal DEX prolongs motor and sensory blockade. A majority of the studies stated 5mcg of DEX as their recommended dose. In the systematic review by Liu et al, 2.5mcg of DEX was found to be ineffective when compared to 5mcg of DEX in decreasing shivering. In a randomized control trial, Bi et al compared 3mcg to 5mcg of DEX and the results revealed that both doses decreased shivering; however, 5mcg of DEX was associated with prolonged motor blockade. Studies also showed that intrathecal DEX did not increase the incidence of hypotension or bradycardia and no significant difference was found in neonatal outcomes compared with placebo.

Conclusion/Recommendations for Practice: Shivering associated with SA during CSDs is an uncomfortable experience for the parturient and has many negative effects, therefore it is imperative for nurse anesthesiologists to practice interventions that can improve perioperative outcomes. According to the studies, 3-5mcg of DEX added to 10-12.5 mg of heavy bupivacaine or ropivacaine in SA can decrease the incidence and intensity of shivering without any significant adverse effects on both the mothers and neonates. Further clinical trials should continue to study DEX as a neuraxial adjuvant and compare outcomes of different neuraxial adjuvants to fully explore the differences, benefits, and possible side effects.

Second Victim Syndrome Phenomena in Nurse Anesthesiology: Implementation of Stress Assessment and Education

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Background/Discussion/Question: Certified Registered Nurse Anesthetists (CRNAs) are exposed to a wide variety of occupational stressors that frequently result in stress, burnout, and their associated outcomes. Student registered nurse anesthetists (SRNAs) face similar pressures in the operating room, coupled with lower professional confidence, academic demands, and financial strains. Second victim syndrome (SVS) presents a potential source of significant stress to both CRNAs and SRNAs following a medical error or other adverse event, potentially leading to further symptoms This two-wing evidence-based practice project seeks to answer the following PICO questions: In third year SRNAs, does the delivery of an education session on second victim syndrome improve knowledge of the phenomenon compared to baseline, and does use of a daily stress check-in app by CRNAs identify trends in the stress-levels?

Methods/Evidence Search: A literature search was performed in PubMed and Cumulative Index to Nursing and Allied Health Literature using the key words “second victim syndrome,” “healthcare providers,” and “anesthesia.” Through review of abstracts, 22 articles were selected for further review, and 13 were selected based on relevancy, with evidence levels 3 to 5 of Johns Hopkins’ levels of evidence. SRNAs received a live education session on SVS with pre-post assessments to evaluate changes in knowledge. Education was based on guidelines from a panel of experts conducted by Daniels and McCorkle (2016), covering background, incidence, risks, impacts, and interventions including Scott’s Three-Tiered Model of Support, peer support, and stress first aid. CRNAs attended a presentation describing the stress first aid model, the first step of which is “check referring to a stress assessment.” A phone-based application was introduced allowing CRNAs to rate personal and team stress. This was accessed via QR codes in the department, with responses collected over 30 days. Descriptive statistics were used for each wing.

Synthesis of Literature/Results/Discussion: Little research has been done on the impacts of SVS on CRNAs and SRNAs, though most anesthesiologists surveyed reported at least one exposure to patient injury/death (84%), subsequent psychological symptoms (>70%), and short-term impacts on ability to provide care (67%) (Gazoni et al, 2012). While any providers may be at risk, higher incidence has been seen in anesthesiology and trainees, placing both CRNAs and SRNAs at risk (Ozeke et al, 2019). In a field associated with high stress, burnout, and substance abuse (Chipas et al, 2011), addressing SVS in nurse anesthesia may provide benefits to providers and patients alike. SRNA assessment scores improved 31.1% from 61.36% to 80.45% following the education session. Survey data revealed that 68% of participants had experienced at least one adverse event during their anesthesia training, with 87% of those reporting after-effects. SRNAs are at risk of developing SVS, and education may better prepare them to cope with its effects. The CRNA application collected 71 responses over a 22-day period, successfully collecting ratings for personal and perceived team stress. Reported explanations for stress levels included internal factors such as performance and external factors such as the war in Ukraine. A daily assessment application is a viable tool for monitoring stress levels and identifying departmental issues.

Conclusion/Recommendations for Practice: CRNAs and SRNAs are at risk for SVS after adverse events or errors. Education can improve knowledge for providers, potentially strengthening their abilities to identify and cope with such effects. SRNAs surveyed reported experiencing both adverse events and subsequent personal effects, thus this population should be considered for inclusion in organizational efforts to curb negative impacts. The stress assessment application was based on the stress first aid model, which has been used in multiple high-risk fields previously, though it has not been tested in

anesthesia. As such, there is insufficient evidence to recommend stress first aid over other models as a basis for SVS interventions. However, the tool successfully collected stress related data and demonstrated that a routine monitoring tool can be useful in monitoring stress and identifying potential sources. Organizations should consider implementing SVS education, stress monitoring, and intervention plans to help students and staff manage the effects of adverse events.

Targeted Mild Hypercarbia to Improve Cerebral Oxygenation in the Beach Chair Position

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Background/Discussion/Question: The beach chair position (BCP), commonly utilized for shoulder arthroscopy, is associated with a decrease in cerebral perfusion and oxygenation with the potential for neurologic injuries from cerebral desaturation events (CDEs). The purpose of this paper is to study whether ventilation strategies involving targeted mild hypercarbia are capable of increasing cerebral perfusion in this vulnerable position.

Methods/Evidence Search: Embase and Pubmed databases were accessed utilizing a date range of 2001-2022 with keywords shoulder arthroscopy, sitting, beach chair, and ventilation. Further limits were added including randomized controlled trials (RCTs), meta-analyses (MA), and systematic reviews (SR). From this search 4 articles pertaining to this topic were identified including 1 SR/MA and 3 RCTs.

Synthesis of Literature/Results/Discussion: SctO2 values were significantly lower in the 30-32 group than the 40-42 group from 16min post-induction until 60min ($P < .01$), and incidence of CDEs was higher in the control group 30-32 (55.6%) than in the study group 40-42 (8.8%, $P < .0001$). Another study found a total increase of 14% between the FiO2 0.3 & ETCO2 30mmHg and the FiO2 1.0 & ETCO2 45mmHg ($P < .001$). The fourth article presented that the rSO2 decreased significantly in the normocapnia group, but not in the hypercapnia group ($P = .048$), and incidence of CDE was lower in the hypercapnia group ($P = .047$).

Conclusion/Recommendations for Practice: Available studies found that using targeted mild hypercarbia with ETCO2 levels between 40-45mmHg increased rSO2 values while decreasing incidences of CDEs. It is therefore the conclusion of this paper that titrating minute ventilation to achieve targeted mild hypercarbia is an effective method of increasing cerebral perfusion and decreasing incidence of CDEs.

The Administration of Lower FiO2 Intraoperatively to Minimize Postoperative Adverse Outcomes

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Background/Discussion/Question: Unanimity of the most appropriate, or least detrimental, FiO2 percentage for intraoperative ventilation in general anesthesia cases does not exist. In 2016, the World Health Organization (WHO) recommended that adult patients undergoing general anesthesia should be ventilated intraoperatively with an 80% FiO2 to reduce the incidence of surgical site infections (SSI) (Fonnes et al., 2016). More recent evidence encompassed in this project suggests that FiO2 of 80% does not decrease the incidence of SSIs, and rather could increase the incidence of postoperative complications related to hyperoxia. Concurrence exists between several studies that increased FiO2 percentages increase postoperative adversities.

Methods/Evidence Search: The Cochrane Library of Systematic Reviews, PubMed, Cumulative Index to Nursing and Allied Health Literature, and Medline (ProQuest) databases were searched using keywords from the following PICOT question: Do adult surgical patients undergoing general anesthesia (P) who receive high FiO2 (I) compared to similar patients who receive lower FiO2 (C) have a higher incidence of complications (O) postoperatively (T)? The searches were termed "effects of high FiO2" and "complications" and "perioperative." The ability to further narrow down the results came from the additional step of Boolean searching. The phrases "lower FiO2" and "perioperative" and "benefits" were also searched as a single set of results. Additionally, the conjunctions "AND" and "OR" either served to conjoin all terms as one search or offered the option of searching just one of the two. Finally, the terms "lower FiO2 vs higher FiO2" as well as "intraoperative" were searched with the Boolean term "AND."

Synthesis of Literature/Results/Discussion: Evidence from 1 meta-analysis and systematic review, 3 randomized control trials (RCTs), and 1 cohort study concluded the following: 1) Increased intraoperative FiO2 (>80%) administration did not decrease incidence of SSIs compared to low FiO2 administration of 30% to 50%, and 2) increased intraoperative FiO2 (>80%) administration elevated perioperative risk of acute coronary syndrome, atelectasis, and pulmonary complications compared to low FiO2 administration (30%-50%). Fernando et al (2020) RCT showed that inspired FiO2 (>80%) intraoperatively does not decrease risk of SSIs compared to use of FiO2 (30%). Fonnes et al (2016) post-hoc RCT revealed that high FiO2 (>80%) compared to use of low FiO2 (30%) increases risk of acute coronary syndrome. Koo et al (2019) meta-analysis and systematic review found high inspired FiO2 (>80%) during general anesthesia is associated with decreased postoperative pulmonary arterial oxygen, alveolar-arterial delivery of oxygen, and causes more severe atelectasis compared to the use of low FiO2 (<50%). Li et al (2020) RCT revealed that using 30% FiO2 compared to 80% resulted in fewer severe pulmonary complications. Staehr-Rye et al (2017) cohort study found administration of a higher intraoperative FiO2 was associated with an increased risk in major respiratory complications in a dose-dependent fashion.

Conclusion/Recommendations for Practice: Based on the findings derived from studies presented in this evidence-based research project, it is recommended that inspired concentration of oxygen during general anesthesia cases at least one hour long in ASA 1-3 patients aged 18 and older receive an FiO2 of 30% to 50%. Intraoperative ventilation with an FiO2 of 30% to 50% reduces adverse patient outcomes, morbidity, and mortality in this patient population for up to 30 days postoperatively. Based on this evidence, a practice improvement has been implemented at University of Florida (UF) Health Shands Hospital.

The Analgesic and Pulmonary Outcomes of Ultrasound-Guided Thoracic Fascial Plane Blocks as an Early Intervention in Multiple-Rib Fractures.

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Background/Discussion/Question: Multiple rib fractures (MRFs) are prevalent and associated with high mortality secondary to pain and pulmonary complications. Epidural and paravertebral blocks (EPVB) have long been the gold standard in regional anesthesia for acute (surgical or trauma) chest wall pain but have a narrow patient population that can safely receive them. Ultrasound-guided serratus anterior plane (SAP) and erector spinae plane (ESP) blocks are two novel fascial blocks that are potentially as effective as EPVB while being safer and less restrictive for application. The purpose of this literature review is to show the efficacy of early intervention with these two ultrasound-guided fascial blocks as a way to improve analgesia and pulmonary outcomes in patients with traumatic rib fractures.

Methods/Evidence Search: A comprehensive electronic search was conducted via PubMed, Web of Science, and Cochrane databases at the Albany Medical College's Schaeffer Library from May 7, 2021 to July 19, 2021. Initial search terms included "trauma patients and regional anesthesia," "regional anesthesia and emergency medicine," and "early regional intervention and trauma patients." The search was further narrowed by inclusion criteria of "fascial plane blocks," "multiple-rib fractures," "serratus anterior plane block," "erector spinae block," and "pulmonary outcomes." Exclusion criteria included trauma patients without rib fractures and with no fascial plane blocks as treatment methods. An initial search yielded 172 articles. After an abstract and title review, 42 full text articles were determined eligible for inclusion. Both authors performed a full text analysis for inclusion and exclusion criteria and quality of evidence. A total of 4 studies were chosen for review.

Synthesis of Literature/Results/Discussion: According to the 4 articles reviewed, SAP and ESP blocks demonstrated improved pulmonary and pain outcomes compared with pre-block measures and were determined to be at least as effective as their thoracic epidural or paravertebral block counterparts. Continuous infusion fascial plane blocks demonstrate greater improvements in incentive spirometry volumes and pain management compared with single-injection. These ultrasound-guided fascial blocks may be safer and easier to place than the current more invasive standard methods. Larger randomized studies need to be conducted to further identify differences between the types of blocks. In addition, larger studies will allow for greater generalizability between trauma patients with MRFs, allowing for a more comprehensive pain management approach with a focus on improving pulmonary outcomes.

Conclusion/Recommendations for Practice: Based on review of the literature, the use of regional anesthesia and analgesia for traumatic chest wall pain management is limited by the traditional neuraxial and paravertebral nerve blockade. Albeit the novelty of ultrasound-guided fascial plane block techniques, it has been shown to be a promising alternative with equivalent results. Although the 4 articles reviewed provided low-quality evidence, they added much-needed data for the continuous development of safe and effective regional anesthesia. The CRNA's role is to develop and adopt comprehensive pain management strategies with less side-effect profile.

The Effect of Intraoperative Esmolol Infusion on Perioperative Opioid Consumption and Pain in Participants Undergoing General Anesthesia

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Background/Discussion/Question: Acute postoperative pain and chronic pain are associated with increased morbidity, extended recovery time, prolonged opioid use, and increased healthcare costs. Opioids are known for negative side effects including hyperalgesia, postoperative nausea and vomiting, respiratory depression, and the potential for dependence. Can non-opioid adjuncts decrease perioperative opioid requirements and postoperative pain scores? Esmolol is a cardioselective beta-adrenergic agonist that is also considered to have antinociceptive qualities via multiple proposed mechanisms which include but are not limited to the suppression of catecholamine release and alteration of calcium influx. The purpose of this literature review is to determine the efficacy of esmolol in the reduction of intra- and postoperative pain scores in participants undergoing general anesthesia.

Methods/Evidence Search: The studies presented in this literature review were selected from a comprehensive electronic search in Web of Science, Cumulative Index to Nursing and Allied Health Literature, and PubMed databases through the Albany Medical Center Schaffer Library of Health Sciences. “Esmolol,” “pain,” “opioid consumption,” “esmolol requirement,” “opioid requirement,” “effects of esmolol on intraoperative pain,” and “effects of esmolol on postoperative pain” were key terms utilized in this literature search. Boolean terms were utilized where appropriate. Studies were included if published within the past 8 years, were limited to the English language, and involved human participants undergoing laparoscopy or rhinoplasty. Only human studies were included in this literature search. Meta-analyses were excluded from selection. Twenty-one studies were found after duplicates were eliminated from consideration, and 15 were further eliminated after not meeting inclusion criteria. Six studies met inclusion criteria for this literature review.

Synthesis of Literature/Results/Discussion: In this review of the literature, 5 of the 6 included studies observed a significant decrease in perioperative opioid consumption in participants who received an intraoperative esmolol infusion compared to a placebo control group. Participants who received intraoperative esmolol infusions experienced quicker recovery times and reported lower pain scores postoperatively. Esmolol and ketamine were observed to be similar in their capacities to reduce postoperative opioid requirement and pain scores. The sixth study observed that when compared to lidocaine, esmolol was found to be statistically similar in its ability to reduce postoperative opioid requirement without the postoperative sedation observed with lidocaine. Further opportunities for future research include the utilization of a conversion calculator to convert analgesic administration to morphine equivalents. This would standardize future studies and make them more comparable. Additionally, a comparison of postoperative analgesic consumption following intraoperative esmolol infusion versus ketamine or lidocaine should be conducted.

Conclusion/Recommendations for Practice: Intraoperative esmolol administration was associated with reduced pain scores in 4 of the 6 included studies. No included studies reported increased pain scores following esmolol administration. Five of the 6 studies concluded that the administration of esmolol was associated with reduced opioid requirements. No studies concluded increased opioid requirements following intraoperative esmolol administration. Based on this literature review, the following is proposed: implement the use of esmolol independently or as an adjunct agent for laparoscopic procedures. An esmolol bolus of 0.5 mg/kg followed by an esmolol infusion of 5-10 mcg/kg/min titrated to heart rate is a frequently cited regimen. Caution should be used for patients with bradycardia, heart block, or hypotension.

The Effect of Subhypnotic Propofol on Postoperative Nausea and Vomiting

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Background/Discussion/Question: Postoperative nausea and vomiting (PONV) can cause increased intracranial and abdominal pressures, dehydration, electrolyte imbalances, and aspiration. These incidents lead to increased hospital stays. PONV costs on average $75 per patient, resulting in several hundred million dollars spent annually. Propofol has known antiemetic properties, and subhypnotic doses augment preventative efforts without using higher amnestic doses.

Methods/Evidence Search: The PICO question: In adults undergoing general anesthesia (population), will the intraoperative use of subhypnotic propofol (intervention), compared with other prophylactic techniques (control), result in a decreased risk of PONV (outcome)? The search for evidence was conducted in the Google Scholar, Pubmed, Cumulative Index to Nursing and Allied Health Literature, and Embase Databases. A systematic search resulted in 24,204 potential sources, with 9 sources meeting the inclusion criteria (7 randomized control trials, 1 prospective cohort study, 1 systematic review). Subjects were excluded if there was a history of PONV, pregnancy, or use of antiemetics 24 hours preoperatively. Adult populations were used with the age range of 18-82. The literature was appraised using the Johns Hopkins evidence-based practice tool for nursing.

Synthesis of Literature/Results/Discussion: The evidence revealed that subhypnotic propofol can be used for PONV prophylaxis as an infusion (1-1.2mg/kg/hr), bolus (0.5 mg/kg), and in conjunction with other antiemetic agents such as dexamethasone. Propofol infusion doses of 1-1.2 mg/kg/hr and boluses of 0.5 mg/kg or 20-30 mg are most effective in preventing PONV. Bolus dosing of subhypnotic propofol at the end of skin closure, or infusion started after induction and discontinued just prior to emergence, are the most efficacious times to administer this medication. The greatest benefit for PONV reduction will be realized within the early postoperative (0-4 hr or 0-6 hr) time period. Infusions showed some benefit up to 24 hours.

Conclusion/Recommendations for Practice: The findings of this review encourage clinicians to utilize subhypnotic propofol as an infusion (1-1.2mg/kg) or bolus (0.5 mg/kg) in combination with an antiemetic adjunct such as dexamethasone (4mg, 8mg), tropisetron, or ramosetron for the greatest reduction in PONV. Bolus at the end of skin closure or infusion after induction and ending at skin closure were the recommended timing of administration.

The Effectiveness of a Standardized Handoff Tool for Intraoperative Anesthesia Handoffs

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Background/Discussion/Question: Handoff of patient care from one provider to another can be an error prone event. The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) reported that 70% of 3,000 sentinel events that occurred over 9 years were caused by communication problems with over half of all communication breakdowns occurring during patient handoffs. The purpose of this project was to describe the evidence on the effectiveness of a standardized intraoperative handoff tool in improving communication and information transfer between anesthesia providers.

Methods/Evidence Search: Keywords from the following PICOT question were used to search The Cochrane Library, PubMed, Cumulative Index of Nursing and Allied Health Literature, and Science Direct databases: Do surgical patients who have anesthesia providers (P) that use a standardized handoff protocol (I) compared to similar patients who have providers who do not use a standardized handoff protocol (C) have better patient outcomes and handoff quality (O) following intraoperative handoff from one anesthesia provider to another (T)? The literature search included the following keywords: handoff, checklist, intraoperative, protocol, and anesthesia.

Synthesis of Literature/Results/Discussion: One systematic review of cohort studies, 2 randomized controlled trials (RCTs), and 1 cohort study were critically appraised using the Melnyk and Fineout-Overholt model (2019). Parent et al (2018) performed and published a randomized control trial that demonstrated using a handoff checklist improved information transfer from one provider to another and increased provider satisfaction. These findings were similar to findings by Salzwedel et al (2016), who conducted another randomized controlled trial that showed having a handoff checklist increased information transfer. Abraham et al (2021) conducted a systematic review of cohort studies investigating intraoperative handoffs with a checklist. They found providers using handoff tools had a satisfaction rating higher than those that did not use a handoff tool (Abraham et al, 2021). They also found that using a handoff tool increased the amount of information transferred from one provider to another (Abraham et al, 2021). Julia et al (2017) conducted an observational cohort study that utilized pre-post intervention monitoring. The findings demonstrated an increase in information transfer once a handoff tool was implemented (Julia et al, 2017). The four studies consistently found that a standardized handoff checklist improved provider satisfaction with the handoff and increased the quality of handoffs.

Conclusion/Recommendations for Practice: Utilizing a standardized handoff checklist can improve information transfer between anesthesia providers and increase provider satisfaction concerning the handoff. A change in practice was made based on this evidence at a large level one trauma center that resulted in an increase in use of a standardized intraoperative handoff tool.

The Effectiveness of Dexmedetomidine at Preventing Emergence Delirium in Adult Surgical Patients

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Background/Discussion/Question: Emergence delirium (ED) is a transient state where the patient becomes hyperactive. Commonly described as agitation, the patient may transition through the stages of anesthesia more violently than anticipated. An agitated patient may be confused and combative, putting themselves at risk for injuries. Dexmedetomidine is a centrally acting anesthetic sedative and selective alpha-2 agonist whose use in pediatric populations for ED is well described. The purpose of this project was to share evidence supporting the use of dexmedetomidine to prevent ED in adult populations, hence avoiding undesirable postoperative sequelae. After providing the evidence, it will be evaluated whether the usage of Dexmedetomidine in the main operating suites has increased or remained unchanged. By May 31, 2022, pharmacy inventory data will be analyzed, and results determined.

Methods/Evidence Search: Keywords from the following PICOT question were used to search the Cochrane Library, PubMed, Cumulative Index of Nursing and Allied Health Literature, and Medline databases: Do adult surgical patients receiving general anesthesia (P) and given dexmedetomidine before emergence (I) compared to similar patients that do not receive dexmedetomidine (C) have a lower incidence of emergence delirium (O) postoperatively (T)? The search words included dexmedetomidine or Precedex, emergence delirium or emergence agitation, adults, general anesthesia, anesthesia or anesthesiologist or anesthetist, and postoperative.

Synthesis of Literature/Results/Discussion: Four randomized controlled trials (RCTs) were found in the literature and critically appraised. Su et al (2016) found dexmedetomidine was associated with a reduction in POD in elderly, non-cardiac surgical patients. Kim et al (2021), in an RCT of 139 adult females undergoing elective thyroidectomy surgery, found patients who received dexmedetomidine had less severe cough, emergence delirium, and postoperative hemorrhage. Kim et al (2019) found pre-operative dexmedetomidine decreased the incidence of POD, severity of POD, and duration of agitation after nasal fracture surgery. Aouad et al (2019) found that administration dexmedetomidine at doses of 0.25, 0.5, and 1.0 μg/kg IV over 10 minutes towards the end of surgery had a statistically significant effect at reducing ED. This dose range did not delay extubation, but dose-dependent hypotension was observed.

Conclusion/Recommendations for Practice: Intravenous dexmedetomidine in the 0.25-1.0 mcg/kg dosing range is a safe and effective pharmacological approach for reducing the incidence of emergence delirium after general anesthesia. Following a review of literature provided, each practitioner is recommended to consider dexmedetomidine administration as an adjunct to prevent or minimize emergence delirium in adult postoperative patients. This change in practice was presented to the Halifax Medical Center anesthesia team, and the quality improvement effort is currently under way.

The Effectiveness of Goal-Directed Fluid Therapy in Reducing Postoperative Complications in Colorectal Surgery

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Background/Discussion/Question: With emerging technology, more objective intraoperative fluid management has developed and may offer an alternative to conventional fluid resuscitation (CFT) methods. During major colorectal surgery, inappropriate fluid therapy in the perioperative setting can lead to poor outcomes (impaired wound healing, decreased renal perfusion, increased hospital length of stay, and multi-organ failure). The current state of practice concerning fluid management is highly variable, which seems to stem from differing clinical experience, competency level, convenience, and provider beliefs which all increase the subjectivity of clinical decision-making. The purpose of this work is to describe the evidence on the effectiveness of goal-directed fluid therapy (GDFT) for intraoperative fluid management in colorectal surgery patients to improve patient outcomes.

Methods/Evidence Search: Keywords from the following PICOT question were used to search the Cochrane Library, PubMed, Cumulative Index of Nursing and Allied Health Literature, and Medline ProQuest literature databases: Do patients undergoing colorectal surgery (P) using goal-directed therapy (GDT) with stroke volume variability (SVV) for fluid replacement (I) compared with similar patients not using GDT (C) have better outcomes (O) postoperatively (T)? Synonyms for the keyword goal-directed fluid therapy included the same terms without the hyphen, GDFT, and goal-directed hemodynamic management. Synonyms for the keyword postoperative outcomes included complications. The addition Sof keywords occurred using the Boolean operator "AND" while the addition of keywords' synonyms occurred using the Boolean operator "OR."

Synthesis of Literature/Results/Discussion: Three meta-analyses and systematic reviews of RCTs and 2 RCTs were critically appraised. Treatment group included patients that had GDFT and control groups included patients that had CFT. The meta-analysis of 16 RCTs by Giglio et al (2009) demonstrated evidence that GDFT decreased major and minor GI complications post-operatively when compared to CFT in non-cardiac major surgeries. The meta-analysis of 45 RCTs by Sun et al (2017) demonstrated evidence that GDFT reduced mortality (both short- and long-term) and complication rates compared to CFT in abdominal surgery patients. The RCTs found that GDFT facilitated faster GI function recovery. The meta-analysis of 11 RCTs by Xu et al (2018) found lower complication rates with GDFT postoperatively compared to CFT in colorectal surgery patients. Ramsingh et al (2013) found patients with GDFT had faster return of GI function and higher quality of recovery scores in both high- and low/moderate-risk patients compared to CFT. Yin et al (2018) found patients with GDFT had hospital length of stay, first flatus, and decreased post-operative complications compared to CFT. Evidence from 3 meta-analyses and 2 RCTs consistently found patients monitored with GDFT intraoperatively had fewer postoperative complications compared to patients monitored with conventional fluid therapy intraoperatively.

Conclusion/Recommendations for Practice: Based on these findings it is recommended that GDFT should be utilized for intraoperative fluid management. Using GDFT is a feasible and low-risk practice change that could reduce postoperative complications.

The Effectiveness of Intravenous Dexmedetomidine Administration on Reducing Perioperative and Postoperative Opioid Consumption

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Background/Discussion/Question: Perioperative opioid use has risen dramatically in the past three decades with a significant percentage of a patient's first exposure to opioids being the perioperative and postoperative period. During this time, anesthetists have a significant role in pain management and utilizing adjunct analgesics to reduce opioid consumption. The overuse and anesthetic reliance on opioid analgesics can lead to negative side effects that include respiratory depression, ileus, and dependence. The purpose of this work is to describe the evidence on the effectiveness of dexmedetomidine as an adjunct analgesic intraoperatively in attempts to reduce patient opioid requirements and to create a change of practice based on said evidence.

Methods/Evidence Search: The Cochrane Library, PubMed, Cumulative Index to Nursing and Allied Health Literature, and Medline databases were searched using keywords from the following PICOT question: Do patients undergoing general anesthesia (P) who receive intravenous dexmedetomidine before surgical incision (I) compared to similar patients who do not receive intravenous dexmedetomidine (C) have less opioids administered (O) intra-operatively and post-operatively (T)? A list of keywords was established to help facilitate a methodical examination for literature using each individual database: dexmedetomidine, opioid, intraoperative, postoperative, reduction, opioid use, and surgical incision. Several synonyms were used to expand the search results. The synonym for the keyword dexmedetomidine was the brand name Precedex. Synonyms for the keyword opioid were narcotic, pain medication, and analgesic. These keywords were separated with the word "OR." The same technique was used for the search terms intraoperative and perioperative; both were separated using the word "OR."

Synthesis of Literature/Results/Discussion: Synthesis of evidence from 1 meta-analysis and 3 RCTs consistently found that perioperative dexmedetomidine use decreases consumption of fentanyl and morphine intraoperatively. Opioid consumption was decreased postoperatively and patients experienced less postoperative pain when perioperative dexmedetomidine was administered.

Conclusion/Recommendations for Practice: Intraoperative administration of dexmedetomidine at 0.5 mcg/kg, either as an infusion over 10 minutes during induction or in equally divided bolus doses throughout the surgical procedure, aids in reducing patients' opioid requirements both perioperatively and postoperatively. Currently, dexmedetomidine is being utilized minimally at this small rural facility which is a CRNA-only practice. Implementation of this practice change will decrease the need for opioids both perioperatively and postoperatively.

The Efficacy of PC6 Acupoint Stimulation for Postoperative Nausea and Vomiting

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Background/Discussion/Question: It is unclear if PC6 acupoint stimulation for the reduction of postoperative nausea and vomiting (PONV) in patients undergoing general anesthesia is a modality that is currently being used in the clinical setting or if it is an intervention that practitioners are aware of. Research has shown that PC6 acupoint stimulation is a modality effective in reducing incidence and severity of PONV. This intervention has recently been added to the latest guidelines for the management of PONV. The purpose of this work is to describe the effectiveness of PC6 acupoint stimulation to reduce PONV and to describe a change in anesthesia practice based on this evidence.

Methods/Evidence Search: The Cochrane Library, PubMed, Cumulative Index to Nursing and Allied Health Literature, and ScienceDirect databases were searched using keywords from the following PICOT question: Do adults undergoing surgery with general anesthesia (P) who receive PC6 acupoint stimulation (I) compared to similar patients who do not receive PC6 acupoint stimulation (C) have a lower incidence of nausea and vomiting (O) post-operatively (T)? The terms PONV and postoperative nausea and vomiting were used instead of nausea and vomiting postoperatively to broaden search results.

Synthesis of Literature/Results/Discussion: Five randomized control trials (RCTs) were critically appraised. Hoffman (2017) found a reduction in PONV scores in patients with mechanical stimulation of the PC6 acupoint using acupressure patches preoperatively. Mobarakabadi (2018) found mechanical stimulation of the PC6 acupoint using an acupressure band for three days reduced severity, duration and frequency of nausea and vomiting in parturients. Ünülü & Kaya (2018) found stimulation of the PC6 acupoint through acupressure equally beneficial as pharmacologic antiemetic therapies in preventing PONV, contributing to higher comfort levels immediately after surgery and during the entire hospitalization period ($P<0.001$). Yang et al (2015) found electrical PC6 acupoint stimulation as an adjunct to traditional pharmacologic therapies reduced the incidence of PONV almost by half in the first 24-hour postoperative period, shortening post-anesthesia care unit (PACU) stays. White (2012) found similar results as Ünülü and Yang with a stronger alleviation of vomiting and retching. Results from these 5 RCTs consistently found mechanical or electrical stimulation of the PC6 acupoint reduced PONV, perception of nausea, time spent in the PACU, and improved patient satisfaction following anesthesia among high-risk populations.

Conclusion/Recommendations for Practice: The use of PC6 acupoint stimulation in patients undergoing general anesthesia for laparoscopic surgery has proven to reduce presence, intensity, and onset of PONV. The evidence from this quality improvement project led to a change in clinical practice through the implementation of PC6 acupoint stimulation to reduce postoperative nausea and vomiting. Post-implementation attitudes regarding this treatment modality showed an increased awareness, knowledge, and acceptance of this intervention.

The Efficacy of Sugammadex Versus Neostigmine on Restoration of Neuromuscular Function in Surgical Patients with Myasthenia Gravis Undergoing Rocuronium-induced Neuromuscular Blockade: a Systematic Review

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Background/Discussion/Question: Patients with myasthenia gravis (MG) are at an increased risk of post-surgical residual neuromuscular blockade (NMB) because of existing neuromuscular transmission and functioning deficits. Traditional NMB reversal methods include administration of neostigmine with glycopyrrolate, but in turn may cause unwanted cardiac, gastrointestinal, and respiratory side effects. This technique applied to patients with MG has the potential to prolong muscle weakness, extending the time to extubation. Sugammadex has been reported to reverse NMB more rapidly and reliably than neostigmine. The efficacy of sugammadex versus neostigmine on restoration of neuromuscular function in patients presenting with MG undergoing rocuronium-induced neuromuscular blockade has been reviewed systematically to provide the best evidence for the reversal of NMB.

Methods/Evidence Search: This systematic review used the Joanna Briggs Institute (JBI) methodology for systematic review of effectiveness. The search strategy looked at published and unpublished studies on the topic. A three-step approach was utilized in the search. An initial search of OVID Medline and Cumulative Index to Nursing and Allied Health Literature was undertaken. A second search using all identified keywords (post-op residual curarization, residual neuromuscular blockade, myasthenia gravis, sugammadex, neostigmine) and index terms was undertaken across all included databases. Finally, the reference lists of all selected for critical appraisal were searched for additional studies. Studies were critically appraised by two independent reviewers using a standardized critical appraisal instrument from JBI. Following critical appraisal, studies that did not meet a quality threshold were excluded. Data was extracted using the data extraction tool from JBI SUMARI. Where statistical pooling was not possible the findings were put in narrative form including tables and figures to aid in data presentation where appropriate.

Synthesis of Literature/Results/Discussion: Two articles remained after the exhaustive search.One article was excluded based on low methodological quality so only 1 study was included. Misiolek et al 2013 was a prospective, randomized study that included 22 patients diagnosed with MG. The patients were induced and maintained under rocuronium in identical manners.The study compared sugammadex versus neostigmine for reversal of muscle relaxation.This study showed that the time from reversal to extubation was significantly shorter in the participant group that received sugammadex compared to the group that received neostigmine (35.00 ±22.17 vs 174.29 ±38.67, $P < .0001$), respectively. Neostigmine is the traditional reversal agent of choice; howe2013ver, the side effects seen in patients with MG have the potential to prolong the postoperative period. These adverse responses warranted a closer examination of an alternate reversal therapy for these patients. Although one substantive study has shown that sugammadex is safe and more efficacious than neostigmine in this patient population, there is was a lack of evidence which compared the two interventions in this cohort. Prospective randomized, double-blinded control trials are needed to answer this prudent clinical question.

Conclusion/Recommendations for Practice: This systematic review identified gaps in the literature on the effectiveness of sugammadex versus neostigmine on the reversal of NMB in surgical patients with MG. Although one substantive study showed that sugammadex was safe and more efficacious than neostigmine in this patient population, there was a lack of evidence which compared the two interventions in this cohort. The lack of available clinical evidence did not allow any conclusions to be drawn about the most effective method for pharmacologic reversal in this patient population. However, a clinical decision can be made by anesthesia providers to avoid the adverse physiological effects from the administration of neostigmine by using sugammadex for NMB reversal if it is available.

The Role of Acute Normovolemic Hemodilution in Cardiac Surgery; Effects on Blood Product Transfusion Occurrence, Hematologic Conditions, and Postoperative Outcomes

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Background/Discussion/Question: Interest in blood conserving strategies has mounted over the last decade with frequent blood shortages, rising transfusion costs, and better understanding of allogenic transfusion risks. One conservation strategy of note, acute normovolemic hemodilution (ANH), has not been widely utilized, but has shown benefit in patients undergoing surgical procedures in which considerable blood loss is expected, such as intracardiac valve surgery and coronary artery bypass grafting (CABG) surgery. Classic ANH is performed by the anesthesia provider and involves the removal of autologous whole blood from a patient shortly after the induction of anesthesia, volume replacement with crystalloid or colloid fluid, and re-infusion of whole blood postoperatively. The purpose of this review is to compare outcomes of cardiac surgery patients receiving ANH therapy versus standard care.

Methods/Evidence Search: A systematic review of literature was performed using databases PubMed, Embase, and Scopus. Search terms included "cardiac surgery" and "acute normovolemic hemodilution" or "autologous whole blood transfusion." Full-text English language articles published between January 1, 2017 and December 1, 2021 were included and duplicates were eliminated. Inclusion criteria included ANH therapy alone or a combination therapy including ANH. Exclusion criteria included "off-pump" or cardiopulmonary bypass (CPB) avoiding cardiac surgery, aortic surgery, emergency surgery, pre-operative donation, and pediatric population. After screening, 14 articles were determined to be the most relevant and included in this review: 7 retrospective observational studies or analysis, 3 prospective observational studies, 1 randomized controlled trial, 1 literature review, and 2 systematic reviews.

Synthesis of Literature/Results/Discussion: ANH has been associated with a beneficial coagulation profile while on CPB, as well as after its completion, due to the preservation of clotting factors and decreased platelet activation that occurs as blood undergoes mechanical trauma while passing through the non-endothelial CPB circuit. More effective clot formation as seen by shorter EXTEM CT values and an increase in EXTEM A10 percentage via thromboelastographic studies supports the hypothesis that ANH may lead to decreased bleeding once CPB is discontinued. In fact, post-operative bleeding was decreased by >60mL on average with ANH implementation. ANH when used as a sole blood conservation method led to decreased incidence of allogenic blood product transfusion, most notably packed red blood cells. The volume of whole blood harvested varied greatly between studies. During a comparison of small volume (median 400mL) versus large volume (median 1100mL) ANH, the large volume group was found to have the most significant reduction in allogenic blood product use. Remarkably, no significant increase in complications was reported with the large-volume ANH group. A statistically significant decrease in overall post-operative complication rate, most notably pulmonary infection and urinary tract infection, was reported with ANH use, as well as a decrease in hospital length of stay.

Conclusion/Recommendations for Practice: ANH should be considered in the anesthetic care of all patients undergoing CABG or intracardiac valve repair or replacement surgery. Clinical judgment should always be used to determine patient eligibility and predicted response to ANH. Harvest amount should be determined on a patient-to-patient basis. Other methods of blood conservation should also be considered in combination with ANH to further reduce risk of allogenic blood product transfusion and associated complications. Presently, there is not a standardized approach to ANH, therefore the authors support mobilizing a task force to create specific recommendations that include the Society of Thoracic Surgeons blood conservation guidelines that could be instituted by any anesthesia provider across institutions with cardiac surgery capability.

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The Role of Point-of-Care Ultrasound for Endotracheal Tube Placement Confirmation

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Background/Discussion/Question: Point-of-care ultrasound (POCUS) has been proven to be a reliable, non-invasive tool for diagnostic exams and procedures. With the exception of x-ray and fiberoptic, other confirmatory methods are unable to provide visual results of endotracheal tube (ETT) placement within the trachea. POCUS may play a role in emergent confirmation of ETT placement in both rapid sequence and cardiac arrest intubations. This review examines the potential benefits of using point-of-care ultrasound for endotracheal tube placement confirmation.

Methods/Evidence Search: The literature was reviewed using the following PICO question: In intubated patients, does the use of airway ultrasonography, compared to chest x-ray, auscultation, and capnography, improve endotracheal placement confirmation? A systematic review of literature was performed using the databases PubMed, Cumulative Index to Nursing and Allied Health Literature, and Medline. Full-text language articles that were published between the years 2014-2021 were included. Keywords included “endotracheal intubation,” endotracheal tube placement,” “ultrasound,” and “ultrasonography.” Initial search results included 507 articles, with 297 articles remaining after excluding duplicates. Exclusion criteria consisted of articles published before 2015 and articles having no relation to ultrasound and endotracheal tube placement confirmation. Inclusion criteria consisted of articles that were related to ultrasound and endotracheal tube placement, with comparisons to auscultation, chest x-ray, and capnography. After the screening, 12 articles were included.

Synthesis of Literature/Results/Discussion: Studies found that point-of-care ultrasound, when compared to auscultation, is superior in accuracy for endotracheal tube placement. In differentiating bronchus (right mainstem and left mainstem) vs tracheal intubation, ultrasound is superior for accuracy compared to auscultation. Ultrasonography has also shown comparable results to both x-ray and capnography for accuracy in endotracheal tube placement confirmation, including identification of esophageal intubations. When compared with x-ray, POCUS is able to accurately identify depths of ETTs within the trachea. In terms of the amount of time it takes for endotracheal tube confirmation, ultrasound resulted in shorter time compared to chest x-ray. For placement of double lumen endotracheal tubes, the accuracy of ultrasound is superior compared to auscultation for both right and left double lumen tubes. Studies have also shown that ultrasound is reliable for endotracheal tube confirmation in patients in cardiac arrest, with ultrasound taking less time to confirm placement than capnography. Point-of-care ultrasound has also been shown to verify endotracheal tube placement more rapidly than the colorimetric CO2 detector.

Conclusion/Recommendations for Practice: Evidence-based literature suggests that point-of-care ultrasound should be considered for endotracheal tube placement confirmation due to it being non-invasive, timely, and comparable, if not superior, to other methods of confirmation used in everyday practice. Literature has also suggested it would be a great adjunct for endotracheal tube placement confirmation when capnography is not available or unreliable. Further education and training for providers would be needed on how to use ultrasound and recognizing correct endotracheal tube placement within the images. Studies also suggest that more research with larger patient groups should be done before making POCUS a routinely used tool. Other recommendations include how POCUS in endotracheal tube placement confirmation plays a role in decreasing respiratory and postoperative complications, as well as improving short- and long-term patient outcomes.

The Use of Total Intravenous Anesthesia for Bariatric Surgery to Reduce Postoperative Nausea and Vomiting

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Background/Discussion/Question: Studies have found the incidence of PONV to be up to 79% in the bariatric surgery population and 42.7% of bariatric surgery patients still require rescue antiemetics despite triple PONV prophylaxis (Ziemann-Gimmel et al, 2014). PONV can jeopardize surgical outcomes by impacting hydration status, electrolyte balance, aspiration risk, intracranial and intraocular pressures, wound dehiscence, and esophageal rupture (Varner & March, 2020). Additionally, nausea and vomiting are the most common reasons for hospital readmission following bariatric surgery, increasing healthcare expenditures (Varner & March, 2020). The purpose of this work is to describe the evidence on the use of total intravenous anesthesia (TIVA) to decrease the incidence of PONV for patients undergoing bariatric surgery and to describe a change in anesthesia practice based on this evidence.

Methods/Evidence Search: The Cochrane Library, PubMed, Cumulative Index of Nursing and Allied Health Literature, and Web of Science databases were searched using keywords from the following PICOT question: Do patients undergoing bariatric surgery with general anesthesia (P) who receive total intravenous anesthetic (TIVA) intraoperatively (I) compared to similar patients who do not receive TIVA (C) have a lower incidence of nausea and vomiting (O) postoperatively? The keywords included “total intravenous anesthesia,” “bariatric,” “nausea,” and “vomiting.” The synonym “TIVA '' was additionally added to expand the literature search. Search terms were separated by the word “AND,” when appropriate.

Synthesis of Literature/Results/Discussion: One cohort study and 4 randomized control trials (RCTs) focusing on bariatric surgical patients were critically appraised. Each separated participants into a volatile anesthetic (VAA) or total intravenous anesthesia (TIVA) group. There was variability in the type of inhalational anesthetic used among these studies. The TIVA anesthetic for all five groups included a propofol drip; however, adjunct infusions varied. Despite the variation in infusions used for TIVA, evidence consistently found TIVA to be superior to VAA at reducing PONV. Demirel et al (2020) found that postoperative nausea and vomiting (PONV) was significantly lower in the TIVA group versus the VAA group. Elbakry et al (2017) found the TIVA group had a decreased incidence of PONV compared to the desflurane group for morbidly obese patients undergoing laparoscopic sleeve gastrectomy. Elsayed et al (2019) discovered less PONV in the TIVA group compared to the VAA group. Groene et al (2019) found that PONV rates were consistently higher when volatile anesthetic agents (VAA) were used. Ziemann-Gimmel et al (2014) found that TIVA reduces PONV compared to the use of VAA and opioids for bariatric surgery patients. These studies demonstrate that bariatric surgical patients who receive TIVA intra-operatively have a lower incidence of PONV compared to patients who do not receive TIVA.

Conclusion/Recommendations for Practice: The use of a total intravenous anesthetic in bariatric surgical patients reduces the incidence of PONV. A change in practice was made based on this evidence resulting in a decrease in the number of patients receiving volatile anesthetics for bariatric surgery.

To Dex or Not to Dex? Administering Dexamethasone to Patients with Diabetes Mellitus

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Background/Discussion/Question: Perioperative IV dexamethasone administration is widely used for postoperative nausea and vomiting (PONV) prophylaxis and for its effectiveness as a pain modulator. Despite these benefits, fear exists that administering dexamethasone can cause hyperglycemia and increase the risk of surgical site infections in the postoperative period. This concern is amplified in patients with diabetes mellitus (DM). This project sought to determine if perioperative administration of dexamethasone to patients with DM increased blood glucose levels or the risk of surgical site infections postoperatively.

Methods/Evidence Search: A search of the literature was conducted through PubMed, Embase, and Cumulative Index of Nursing and Allied Health Literature using the following keywords: dexamethasone, PONV, diabetes, hyperglycemia, surgery, and surgical site infection. Inclusion criteria were: published in 2017 or later, English language, quantitative study, population of patients with DM, intervention of intraoperative dexamethasone administration, and outcomes analyzing postoperative blood glucose and surgical site infection rates. A total of 132 articles were retrieved. After 42 duplicates were removed, 90 articles were screened. Sixty-seven articles were excluded: 2 non-research, 12 outdated, 6 ineligible populations, 1 ineligible intervention, 1 ineligible outcome, and 45 unrelated to the PICO question. Of the 23 remaining articles, two did not have full-text available. Eight additional articles were excluded from eligibility: 4 were not a quantitative study, 1 was non-research, 1 had ineligible population, and 2 had ineligible outcomes. Thirteen final articles were included in this review.

Synthesis of Literature/Results/Discussion: The literature unanimously revealed that administering IV dexamethasone to surgical patients with DM does not increase the risk or incidence of surgical site infections (SSIs). In fact, two articles looking at SSIs found that patients with DM who received dexamethasone had a statistically significant shorter length of hospital stay. In contrast to the clear evidence on SSIs, the effects dexamethasone had on blood glucose were inconsistent. Some studies found statistically significant increases in blood glucose after perioperative dexamethasone administration, while others observed the opposite. Most studies that noted increases in blood glucose reported that this effect was transient and did not impact clinical outcomes. Despite the differences in blood glucose results, most studies recognized that the act of dexamethasone administration was not as critical as the patient's preoperative hemoglobin A1C (HbA1C). Several studies established that preoperative HbA1C had a stronger association with postoperative blood glucose than dexamethasone administration. One study observed that every one-unit increase in HbA1C led to a statistically significant increase in risk of postoperative hyperglycemia. Another report found that HbA1C > 7.05% was associated with an increased risk of postoperative complications and required diabetic medication change.

Conclusion/Recommendations for Practice: Based on this review, anesthesia providers should not withhold intraoperative IV dexamethasone in patients with controlled diabetes mellitus. Dexamethasone may transiently increase blood glucose levels postoperatively; however, it does not increase the risk or incidence of surgical site infections. Rather than diabetic status, anesthesia providers should consider the patient's preoperative hemoglobin A1C when deciding whether to administer dexamethasone. Patients with a higher HbA1C experience the greatest increases in blood glucose levels postoperatively after dexamethasone administration. Future research is warranted to investigate the use of dexamethasone in patients with higher HbA1Cs; exploring the effects of a reduced dose of 4mg and its impact would be reasonable. Overall, in patients with controlled diabetes, the glycemic side effects of dexamethasone may have little clinical significance especially when compared to the established benefits of decreased postoperative pain, nausea, and vomiting.

Virtual Reality Distraction Therapy to Reduce Procedural Pain and Anxiety in Pediatric Patients

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Background/Discussion/Question: Medical procedures can be the most distressing and painful events pediatric patients endure. Although there is a place in practice for pharmacological interventions, many medications carry the potential for untoward side effects such as drowsiness and respiratory depression. Therefore, non-pharmacological interventions, such as distraction therapy, have gained attention as a first-line therapy to temper pain and anxiety in the pediatric population. The purpose of this literature review is to investigate the usefulness of virtual reality (VR) as a form of distraction therapy to decrease pain and anxiety in pediatric patients undergoing medical procedures.

Methods/Evidence Search: The literature presented in this review was selected from a comprehensive electronic search in the Ovid, Science Direct, and Wiley Online Library databases via the Schaffer Library at Albany Medical College. The search was conducted from May 24 to May 31, 2021. Key terms used for the search included: pediatric, children, pain, anxiety, virtual reality, and procedural. Broad MeSH terms and Boolean operators were selected for each database search. In addition, the same search terms were used to identify further relevant research. Research included for review were randomized control trials with the control group being “care as usual” or the “standard of care.” All research was confined to the past 2 years and was required to have an adequate sample size. Studies were also limited to human studies and the English language. A total of 4 studies were selected for critical appraisal in this literature review.

Synthesis of Literature/Results/Discussion: All 4 studies included in this literature review were blinded prospective randomized control trials. The researchers utilized several validated scales to compare pre- and post-procedure pain and anxiety in a VR group as compared to a control group. Gerçeker et al studied the effect of VR during venous port access and found that the VR group exhibited a 1-point decrease in pain and a 2-point decrease in anxiety compared to the control group which had no decrease in either metric. Two studies, 1 by Özkan & Polat and the other by Wong et al, investigated the effect of VR during venipuncture and unveiled significantly decreased pain and anxiety in the VR group. Lastly, Liu et al examined the effect of VR during nasal endoscopies and found significantly decreased pain, anxiety, and distress in the VR group. Interestingly, in this study, the younger VR subgroup displayed enhanced pain reduction as compared to the older VR subgroup. Future research should consider subgroup analyses to determine which patients have the highest potential to benefit from VR distraction therapy, and whether the choice of VR headset or program impacts the degree to which the subject’s pain and anxiety is reduced.

Conclusion/Recommendations for Practice : This literature review focused on some of the most common medical procedures performed in the pediatric population: nasal endoscopies, peripheral intravenous (IV) insertion, and port access. Despite different clinical settings, procedures, patient cohorts, and geographical locations (Turkey, China, and United States of America), all 4 studies produced statistically significant results displaying a reduction in pain and anxiety levels in the VR group as compared to the control group. This literature review supports the conclusion that the use of VR distraction therapy decreases procedural pain and anxiety in the pediatric population. Therefore, clinical settings that care for the pediatric population should consider the use of VR distraction therapy in select patients to ease pain and anxiety with the goal to decrease the utilization of potentially hazardous sedative medications and enhance the patient experience.

Product Invention

VR Simulation for OR Clinical Exposure for Novice Anesthesia Learners

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Introduction: Simulation education is essential to integrating theoretical knowledge with clinical practice that helps a novice student registered nurse anesthetist (SRNA) perform anesthesia skills in the operating room (OR). Multiple studies have emerged solidifying the potential significant benefit of virtual reality (VR) technology in healthcare training, providing repetition of practice in a realistic environment while consuming less time and resources than traditional simulation. VR has been used for skills training in surgical procedures; however, only a few studies have been done using VR simulation for nurse anesthesia education. VR simulation has yet to be leveraged for initial OR exposure that can alleviate a novice anesthesia learner's anxiety. To address this gap, this project describes the development and implementation of VR simulation teaching modules for novice anesthesia learners to teach and practice setup of anesthesia equipment and basic skills. The project evaluated the usability of the application and the virtual reality simulation effects on the users.

Development/Design: VR simulation offers potential advantages over traditional simulation-based training. This project describes the creation and implementation of VR teaching modules that will enable users to view and interact with virtual patients in the context of the perioperative environment using Oculus headsets. The script will guide the learner through the selected processes and OR equipment in a typical OR environment. The modules include setting up a fluid warming system, forced air blanket, anesthesia depth monitoring, ETCO2 monitoring, and neuromuscular blockade monitoring. The students were asked to rate the application on ease of navigation, realism of scenarios, user-friendliness, and clarity of instructions and sequence, and to evaluate any potential side effects of the VR experience.

Proof of Concept/Results: There were 40 participants enrolled in their first semester in a DNP program at the University of XXX as first-year SRNAs. More than half of them had 3-5 years of nursing experience, and the rest had 6 or more. Seventy percent had used VR goggles in the past. Although varying degrees were noted, all the participants agreed that the Oculus VR goggles are user-friendly. The majority (63%) strongly agreed that the instructions and sequence of actions helped them understand how to use the equipment. Over 77% strongly agreed that the environment in the app is realistic, and found it easy to orient themselves to the virtual environment and identify appropriate objects necessary to perform tasks. There were only 3 students who had trouble manipulating the equipment in the VR environment using the clicker. Physical effects after using the VR app were evaluated: among the SRNAs, 7 = blurred vision, 4 = warm, 3 = disorientation, 2 = nausea, 2 = dizziness, while 23 did not report any physical effects.

Discussion/Conclusion: Tailored to VT and the Oculus goggles' usability, an edited version of the Computer System Usability Questionnaire (CSUQ) was utilized for the initial evaluation. Along with usability, the Motion Sickness Assessment Questionnaire (MSAQ) was also utilized to evaluate physical adverse effects after using the VR app. Many students verbalized their enjoyment of the experience so far, but there were two comments concerning blurriness of the images which left the students slightly dizzy and nauseous. The blurry images were easily fixed by adjusting the Oculus lenses, which should be included in the initial instructions for using the goggles. Despite these effects, SRNAs had a high level of engagement and satisfaction with the Oculus VR goggles. Some students mentioned that there was a slight confidence boost from this initial experience alone. Based on the initial data and feedback, there is assurance that the implementation of VR simulation as a teaching modality for novice anesthesia learners can impact their learning experience in a positive way and boost confidence in their initial OR

clinical exposure. The ultimate assessment of the success of the VR simulation training will be after the initial clinical exposure. Feedback from the SRNAs regarding their level of confidence while performing the actual tasks in the OR after having the VR experience will be evaluated.

Quality Improvement

An Evaluation of the HELP Program's Trained Peer Supporters' Experiences in Providing Peer Support to Colleagues as Second Victims to Traumatic Clinical Events

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Background: The Healing Emotional Lives of Peers (HELP) program, a peer support program for healthcare professionals (HCPs) involved in stressful or traumatic clinical events, was implemented in July 2018 within the Department of Anesthesia at Mayo Clinic. Fifty-six anesthesia providers serve in the voluntary role as a Trained Peer Supporter (TPS) and offer support to colleagues involved in perioperative events. An essential element of the program's sustainability is ensuring that TPSs are comfortable supporting affected colleagues. The primary aim of this study is to assess the experience of TPSs in serving colleagues after involvement in such events.

Method: Approximately 3 years post-implementation of the HELP program, an anonymous survey was distributed to 56 TPSs via email using Research Electronic Data Capture (REDCap), a secure web-based application. This 20-question survey evaluated TPSs' experiences supporting affected colleagues, including number of supportive encounters, personal distress, benefits of the role, confidence as TPSs, and demographics. The survey consisted of quantitative questions and Likert scales. It was available for 6 weeks, with follow-up reminders every 2 weeks. Data were summarized using descriptive statistics with frequency and percentages for categorical variables.

Results: Response rate was 71.4% (40/56). 82.5% (33) provided 1:1 peer support to a colleague. 92.5% (37) felt confident in providing support to a colleague after involvement in an adverse event. 12.1% (4) experienced emotional distress after supporting an affected colleague, yet felt adequate resources are available to cope. 40% (16) desired increased efforts to maintain engagement and 47.5% (19) desired increased opportunities to enhance skills. To maintain engagement with the HELP program, 72.5% (29) preferred email and 52.5% (21) preferred announcements in the departmental newsletter. 92.5% (37) agreed that serving in the role of a TPS has been positive overall.

Discussion: The majority of TPSs have provided 1:1 peer support to affected colleagues, are confident in their skills, and indicate this role to be fulfilling. The majority did not experience emotional distress after interactions with an affected colleague, while the few TPSs that were affected felt there were adequate resources to cope. The majority of TPSs expressed interest in increased efforts to maintain engagement and to enhance skills. Other studies assessing experiences of peer responders of peer support programs report similar findings, including a desire for ongoing training, focused assessments, and monthly peer supporter meetings. Some studies have reported burnout and lack of engagement of peer supporters. Future areas of study should involve evaluation of peer support members' wellbeing utilizing a validated tool, such as the Professional Quality of Life: Compassion, Satisfaction and Fatigue Version 5 (ProQOL). Future studies should also assess burnout and more thoroughly examine the benefits of supporting colleagues.

Anesthesia-Specific Quick Reference Guide for Patients with Left Ventricular Assist Device Undergoing Noncardiac Procedures to Improve CRNA Confidence when Providing Anesthesia

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Background: As the number of patients having left ventricular assist devices (LVADs) implanted increases, there is an increase in patients with LVADs having noncardiac procedures. Quick reference guides (QRGs) have been used in anesthesia for unexpected or uncommon events to provide current evidence-based information at providers' fingertips. It was hypothesized that a QRG would be a beneficial resource that would increase confidence for Certified Registered Nurse Anesthetists (CRNAs) caring for patients with LVADs undergoing procedures in noncardiac areas. The aim of this study is to assess whether an online QRG improves CRNA confidence in providing anesthesia care for patients with LVADs undergoing noncardiac procedures. Surveys were conducted prior to and subsequent to the publishing of the online QRG to assess improvement in CRNA confidence.

Method: A survey was sent to CRNAs at a large academic institution to measure confidence levels in providing anesthesia care for patients with LVADs undergoing noncardiac procedures. The baseline survey (pre-intervention) assessed CRNA preference in method of receiving education on patients with LVADs. The survey demonstrated that a QRG was the preferred method of receiving education. The survey further showed that CRNAs had reduced confidence in providing anesthesia care for this patient population. A QRG was developed and published on the institution's anesthesia webpage. CRNAs were made aware of the new QRG by email, monthly newsletter, notification from area supervisors, and a journal club presentation. After the QRG was viewed, a post-survey was sent to all CRNAs to assess their confidence level in providing anesthesia care to patients with LVADs undergoing noncardiac procedures.

Results: In the pre-education survey 29.9% to 30.7% of CRNA respondents stated they had no confidence in caring for patients with LVADS undergoing noncardiac procedures. The post-education survey provided the electronic QRG. When asked their confidence level when having access to the QRG, the number of respondents who stated they had no confidence in caring for this patient population dropped to 2.3%. The post-education survey results showed the CRNAs perceived an improvement in their confidence level regarding caring for patients with LVADs undergoing noncardiac procedures when they had an electronic reference available to them. Over 84% of the CRNAs in the post-survey answered "yes" when asked if the QRG was helpful in improving their confidence level. CRNA comments on the QRG included: "very helpful," "highly effective resource," and "improves confidence." One respondent commented that they felt "hands on education would be better."

Discussion: The use of cognitive aids, checklists, reference sheets, and decision-making flow charts has proven to be helpful in situations that arise infrequently and/or are highly stressful. When applying this concept to improving CRNAs' perceived confidence, the electronic QRG was successful. One limitation of this study is that it did not provide other education, electronic learning modules, or hands-on teaching which may have been just as effective in improving perceived confidence. This is a potential area for further study. Another limitation of this study was that confidence levels are a perceived marker, being collected through a survey rather than a quantitative marker like a pre- and post-test. The QRG is a tool that can assist CRNAs in specific cases that CRNAs may rarely see. A yearly education or simulation may be less desirable given the time and resources needed for each. Further exploration into what cases/devices or patient populations may fall into this same category may be helpful in determining if other QRGs could be helpful.

Evaluating the Impact of a Vascular Access Workshop for Acute Care Nurse Practitioner Students

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Background: The demand for acute care services continues to rise due to the aging population presenting with multiple comorbidities, rising patient expectations, and fewer physicians to fill this need alone (Chen, 2020). Acute care nurse practitioners (ACNPs) are an effective and affordable alternative to fix this demand. To do so effectively, it is crucial that ACNPs are provided the clinical skillset requisite when caring for patients in the acute setting. This includes establishing invasive vascular access, which is essential when managing critically ill patients. As this is within the scope of practice for ACNPs, it is imperative that this training on placement of vascular access be integrated into their curriculum. Inclusion of a didactic lecture and a vascular access workshop will enhance the confidence, knowledge, and competency of the graduate students. Expanding the availability of health care providers that are competent in using ultrasound for the insertion of invasive catheters will improve patient outcomes (Kaganovskaya & Wuerz, 2021).

Method: Statistical information was able to be collected via mobile phone using Google Forms and a QR code. Pre- and post-evaluation tests were created to obtain demographic data: a 4-point Likert scale on knowledge, confidence, and competency pertaining to ultrasound, and a 15-question exam on ultrasound and invasive vascular access. A voice-over PowerPoint comprised of using ultrasound to place arterial and central venous catheters was then made available to the ACNP students to view prior to the simulation lab. This simulation lab consisted of multiple stations, one of which included ultrasound scanning and needle guidance for insertion of arterial and central venous catheters. After the vascular access workshop, the ACNP students completed the post-evaluation test consisting of the same questions as the pre-evaluation test. Descriptive statistical analysis and an independent t-test with mean scores will be used to compare the interventions to baseline knowledge

Results: When comparing the pre-evaluation to the post-evaluation test there was a significant increase in knowledge, confidence, and competency pertaining to using ultrasound for vascular access after the implementation of the didactic lecture and hands-on skills session compared to baseline knowledge. From the dataset with a sample size of 35, the mean-average of the pre-evaluation score to the mean-average of the post-evaluation score using an independent t-test with assuming equal variance and 95% confidence resulted in a mean for pre-evaluation score of 8.8 and a mean for post-evaluation score of 11.4. This observed difference of 2.6 was tested for whether true population difference was different from 0. From this test, the resulting *P* value was 0, indicating that $P < .05$. In conclusion, the statistical evidence supports that the mean-averages from the two variables are different from one another.

Discussion: Introducing high-fidelity simulation (HFS) within an ACNP curriculum can prepare the graduate student for an effective transition to practice. HFS allows for vascular access training of insertion technique, knowledge, and decision-making, which in return builds the confidence and competency of the student in a safe and controlled environment (Warren et al, 2016). Limitations of this study include inaccuracies in the individual 4-digit identifier codes, resulting in just the comparison of the average test scores from the pre- to post-evaluation exam. Five students were unable to attend the hands-on simulation training which could have affected the outcome in the post-evaluation scores. The goal of this quality improvement (QI) project was to have an increase in competence, knowledge, and confidence in ultrasound guided vascular access which in return will provide safe and effective practice as future practitioners (Kaganovskaya & Wuerz, 2021). While this QI project will not observe the long-term effects of the ACNP students as future practitioners, improving knowledge, competency, and confidence in ultrasound guided vascular access was shown and it can be inferred that this intervention will make positive changes in the acute care setting.

Evaluation of ERAS Multimodal Analgesia Protocol for Bariatric Surgery

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Background: Bariatric surgical weight loss patients are a unique population, inundated with a proclivity towards increased postoperative pain. Multimodal analgesia is a proposed solution to this problem. Inclusion of opioid alternatives, such as NSAIDS, ketamine and magnesium, has demonstrated decreased opioid consumption and improved pain management. A large community hospital recently implemented a new ERAS protocol tailored for bariatric surgical weight loss patients. The purpose of this quality improvement project is to evaluate the implementation of the ERAS protocol, evaluate patient pain outcomes, and identify areas for improvement. Assessment of multimodal analgesia protocol adherence and correlation to postoperative pain scores is the primary objective.

Method: A retrospective chart review was performed. Sixty patients who received care under this protocol were selected. All patients met the following criteria: age ≤ 70, creatinine ≤ 1.5 mg/dL, and no allergies to NSAIDS. A protocol checklist was maintained for each patient, tracking protocol adherence in the pre-, intra-, and postoperative phases of care, with protocol medication being recorded in each phase. In addition, patient verbal pain scores were documented and reviewed in the post anesthesia care unit (PACU) 6, 12, and 24 hours post procedure. Patients were separated into two groups: high-protocol adherence (n=31) and low-protocol adherence (n=29), with 70% protocol adherence being the cutoff for group separation. Mean pain scores were compared between the two groups.

Results: The mean pain scores for the low-protocol adherence group in PACU 6, 12, 24 hours, and overall mean are as follows: 7, 5.4, 5.9, 4.9, 5.8. The mean pain scores for the high-protocol adherence group are as follows: 5.4, 4.7, 3, 3.9, 4.3. Statistical analysis was performed on the mean pain scores between the two groups. A Welch Test, which is a t-test for a 2-sample assuming unequal variance, was used. A significance level of $\alpha = 0.05$ was used, with $P = .001$. Therefore, there was a statistically significance difference between both groups.

Discussion: In summary, patients who received a high adherence to the protocol had significantly decreased pain scores throughout the postoperative period. The mean pain scores for high verses low adherence were 5.8 verses 4.3. Therefore, further implementation of this protocol should be promoted. There was one limitation discovered post implementation. The protocol was designed to stop after the patient leaves the post anesthesia care unit (PACU). On the floor, post-operative pain medication regimen is at the discretion of the surgeon, which can include non-multimodal medications. Medication administration was not recorded past the PACU phase of care, which may impact the pain scores recorded. In conclusion, high adherence proved to be effective in lowering pain scores in this population in the immediate postoperative period. This analgesia strategy offers a paradigm shift in the way providers care for this unique population. Of note, continued administration of scheduled NSAIDS and ibuprofen would enhance the protocol to maintain analgesia and decrease opioid consumption, reducing the risk of potential respiratory depression from opioid consumption. Further study could be performed at evaluating medication administration beyond the PACU phase of care.

Improving Access to Wellness in Student Registered Nurse Anesthetists

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Background: Student Registered Nurse Anesthetists (SRNAs) endure stress related to clinical, academic, and personal factors. Unmanaged stress may lead to the formation of negative coping mechanisms, including substance abuse and social seclusion (Del Grosso & Boyd, 2019). Developing effective coping mechanisms may combat stressors and prevent burnout. Bozimowski et al (2014) reported a 0.65% prevalence of substance abuse among SRNAs. Alarmingly, 47% of SRNAs reported feeling depressed and 21% experienced suicidal ideation (Chipas et al, 2012). Notably, the most robust relevant knowledge is limited and outdated. The purpose of creating a student-run wellness newsletter and Canvas page is to promote wellbeing and resource awareness. Using the Salutogenesis model provides a framework to promote stress management and resiliency. The wellness initiatives include: organized social events, workout classes, podcasts, therapist, meditations, and direct links to mental health sites.

Method: The wellness project was facilitated through the usage of the Salutogenesis Model and the Iowa Model. A literature review was conducted, utilizing 19 sources. Approximately 42% of the articles were evidence level V, 26% level VI, 15% level III-IV, 10% level I-II, and 5% level VII. Education sessions were provided to 54 junior and senior University of Cincinnati (UC) SRNAs. Immediately following the education session, the wellness newsletter was distributed via email and Canvas page access was enabled. Wellness resources adhered to the Salutogenesis 7 domains. Intervention data included results from anonymous pre- and post-tests using participant-created identification numbers. Outcomes measured were resource awareness, resource effectiveness, and overall sense of perceived wellness. Data was measured through a Likert scale. Data analytics were performed using an unpaired t-test. Interaction with the Canvas page and newsletter were recorded by “clicks” and elapsed time tracked by third parties to ensure anonymity.

Results: Results from the pre-test were gathered immediately preceding the education session. Post-test results were gathered one month afterward. Results demonstrated a statistically significant improvement in resource awareness ($P < .05$) and resource utilization ($P < .05$). Notably, there was no statistically significant change in stress level ($P = .385$) or perceived wellness ($P = .95$). Analytics were tracked throughout the one-month period. During that time, 77% of students accessed the wellness newsletter and wellness Canvas webpage. On the wellness newsletter, 11% of students clicked on provided hyperlinks. There were 9 average “clicks” per student within the webpage. The most common reported coping mechanisms included quality time (40%), exercise (40%), and sleep (14.8%). Most common emotions reported were stress (44.4%), anxiety (29.6%), and exhaustion (12.9%). Twenty-four percent of students reported starting prescription medication for anxiety or depression since starting the program.

Discussion: Academic expectations of doctoral programs have created higher demands on SRNAs’ time, making wellness a pressing issue (Griffin et al, 2017). In addition, COVID has evoked a heightened sense of isolation to SRNAs. There was found to be a lack of knowledge and utilization of allocated wellness resources within the UC CRNA program. One month following implementation of the wellness newsletter and Canvas site, SRNAs reported an overall increase in awareness of wellness resources. The surveys revealed pre-test stress level 7.2 and post-test stress level 6.6, which were not statistically significant. Increase in SRNAs perceived wellness also did not demonstrate statistical significance. The lack of increased perceived wellness was thought to be largely due to the limitation of a one-month time frame. COVID has caused SRNAs to face many changes, leading to unprecedented levels of stress (Horvath & Grass, 2021). The surveys validated prior research with 46% of UC SRNAs reporting stress as a top emotion. Unavoidably SRNAs endure chronic stress during their journey to become a Certified Registered Nurse Anesthetist (CRNA). Providing a centralized location of wellness resources allows for

the establishment of positive coping mechanisms. CRNA programs must continue to promote SRNAs' well-being through offered wellness interventions and resources to prevent burnout.

Improving Interdisciplinary Communication & Anesthesia skills in Cardiopulmonary Bypass Cases

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Background: A survey of SRNAs who completed their first cardiovascular (CV) rotations reported that students did not feel clinically prepared to handle the advanced skills required for cardiopulmonary bypass (CPB) anesthesia. Additionally, preceptors overseeing SRNA cardiac rotations identified that SRNAs are not adequately prepared to start their CV rotation. The CPB QI project aims to develop and implement an interdisciplinary CPB simulation experience between SRNAs and cardiac perfusion (CP) students to increase knowledge of CPB anesthesia, increase self-confidence, and facilitate interdisciplinary communication during CPB cases.

Method: SRNAs and CP students were invited to participate in a 45-minute CPB simulation. SRNAs completed an electronic pre-test and were provided a pre-education module. The simulation experience included an overview of the insertion of peripheral, central, and arterial lines and pulmonary artery waveforms led by the project leads. The simulation included a CPB practice session using high-fidelity simulation, a debrief session, and a post-test evaluation of the simulation experience. The project used the IHI Model for Improvement and PDSA cycles to evaluate the project's efficacy and improvement needs. The procedure to analyze process and outcome measures compared the individual and mean percent of students' pre- and post-test scores. Additionally, project leads completed a qualitative statistical analysis of the post-test evaluation responses to identify themes related to the simulation experience quality and areas of improvement.

Results: Evaluation of participants' knowledge, CPB skills, and self-confidence in CPB anesthesia management and communication among anesthesia and perfusion showed student improvement in each area. After the simulation experience, mean scores improved: perceived knowledge of skills needed to administer CPB anesthesia increased by 56%, self-confidence to provide anesthesia during CPB increased by 44%, and self-confidence to communicate with CP students during CPB increased by 50%. Student assessment of the quality of the simulation experience identified that the simulation was timely and organized and the pre-education material was concise and informative. Knowledge-based questions were assessed via multiple-choice questions with a 27% increase from pre- to post-test.

Discussion: Post-simulation results indicated all participants improved in measured areas. Interdisciplinary simulations improve participants' confidence and communication skills and strengthen team function (Mendel, 2014; Myers & Ober, 2017; Paige et al, 2014). Simulation for skills and training should be a mandatory component of anesthesia training programs (Krage & Erwteman, 2015). Limitations included scheduling, level of engagement, and varying levels of participants' experience. COVID-19 restrictions also limited the number of students and faculty per session. Anesthesia for CPB is complex; effective interdisciplinary communication is essential for optimal patient outcomes. Adequate preparation of SRNAs for CPB anesthesia involves didactic coursework and hands-on simulation in an interdisciplinary setting. Simulation projects paired with didactic education can improve hands-on skills and increase participants' self-confidence (Meeker et al, 2018). This CPB skills QI initiative effectively prepared SRNAs to enter their CV rotation, and the simulation experience can help guide future interdisciplinary simulation initiatives.

Increasing Nurse Anesthesia Engagement and Interest Among Diverse Nursing Students: A Quality Improvement Project

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Background: Patients with health care providers who share the same race/ethnicity are more likely to have increased communication and trust, which can lead to higher quality care and better patient outcomes. Providers from underrepresented backgrounds are also more likely to live and provide care within diverse and underserved communities. Unfortunately, according to the 2020 American Association of Nurse Anesthesiology member survey, only 11% of Certified Registered Nurse Anesthesiologists/Anesthetists (CRNA) self-identified as people of color compared to 23.6% in the general population. This quality improvement (QI) project sought to address early interventions to guide diverse and underrepresented nursing students to a path towards admission into a nurse anesthesia program.

Method: The project used a pre-post design with the Plan-Do-Study-Act framework. The pre-intervention phase consisted of a 20-minute presentation followed by baseline data collection done in April 2021. Objectives of the presentation included reviewing the role and scope of the CRNA profession, the history of the profession, current diversity statistics for the CRNA workforce, and the basic requirements for application and enrollment in a nurse anesthesia program. The intervention was a three-and-a-half-hour workshop held at a large midwestern university in September 2021. BSN and MN students were invited to attend. Activities included a short presentation on the path to enrollment in a DNP nurse anesthesia program, hands-on simulations and demonstrations, and small group question and answer sessions. The impact of the workshop was measured with qualitative data from a newly developed 21-item survey based on the previously validated Theory of Planned Behavior questionnaire.

Results: The survey showed a positive increase in mean for all items from pre-intervention to post-intervention, indicating increased intention to pursue nurse anesthesia after the workshop. Increases in positive attitude on 2 items were 9.7% and 1.3%. Two subjective norm items showed 10.8% and 43% increases. Perceived behavioral control increased 19.7%. Intention to pursue nurse anesthesia increased 27.7%. Eleven open-ended items were included to further identify perceived barriers and supports.

Discussion: The workshop resulted in positive outcomes with increased intention to pursue a career as a CRNA among participants. For open-ended items, positive factors included themes of increased responsibility and respect, scope of practice, and financial and job security. Negative factors included concerns about competitive and limited admission opportunities and the rigor and stress of nurse anesthesia programs. Several respondents indicated that despite the disadvantages, it would still be "worth it" to pursue a career as a CRNA. An unanticipated effect of the workshop was a reported increase in SRNA confidence and enthusiasm about nurse anesthesia. The COVID-19 pandemic necessitated virtual pre-intervention presentation and limited capacity at the intervention workshop, resulting in small sample sizes. Selection bias is a potential factor to consider since participants who attended the presentation and workshop may have already been interested in pursuing nurse anesthesia education. Additionally, a greater than 100% response rate on the post-intervention survey skews results to an unknown extent. While process objectives regarding diversity were achieved, the demographics of workshop participants still reflected a majority White group. Additional steps will need to be taken for future events to further increase the number of diverse and underrepresented participants in attendance.

Interactive Disaster Response Pre-Deployment Checklist: A Quality Improvement Project

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Background: Disaster preparedness in the nursing profession is still developing. The pre-deployment phase of disaster preparedness has the least amount of collected data and research, leading gap in psychological, physical, and clinical preparedness for health care providers. Managing travel requirements, stress and clinical preparedness continues to be a challenge for new and experienced health care providers responding to local and international disasters.
Method: The use of Qualtrics pre- and post-survey identified confidence, knowledge, and perceived stress before and after the implementation of the interactive pre-deployment checklist. The study was advertised through general email sent to the university-wide mailing list of former students, graduate students, and undergraduate students in the medical or nursing professions engaged in university disaster response travels.
Results: Implementing an interactive pre-deployment checklist facilitates the pre-deployment period of disaster preparedness for university students engaging in medical mission travels.
Discussion: The implementation of a disaster response pre-deployment checklist improves the overall experience of the pre-deployment phase. The checklist positively influences pre-deployment knowledge and confidence while decreasing participants' perceived stress. The pre-deployment checklist is flexible and beneficial for health care providers and students engaging in disaster response travels.

Local Anesthetic Systemic Toxicity Education for Perioperative Nurses

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Background: Local anesthetic systemic toxicity (LAST) is a rare but potentially fatal complication of local anesthetic administration. It can occur when large doses of local anesthetic are administered or are given intravascularly. Any time local anesthetic is given, there is a risk of LAST. According to a 2018 systematic review, LAST was prevalent in 1.04 cases per 1000 peripheral nerve blocks, describing LAST as rare but clinically significant due to its potential effects (Neal et al, 2018). When LAST complications occurred, 1 in 5 resulted in seizure or cardiovascular complications, and of those cases, 1 in 3 resulted in brain injury or death (Ilhan & Demir, 2020). During and after a peripheral nerve block is performed, a nurse is often responsible for monitoring the patient. There is a lack of knowledge of LAST among providers, particularly perioperative nurses (Ferry & Cook, 2020; Ferguson et al, 2019). This project aims to educate perioperative nurses on LAST signs, symptoms, and treatments to improve patient monitoring and care.

Method: In total, a sample size of 17 perioperative nurses who care for patients receiving peripheral nerve blocks was included in the study. A PowerPoint lecture was created with information on LAST pathophysiology, signs and symptoms, and treatment. The lecture was delivered to the nurses as a self-guided lecture via the MyKnowledge education application. A LAST educational simulation session, where a patient experiences LAST symptoms and the nurses are expected to treat the patient, was delivered in situ at the nurses' places of work within 2 to 3 days of receiving the lecture. A debrief took place after the simulation to discuss what went well and what could have been improved throughout each stage of the simulation. The success of the education and increased knowledge were measured through pre- and post-intervention tests delivered via Microsoft forms and consisting of 6 demographic questions and 10 questions about LAST. The scores of the pre- and post-intervention tests were analyzed using SPSS software with a paired t-test.

Results: The average pre-assessment score was 65.29%. After the education session and simulation, the average post-assessment score was 88.24%. These results were analyzed via a paired t-test assuming equal variance and a 95% confidence interval. With a *P* value of .0001 from an average 23-point difference between the pre-test and post-test scores, evidence supports that the project improved perioperative nursing knowledge on LAST (Lambert, 2019). Therefore, the results show a statistically significant improvement in LAST knowledge after the perioperative nurses received the educational lecture and participated in the simulation and debriefing session.

Discussion: The results show a statistically significant increase in LAST knowledge following the education implementation. Among the 17 perioperative nurses included in the study, over 59% had 8 or more years' experience as a nurse. Only one nurse had witnessed an occurrence of LAST during their career and most nurses reported having never heard of LAST prior to the education or realized the signs and symptoms mentioned in the patient discharge instructions were referring to LAST. This educational gap among the nursing staff is also reflected in other publications. A 2020 study showed that only 29% of preoperative nurses possessed any knowledge of LAST, let alone all the signs, symptoms, and treatments of this potentially fatal complication (Ferry & Cook, 2020). Limitations of the study include the limited sample size within a main academic hospital setting and a branch of the academic hospital. The project did not evaluate long-term retention of LAST knowledge. The project achieved its purpose to increase the knowledge level of local anesthetic systemic toxicity in perioperative nurses. In addition, nurses were made aware of resources available to them including personnel, medication locations, crisis checklists, and decision trees to help guide patient care. Future implications of practice include providing yearly educational and simulation sessions on LAST to sustain knowledge among nurses.

Outcomes of Leadership Training for Nurse Anesthetists and Other Advanced Practice Providers

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Background: Leadership opportunities are expanding among nurse anesthetists and other advanced practice providers (APPs). There is an increasing need for professionally developing these competencies in APPs to develop effective, inclusive, and adaptive leaders. Many studies and the professional literature highlight the importance of professional growth in the engagement and retention of APPs. As of April 2022, accreditation standards for entry-level training programs for nurse anesthetists, nurse practitioners, nurse-midwives, and physician associates/assistants do not require leadership development as part of their curricula. Extracurricular leadership training for entry-level students and professional development opportunities for these APPs exist through various organizations but are often not led by an interprofessional team nor attended by interprofessional APP cohorts. The project team developed and implemented a leadership course, with the purpose of this project to enhance its quality by analyzing course outcomes and planning improvements for future course offerings.

Method: The intervention that is the focus of this project is an interprofessional, collaborative, APP leadership course designed and implemented by a diverse team of APPs to develop the skills and strategies needed to lead and supervise clinical teams. The 16-week course divided into 8 self-paced modules was designed to fit the demanding schedules of working clinicians. Topics for course modules included: leadership styles, conflict resolution, equity and inclusion; personal wellness; strategy and change management; and systems-based thinking. Each module included instructional content and application activities including portfolio-building, journaling, and discussion. Two live synchronous sessions were also offered. Networking opportunities with colleagues, course faculty, and local and national leadership experts were integrated throughout the course. Attitudes about leadership were measured via a quantitative, 30-item survey before and after the course, and analysis was performed using descriptive and inferential statistics.

Results: Pre-course survey completion rates were 57/61 (93%) and post-course were 48/61 (79%). The post-course rating for each item was statistically significantly higher ($P < .05$) and the mean overall rating was statistically significantly higher (at a 5% significance level). The magnitude of difference was large (Cohen's d=2.45). The greatest increases were seen in the following areas pre- and post-course: creating an engaging culture, understanding how personal leadership style impacts others, the awareness of how exhibited behaviors may negatively impact team performance, supporting collaborative practice and team effectiveness through applied leadership practices, and how choosing effective communication tools and techniques to facilitate discussions and interaction can enhance team function.

Discussion: This study indicates the course was impactful in developing the professional expertise and confidence of the participants in the topic areas and in their overall self-assessment of themselves as leaders. This finding aligns with other literature that leadership training advances the scope and skill of nurse anesthetists and other APPs, thus preparing them to lead interprofessional teams, healthcare initiatives, and health care organizations. The study was limited by using a single measurement methodology and by not pairing results by profession and other demographics. As a result of this analysis, the project team will continue the course as a means to further develop and diversify the health care leadership team with nurse anesthetists and other APPs ready to lead. Further study of this project will include the use of the survey instrument for future cohorts as well as the collection and analysis of date from course graduates after at least several months have passed to evaluate attitudes about leadership when further removed from the course. Additionally, outcomes of this course and other leadership courses can be analyzed to identify their impacts.

Patient Handover from Operating Room to Intensive Care Unit: A Standardized Process to Improve Communication

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Background: Patient handover consists of transferring a patient to a separate location, transitioning equipment and monitors to the receiving team, and sharing pertinent medical information to the providers assuming care. Transitioning a post-surgical patient from operating room (OR) to intensive care unit (ICU) has additional factors that must be addressed to optimize patient safety. McElroy et al (2015) evaluated OR to ICU handover failures and defined them using the prehandover, equipment handover, and information handover framework. Examples of these failures respectively include lack of timely notification, poor prioritization of tasks and patient care, and variations in staff presence (McElroy et al, 2015). Standardized handover processes from OR to ICU have addressed these gaps and demonstrated positive results (Abraham et al, 2021). The purpose of this project was to improve communication quality during cardiac patient handover from OR to ICU.

Method: A standardized process following the prehandover, equipment handover, information handover model was implemented at an academic medical center. A sterile cockpit environment and laminated Information Handover Tool checklist were integrated to support the information handover period. Pre- and post-implementation surveys were distributed to OR and ICU handover participants. Fifteen data points were collected to evaluate change in frequency of key information discussed during information handover. Participant satisfaction, perceived handover efficiency change, and perceived patient safety change were also evaluated as outcome measures. A formal statistical analysis was not performed because the small sample size lacked power to demonstrate statistical significance.

Results: Process measures included providing an “hour out” notification, transitioning patient monitors prior to information handover, and utilization of a sterile cockpit environment. Each process outcome demonstrated 100% compliance except for one instance of information handover occurring without a sterile cockpit environment. Outcome measures demonstrated positive findings. All handover topics showed improvement and were discussed more frequently except patient allergies. A 76.27% reduction in reported distractions during information handover occurred after implementation. Staff unanimously agreed that they are satisfied with the new system. Most staff also reported that they “strongly agree” or “agree” that the new process is more efficient and improves patient safety.

Discussion: The evidence-based process in this project demonstrated improvements in communication quality, staff satisfaction, perceived efficiency, and patient safety. Addressing specific staff and facility needs was important to promote satisfaction and was heavily considered in development of the standardized process. Team members believe this is what contributed to improvements in staff satisfaction and process outcomes. A sterile cockpit environment was introduced to limit the quantity of distractions during information handover as done in other studies like Petrovic et al (2012). This led to a 76.27% reduction in distraction frequency. The Information Handover Tool checklist served as a prompt to remind providers to discuss key information during handover. This is believed to have contributed to an overall improvement in discussion of key topics during information handover. The Covid-19 pandemic was a large limitation that led to decreased cardiovascular surgical volume and limited sample size during the project. Instituting a standardized handover process from OR to ICU, including the prehandover, equipment handover, and information handover model, improved handover communication quality. This process was further strengthened with integration of the Information Handover Tool and sterile cockpit environment to support the information handover period.

The Effectiveness of Lower Dose Dexamethasone at Preventing Postoperative Nausea and Vomiting

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Background: Postoperative nausea and vomiting (PONV) occurs following general anesthesia and dexamethasone at several doses has been used to prevent PONV. Because of this variability in practice, it is unclear as to which dose of dexamethasone is most effective at avoiding PONV. The purpose of this work is to describe the evidence regarding the most effective dose of dexamethasone for the prevention of PONV.

Method: Keywords from the following PICOT question were used to search the Cochrane Library, PubMed, Cumulative Index of Nursing and Allied Health Literature, and ScienceDirect literature databases. Do patients undergoing general anesthesia (P) who receive a lower dose (4 mg) of dexamethasone after induction (I) compared to patients who receive a greater dose (8-10 mg) of dexamethasone after induction (C) have greater incidences of PONV (O) in the perioperative period (T)? Synonyms for postoperative nausea and vomiting included PONV, emesis, and gastrointestinal. Synonyms for dosing included medicating. Synonyms for treatment included management.

Results: TBD

Discussion: Literature revealed that lower doses of dexamethasone were equally as effective as higher does of dexamethasone for the treatment of PONV.The project was implemented after the collection of data 30 days prior to the education being delivered with the target population focusing on females undergoing abdominal surgery. A PowerPoint presentation was prepared and delivered to the UF Health anesthesia department discussing the data and literature supporting the most effective dose of dexamethasone. After the next 30-day period, data was collected to demonstrate that the provision of the evidence-based practice (EBP) data presented was able to influence an improvement in practice. Based on these findings it is recommended that a lower dose of dexamethasone is as effective as a higher dose specifically for the treatment of PONV. Therefore, higher doses of dexamethasone should be reserved for when other factors outside of PONV are considered.

The Impact of a Departmental Peer Support Program on Anesthesia Providers' Second Victim Experiences and Perceptions of Support Using the Second Victim Experience and Support Tool

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Background: Anesthesia providers are involved in events leading to emotional impacts, including anxiety, self-doubt, guilt, isolation, and depression. Second victim (SV) is defined as "a health care provider involved in an unanticipated adverse patient event, medical error and/or a patient-related injury who becomes victimized in the sense that the provider is traumatized by the event." Prevalence of SVs in anesthesia ranges from 60% to 85%, and the most desired form of support is talking to peers. A 2016 survey in a large anesthesiology practice indicated that 62% experienced compromised well-being after an adverse event, and 65% felt there were inadequate post-event resources available. This led to the implementation of a departmental SV peer support program in 2018. The purpose of this project is to evaluate the impact of the peer support program on anesthesia providers' second victim experiences (SVEs) and perceptions of support through utilization of the validated Second Victim Experience and Support Tool (SVEST).

Method: A departmental peer support program was implemented in 2018 to augment support for anesthesia providers as SVs to adverse events. To assess the impact of the peer support program, anesthesia providers were invited to participate in an anonymous, voluntary survey including the validated SVEST. This tool evaluates anesthesia providers' SVEs and desired support prior to and 2 years after implementation of the peer support program. The validated SVEST contains 29 statements to which respondents indicate the extent to which they agree (5-point Likert scale: 1 = strongly disagree, 5 = strongly agree) pertaining to their personal experiences with adverse events, medical errors, or unexpected outcomes. The SVEST includes 7 dimensions and 2 outcomes, along with 7 support options. Comparisons between the pre-and post-implementation surveys were evaluated using the 2-sample t-test. All calculated *P* values were two-sided, and *P* values less than .05 were considered statistically significant.

Results: 57.9% (348/601) completed the pre-implementation survey; 37.6% (231/614) completed the 2-year post-implementation survey. Majority were female CRNAs practicing for 5-10 years. 98.3% (227/231) were aware of the program. A statistically significant reduction in the proportion of anesthesia providers reporting SV-related psychological distress (24.3% vs 16.4%; $P = .04$) and inadequate institutional support (23.1% vs 3.7%; $P < .0001$) 2 years post-implementation is noted. For both assessments, the most desired form of support was a "respected peer to discuss the details of what happened." 99.1% (213/215) would recommend the peer support program to anesthesia providers. Two years post-implementation, 84.9% (191/225) agreed that the program enhanced departmental support and 93.2% (207/222) agreed that the program takes provider well-being into consideration after involvement in traumatic events. 81.7% (183/224) agreed that the program has contributed to fostering a culture of safety within the large anesthesiology department.

Discussion: Anesthesia providers experience SV-related psychologic and physical distress, along with professional self-efficacy issues, absenteeism, and turnover intentions. Like other studies, the most desired form of post-event support remains talking to peers. Support from peers offers advantages of shared experiences, normalization of the impact, and timely outreaches. Having the SV peer support program may have mitigated psychological distress related to SVEs. Additionally, having a peer support program at the departmental level may enhance anesthesia providers' perceptions of institutional support for SVEs. Perceptions of adequate support may help SVs thrive after involvement in traumatic clinical events. Anonymity and attrition prevented direct comparisons of participants in the study. CRNAs were well-represented in comparison to other anesthesia colleagues which could decrease generalizability to other disciplines. The 2-year-post-implementation survey was conducted during the summer of 2020 amidst the COVID-19 pandemic when anesthesia clinical areas experienced a decreased

census and temporary workflow changes, which may have led to decreased opportunities to use the peer support program. Future areas of study include assessing peer support programs' impact on providers, along with any positive dimensions of SVEs such as resilience.

Utilization of a Nurse Anesthesia Teaching Application to Improve Clinical Instructor Confidence and the Quality of Student Training

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Background: In 2019, the American Association of Nurse Anesthetists (AANA) reported 121 accredited nurse anesthesia programs in the United States with more than 1,870 clinical sites with graduates logging an average of 9,369 clinical hours (AANA, 2019). The role of the clinical instructor (CI) is imperative to teach students to prioritize clinical tasks while fostering the development of problem-solving skills needed to work in a fast-paced health care field (Collier, 2017). Certified Registered Nurse Anesthetists (CRNAs) must provide safe care while also instructing and evaluating the student registered nurse anesthetist (SRNA) (Wong & Li, 2011). A lack of supportive resources directly limits CRNA preceptor effectiveness in this critical role (Easton et al, 2017). Providing CIs with a tool that outlines expectations and defines clinical learning objectives can improve confidence in their ability to maintain patient safety while providing a quality learning experience for the SRNA.

Method: This quality improvement (QI) project took place at a large, urban academic medical center, the primary clinical site for a nurse anesthesia program. The resource tool was implemented using the Canvas application platform which contained CI role expectations and learning objectives with correlating questions and answers for 11 different clinical sub-specialties. Additionally, scholarly articles and information to increase CIs' confidence in their role in terms of methods to provide effective feedback, close generational gaps, teaching critical thinking skills, and various adult learning resources were included. A group of voluntary participants were granted access to Canvas using standard internet access or by downloading the app on their smartphone and completed a one-hour course in how to utilize the application. Utilization was monitored over 1 semester and application impact was evaluated using anonymous pre- and post-course 5-point Likert scale surveys. Results were analyzed using a paired t-test to evaluate impact.

Results: Pre- and post-surveys consisted of a set of 12 questions adapted from a QI project by Scott-Herring & Singh (2017) addressing preceptor satisfaction, confidence, and comfort in their role. These 5-point Likert scale questions addressed (1) training or formal education pertaining to the CI role, (2) confidence, comfort, and knowledge of expectations when functioning in the CI role, (3) comfort level instructing students with difficult personalities and resolving conflict, (4) ability to provide positive and constructive feedback to students, and (5) perception of support in CI role. Results were entered into an Excel database after consultation with a biostatistician. Mean scores for pre- and post-course results were compared for illustration (pre M = 35.7, post M = 52.9). A paired t-test was utilized to analyze application impact and revealed that participants who completed the course showed a significant (P < .05) improvement in their confidence (P = .00000137) and understanding of their role (P = .000000395) as CIs.

Discussion: A common theme throughout the literature is the overall lack of formal preceptorship or educational training for CRNA CIs. This project has provided instructors the opportunity to have access to materials to facilitate learning and clinical training. The pre-post questionnaire demonstrated an improvement in instructor role definitions, preparation, confidence, and knowledge levels of adult learning theory and student evaluation processes. CRNA CIs are imperative to the development and success of SRNA trainees. Effective clinical instructors armed with productive teaching strategies, constructive communication skills, clearly defined role expectations, and supportive resources are capable of instructing and positively mentoring future nurse anesthesia providers. The implementation of this application to a larger cohort of CRNA clinical instructors will validate the enhancement in the educational experience of the SRNA and have a positive impact on future nurse anesthesia clinical educators. The opportunity to demonstrate application effectiveness on the impact of SRNA learning experience will further support the implementation of this project to additional nurse anesthesia

program clinical sites.

Quantitative Research

A Comparison of Novel Anterior Cul de Sac Catheter and Transverse Abdominus Plane Block for Post-Cesarean Section Opioid Consumption and Pain Management

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Introduction: Cesarean surgical deliveries are associated with visceral and somatic pain leading to new persistent opioid usage in 2.2% of patients. Acute pain management strategies aim to minimize opioid use perioperatively and reduce prescribed opioids upon discharge. Effective opioid-sparing strategies involving enhanced recovery after surgery (ERAS) protocols and regional anesthesia techniques have been well-established. Use of the transversus abdominis plane (TAP) block is well documented in this surgical population despite evidence indicating its inadequacy at managing visceral pain. There is currently no literature regarding the analgesic efficacy of the anterior cul de sac (ACDS) catheter. This study aims to compare the ACDS catheter to the TAP block in reducing postoperative opioid consumption and opioid related complications in subjects undergoing cesarean section.
Methods: Institutional review board approval was obtained for this retrospective chart analysis of cesarean sections at a rural hospital from October 2020 through October 2021. A total of 93 charts were reviewed, 11 were excluded, and remaining subjects were divided into two groups. Group 1 received single injection bilateral TAP blocks with 15 mL 0.5% ropivacaine. Group 2 received ACDS catheter with 15 mL bolus 0.5% ropivacaine followed by 10 mL/hr 0.2% ropivacaine infusion for 54.5 hours. The primary outcome measured was opioid consumption during postoperative day (POD) 0 through 3. Demographics and secondary measurements including pain scores, incidence of postoperative nausea and vomiting (PONV), foley catheter duration, length of stay, and 30-day postoperative emergency department and hospital readmission rates were recorded. Data were collected and averaged using password protected Excel spreadsheets. Independent student t-tests were performed using the JASP statistical program.
Results: Both groups had low pain scores and opioid consumption. However, statistical analysis confirmed that subjects who received an ACDS catheter consumed significantly less opioids as measured in morphine equivalents (mg) in comparison to subjects who received bilateral TAP blocks on POD 0 (average of 0.39 mg versus 1.68 mg respectively; $P = .034$) and POD 1 (average of 2.21 mg versus 4.87 respectively; $P = .034$). Total opioid consumption for the entire hospital stay was significantly less in the ACDS group in comparison to the TAP group (average of 3.4 mg versus 8.1 mg respectively; $P = .024$). Foley catheter duration was noted to be significantly longer in the ACDS group compared to the TAP group (average of 1630.5 mins versus 1452.8 mins respectively; $P = .02$). No statistical difference was found between POD 2 and 3 opioid consumption, demographic variables, pain scores, or ERAS protocol adherence between the two groups.
Discussion/Conclusion: ERAS protocols are known to be successful in reducing opioid requirements in the obstetrical population. The ACDS catheter appears to be an effective alternative in reducing these opioid requirements even further. While there was no statistical difference in pain scores, opioid consumption was significantly reduced in the ACDS group. This decrease in opioid use occurred in the early postsurgical period during POD 0 and 1 and during the overall length of stay. For POD 2 and 3 opioid consumption was not statistically different between the two groups. It is also possible that ACDS catheters can serve as a potential alternative to TAP block placement in populations that contraindicate the placement of a TAP block, such as the morbidly obese. It is worth mentioning that the ACDS group had a statistically significant longer time period of foley catheter duration compared to the TAP block group, which prompts the question of whether bladder function is impaired by ADCS catheter use.

However, neither group had a statistically different length of stay or number of emergency room visits related to increased foley catheter duration.

Intraoperative Intravenous Ketamine In Elective Spinal Fusion Surgery: An Evidence Based Practice Project

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Introduction: Anesthesia providers play an integral role in managing patients' pain when undergoing spinal fusion surgery. In an effort to fight against the opioid epidemic, anesthesia providers are moving toward delivering multi-modal analgesia, which avoids opioid-based pain management. A review of the research evidence demonstrated ketamine is efficacious as an opioid sparing anesthesia adjuvant and results in reduced perioperative opioid requirements and postoperative complications. The primary outcome of this project was to identify practice trends and prevalence of intraoperative intravenous ketamine administration among adult patients undergoing spinal fusion surgery at Providence Sacred Heart Medical Center (PSHMC). This project aimed to answer the question: What are the utilization trends of ketamine administration among patients undergoing spinal fusion surgery?

Methods: This retrospective project examined adult patients undergoing general anesthesia for elective spinal fusion surgery at PSHMC between 2014 and 2020. PSHMC is a non-profit 644 bed, level II academic trauma center that serves the greater Spokane area, Idaho and Montana. The total sample size was 2865 patients. Univariate analysis was conducted to identify and characterize the project sample. Bivariate analysis was conducted to compare demographics and case characteristics of patients that did and did not receive intraoperative ketamine. The proportion of intraoperative intravenous ketamine administration over time was calculated to assess practice trends over time and prevalence of cases receiving ketamine was reported. Binary logistic regression, both unadjusted and adjusted, was used to examine odds of ketamine administration over time and identify confounding variables. The purpose of the adjusted logistic regression was to account for other variables that may influence the outcome.

Results: Among 2865 reviewed cases at PSHMC, intraoperative intravenous ketamine administration was observed in 29% of patients undergoing elective spinal fusion surgery. Patients with an American Society of Anesthesiologists (ASA) score of 2-4 were 1.76 to 1.97 times more likely to receive ketamine than those with an ASA score of 1. Intraoperative ketamine administration was associated with longer case duration (median 222, IQR 166-295, $P < .001$) and post anesthesia care unit (PACU) times (median 86, IQR 67-110, , $P < .001$) with a median difference of 12 minutes compared to those who did not receive ketamine. An increase of ketamine administration intraoperatively of 3% to 45% was observed between surgical years 2014 and 2020.

Discussion/Conclusion: Research evidence has demonstrated improved pain management and reduced opioid requirements in cases utilizing intraoperative intravenous ketamine. By identifying implementation rates over time at PSHMC, findings can be utilized by anesthesia providers to further improve patient care. Additionally, by categorizing the patient demographics of those who receive intraoperative intravenous ketamine, anesthesia providers can more easily identify patients who are an appropriate candidate for ketamine. The main limitation of this project is because it is retrospective, it is subject to confounding biases. Recommendations for future research include stimulating further hypotheses for well-designed randomized controlled trials (RCTs) that can evaluate appropriate dosing and timing for administration of ketamine in elective spinal fusion surgeries.

Closing the Knowledge Gap: Educating SRNAs about Cannabis and the Endocannabinoid System

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Introduction: Cannabis is the most frequently used illegal drug in the United States and usage continues to rise as more states legalize medical and/or recreational cannabis. Increased usage raises the likelihood that a health care provider will treat a cannabis user. Cannabis has numerous physiologic effects, such as increased heart rate and cognitive sedation, which are specifically concerning to the perioperative period. Anesthesia providers must have a fundamental understanding of the drug and its physiologic effects, as well as the endocannabinoid system (ECS), in order to provide safe anesthesia care. A knowledge gap in healthcare providers about cannabis has previously been identified. The purpose of this study was to assess the knowledge gap and the efficacy of an educational session on student registered nurse anesthetists' (SRNAs) knowledge of cannabis and the ECS.

Methods: This project was a pre/post-evaluation of an online, synchronous educational session for 1st and 2nd year SRNAs in a single nurse anesthesia program. The presentation objectives were developed from the literature and National Council of State Boards of Nursing (NCSBN) education recommendations. Outcome variables included self-assessed knowledge level, assessed knowledge level, and presentation efficacy. Self-assessed knowledge was measured by 4 5-point Likert scale questions, with an overall knowledge level score calculated using the sum of the 4 questions (max score of 20). Assessed knowledge level was measured by a 5-question multiple choice quiz, with each question worth 1 point (max score of 5). Presentation efficacy was assessed using 5-point Likert scale questions and open-ended questions. Data were analyzed using descriptive statistics, content analysis, and non-parametric statistics.

Results: Seventeen SRNAs participated in the educational session and completed the associated pre- and post-surveys. A gap in knowledge was confirmed by the mean pre-education self-assessed knowledge level overall score of 7.59 (SD = 2.96) and mean pre-education assessed knowledge level score of 3.24 (SD = 0.56). A paired samples Wilcoxon signed-rank test revealed a statistically significant increase in both self-assessed and assessed knowledge levels pre- vs. post-education, ($Z = -3.630$; $P < .001$) and ($Z = -3.525$; $P < .001$), respectively. Participants had positive perceptions of the educational session: The average ranking of each of the four feedback Likert questions was > 4.5 out of 5. SRNAs strongly agreed that the education would change their approach to patient care and influence their practice. They also strongly recommended the content be integrated into the nurse anesthesia program curriculum. Participants listed the following information as most helpful: (1) receptors effected by cannabis and (2) the ECS and endocannabinoids.

Discussion/Conclusion: Cannabis research has been limited by government regulation, but in the past few decades began to grow as legislation evolved and the amount of cannabis users increased. As more data emerges it is imperative for anesthesia providers to stay up to date on current research and clinical practice guidelines and recommendations. This novel information is influential to anesthesia practice and needs to be incorporated in educational objectives. This study helped to confirm a population with a knowledge gap and assess their comfort level when caring for cannabis users. The associated educational session was implemented and determined to be efficacious, the materials used can serve as a template for cannabis lectures. The results of the study will hopefully create awareness among anesthesia program leaders and influence a change to program curriculums. Nurse anesthesia programs should integrate cannabis and ECS content into their curriculums in alignment with NCSBN recommendations, particularly the relationship between cannabis and anesthetic agents, and provide SRNAs with related educational resources. Limitations included convenience sampling and education session scheduling conflicts. Further research could be performed to reassess knowledge levels at multiple intervals to evaluate information retention and to determine additional cannabis topics SRNAs would like to learn about.

Improving Student Registered Nurse Anesthetists' (SRNAs) Response to Incivility in the Operating Room

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Introduction: Incivility is a complex social and behavioral phenomenon that is particularly dangerous in the perioperative area of health care with student registered nurse anesthetists (SRNAs) and Certified Registered Nurse Anesthetists (CRNAs) experiencing incivility at rates of nearly 70% and 80%, respectively, in 2014. Incivility has been linked to a decrease in the accuracy of medical decision-making, intraoperative errors due to ineffective communication between staff, increased psychological and physical disturbances in clinician health, and an increased overall cost to health care institutions. An experiential education intervention aimed at improving SRNAs' ability to respond to incivility is intended to give SRNAs the tools needed to manage incivility during their clinical training, thus decreasing the above untoward outcomes.

Methods: This was an evidence implementing/evaluating quality improvement project that used a pre-post quasi-experimental design to evaluate an experiential education intervention using an interactive video learning experience. The intervention included a primary education session and the viewing of an investigator created video depicting examples of incivility. A synchronous learning event allowed participants to work through these examples together. The pre- and post-intervention surveys consisted of a communication competency scale, a general self-efficacy measurement tool, and a self-reported confidence scale. A paired samples t-test was completed for the 3 main dependent variables: communication competency, general self-efficacy, and reported self-confidence. This paired samples t-test was analyzed to assess if a statistically significant change occurred due to the project's intervention.

Results: Ninety-one percent of participants reported personally experiencing incivility while 99% admitted to witnessing workplace incivility. Additionally, 66% of participants indicated that they would be likely to avoid addressing personally experienced incivility. Post-intervention measurements indicated a statistically significant increase in SRNAs' self-confidence related to responding to incivility.

Discussion/Conclusion: Of the 3 core study metrics (communication competency, general self-efficacy, and reported self-confidence) that were evaluated pre- and post-intervention, only reported self-confidence was significantly improved by this study's intervention. This finding was not readily supported by existing literature, which may indicate a unique finding from this intervention, or it could be due to a limited amount of research in this area. Regardless, the finding of significantly increased self-confidence seems to indicate that focusing on methods that improve SRNA confidence related to incivility would be most effective. In summary, while SRNAs are prepared for their clinical training in numerous ways, many do not receive any training in incivility management. Incivility management exists in many forms and a unique mix of didactic and experiential education was proven to increase the self-confidence of SRNAs as they anticipate encountering incivility during their progression into the clinical setting. While witnessing or experiencing incivility may make SRNAs uncomfortable, additional training and education can help SRNAs become proficient at managing these inflammatory encounters with the professionalism that is quintessential to their profession.

Comparison of Onset of Epinephrine Between Intravenous and Tibial Intraosseous Administration in a Pediatric Porcine Model

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Introduction: Obtaining reliable vascular access is essential in pediatric resuscitation. Without vascular access, the administration of epinephrine is delayed and the chance of survival decreases 9% each minute. Intraosseous (IO) access is a fast and reliable route to give medications in situations when vascular access cannot be rapidly achieved. The purpose of this study was to compare the onset of epinephrine by the intravenous (IV) versus the tibial intraosseous (TIO) route in a normovolemic pediatric model. Few studies have examined the onset of any drug when comparing IV and IO routes, and it is not known if a significant difference in onset exists. If a significant difference does not exist, this would support obtaining TIO access sooner when IV access cannot be established. TIO was chosen since it is the preferred site of IO access in pediatric emergencies.

Methods: Design: This was an experimental study. Setting: The Tri-Services Research Laboratory was used. Subjects: Eighteen swine weighing between 20-40 kilograms, which is representative of a pediatric child. Measures: G-Power was used to determine the number of subjects. A multivariate analysis of variance (MANOVA) was used to analyze the pretest data to determine the equivalence of the groups. An independent t-test was used to analyze the differences in onset between the groups. Intervention: The pigs were randomly assigned to the IV or TIO group. Swine were anesthetized, and after 15-minute stabilization, baseline blood pressure and pulse were recorded for each subject. Epinephrine 1:10000 was then administered at a dose of 0.01 mg/kg followed by a 10 mL flush of 0.9% normal saline. A stopwatch was started on administration and stopped once a 10% increase above the baseline pulse and/or blood pressure was achieved. This value was recorded as onset of effect.

Results: Similar studies were used to calculate a large effect size of 0.6. Using a power of 0.80, an effect size of 0.6, and an alpha of 0.05, a sample size of 9 was calculated in each of the IV and TIO groups. A MANOVA indicated there were no significant differences between the IV and TIO groups relative to weight, blood volume, systolic blood pressure, or pulse, indicating that the groups were equivalent on these variables ($P > .05$). The initial systolic blood pressures and pulses by group were reported in means ± standard deviations. The systolic blood pressures were as follows: TIO 99.4 ± 27.7; IV 97.3 ± 16.0. The initial pulses were as follows: TIO 83 ± 21.0; IV pulse 88 ± 8.7. An independent t-test indicated there was a significant difference in time to onset ($P = .002$). The means ± SD of time in seconds to increase systolic blood pressure and/or pulses by 10% were as follows: TIO 14 ± 4; IV 8 ± 2.

Discussion/Conclusion: Synthesis and Conclusion: The American Heart Association recommends using the IV route for epinephrine administration; however, this recommendation is based primarily on expert opinion rather than on research data. The difference in onset of action of epinephrine between IV and TIO was statistically significant; however, it was not clinically significant. CRNAs can be confident that administration of epinephrine by the TIO route is efficacious. Relevance: Initial placement of an IV may delay epinephrine administration. A TIO is easier and faster to place in a pediatric patient. Given the clinical similarities in time of onset of epinephrine in the IV versus TIO route, the faster placement of TIO may result in improved outcomes in pediatric arrest in terms of odds and time to return of spontaneous circulation. Limitations: Swine may not be generalizable to humans; however, they do have similar cardiovascular systems and bone structure. Another limitation to this study was the small sample size, although the power was large enough to find a statistically significant difference. Recommendations for Future Research: Future studies should include a larger sample size and other IO sites. Measuring peak

and duration as well as time for elimination (t1/2β) from the body should also be investigated.
Funding Source: This study was funded by a grant from the TriService Nursing Research Program.

A Novel Device for Training and Evaluating Ultrasound-Guided Procedures in Anesthesia

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Introduction: Currently, the method of evaluating a student's skill is a professor's observation of the student performing the intervention. The novel educational device (EDU) developed provides quantitative metrics by continuously tracking the position of the probe and the instrument. EDU provides artificial intelligence-based instrument guidance. The device allows students to select a target and receive guidance about the orientation of the needle required to reach that target prior to insertion. The device also provides continuous visual overlay of the needle trajectory and the needle tip location at all times during the procedure. EDU can operate in either a with-guidance or without-guidance mode, with the ability to evaluate the same performance metrics in both modes. A total of 5 different scoring criteria were identified for use in assessing student performance.

Methods: Thirty-five student registered nurse anesthetists (SRNAs) were assessed performing infraclavicular (IC) and thoracic paravertebral (TPV) blocks. The aim was to assess performance with and without EDU's guidance. The target to be achieved was preselected by the instructor. The following metrics were evaluated: Distance to Target (DT): Distance in millimeters (mm), final needle-tip position to target. Total Procedure Time (TPT): Time between the start of the procedure and the needle-tip reaching the target in minutes (min). Phantom Penetration Time (PPT): Time between the instrument penetrating the phantom surface and the needle-tip reaching the target in minutes. Number of Attempts (NOA): Number of times the needle was redirected/withdrawn. Image Stability (IS): Amount of time the target remained at the center of the screen (percentage of total procedure duration), a summary across all attempts irrespective of guidance. A two-way repeated measures ANOVA for mean differences was conducted with Guidance (with and without) and Procedure Type (IC vs TPV) as the two within-subjects variables.

Results: In comparing the with-EDU guidance and without-EDU guidance results, statistically significant differences were seen for number of attempts. For the IC procedure, attempts ranged from 2 to 10 (M = 5.00) without guidance and from 1 to 2 (M = 1.04) with guidance. Those who performed without guidance had a significantly higher mean difference of 3.957 ($P < .001$). For the TPV procedure, attempts ranged from 1 to 10 (M = 1.96) without guidance and 1 (M = 1.00) with guidance. Those who performed without guidance had a significantly higher mean difference of 0.96 ($P = .023$). Significant main effects of procedure on time to puncture were discovered, with the time to puncture taking significantly longer for the IC (M = 4.18) compared to the TPV (M = 2.43), ($P = .013$). Overall, DT, TPT, PPT, and NOA were all enhanced with the utilization of guidance in both the IC and TPV procedures. For the IC block, students showed improved image stability [75.55 to 100 (M = 96.13, SD = 5.43) %] compared to the TPV [49.47 to 100 (M = 86.25, SD = 15.06) %].

Discussion/Conclusion: The preliminary results from this study confirm the effectiveness of our approach in a live educational environment, specifically: (1) The computation of standardized student performance assessment metrics on ultrasound usage, benchmarking against expert usage in both with-instrument-guidance and without-instrument-guidance modes, and (2) the provision of instrument targeting cues to the student which assist in targeting faster and more accurately with fewer attempts and needle redirections. The preliminary results were particularly striking in exhibiting a decreased number of attempts when SRNAs utilized the guidance mode of the EDU unit during both the IC and the TPV procedures. This study is ongoing, with additional nerve block procedures and scoring metrics planned over the course of the semester-long curriculum.

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Perceptions of Regional Anesthesia Competency Among Newly Graduated CRNAs: A Cross-Sectional Survey

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Introduction: Recent nurse anesthesia graduates desire more training in administering peripheral nerve blocks and chronic pain management to meet the growing demand for regional anesthesia. CRNAs are seeking certification in nonsurgical pain management to enhance clinical competence in managing pain. Further research exploring the quality of regional anesthesia education in nurse anesthesia schools; the availability of resources, clinical sites, and trained faculty; and the effect of facility and state policies in learning regional anesthesia, would help address the needs of current regional anesthesia education for student registered nurse anesthetists (SRNAs). This exploratory survey study aimed to identify the self-perceived level of competence in regional anesthesia among newly graduated CRNAs.

Methods: This study used an exploratory, descriptive, cross-sectional, online survey design. The survey, titled "Assessment on Perceptions of Regional Anesthesia Competency Among Newly Graduated Certified Registered Nurse Anesthetists," was used to collect the data. The AANA Research Department surveyed 2424 newly-graduated CRNAs. The survey window was open for 4 weeks. Participation was voluntary, anonymous, and non-incentivized. A total of 194 surveys met the inclusion criteria. The sample demographic characteristics were reported using frequencies and percentages. Further analysis of the data using cross-tabulation, chi-square analysis, and Levene's test for equality of variances showed the association of perceived competence to various factors, including the gender, anesthesia care delivery model at primary clinical practice, number of hours devoted to ultrasound scanning each month, and number of procedures performed during nurse anesthesia education. The qualitative data were reported using content analysis and thematic analysis.

Results: The newly-graduated CRNAs reported feeling "competent" to "very competent" in placing spinal anesthesia (65.5%), epidural anesthesia (43.8%), peripheral nerve blocks (24.2%), and peripheral nerve block catheters (6.7%). CRNAs that reported feeling "very competent" in performing regional anesthesia worked under medical supervision (45.5%) or in independent practice (45.5%). CRNAs working under medical direction were less likely to perceive as "very competent" (25.2%), $X2(3) = 9.047$, $P = .03$. Participants who felt "very competent" in performing regional anesthesia procedures independently in their first job reported receiving ultrasound scanning practice for more than 3 hours every month (71.4%) $X2(3) = 16.774$, $P = .001$ and performing more than 50 each of spinal anesthetics (63.3%), $X2(2) = 46.194$, $P < .001$, and peripheral nerve blocks (54.5%), $X2(2) = 21.132$, $P < .001$. A direct relationship was found in the number of procedures performed to the CRNA's self-perceived competence in performing regional anesthesia techniques.

Discussion/Conclusion: Among newly graduated certified registered nurse anesthetists, those who reported feeling competent to very competent in placing spinal anesthesia were 65.5%, epidural anesthesia were 43.8%, peripheral nerve blocks were 24.2%, and peripheral nerve block catheters were 6.7%. These results are supported by Cook et al, who noted that CRNAs want opportunities to administer peripheral nerve blocks and provide chronic pain management.1 The study results also align with Negrusa et al, in which CRNAs sought training opportunities in peripheral nerve blocks and epidural anesthesia.2 These findings indicate a need for improvement in regional anesthesia education for SRNAs, especially in administering epidural anesthesia, peripheral nerve blocks, and peripheral nerve block catheters. Baydar et al, showed that trainees' perception of adequate training was directly related to the application of peripheral nerve blocks in practice.3 The results of this study showed that only 43.8% of participants felt adequately prepared after completing didactic education and simulation experience. Nurse anesthesia education can be supplemented with electronic modules on regional anesthesia, video demonstrations of all procedures highlighting the key concepts, podcasts, regional

anesthesia workshops, and problem-based learning discussions to meet the trainee's need for various learning styles, so that trainees feel adequately prepared before starting their clinical rotation.

Length of Stay and Readmission Outcomes Among Patients Undergoing Total Knee Arthroplasty

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Introduction: Total knee arthroplasty (TKA) is now being performed as an outpatient procedure for select patients. A review of the research evidence supported that same-day discharge following TKA is safe and highlighted common reasons (nausea, hypotension, pain, urinary retention, and hypoxia) for same-day discharge failure. General anesthesia (GA) and neuraxial anesthesia (NA) are both safely used for TKA and anesthesia-type influences outcomes following TKA. This project's purpose was to examine TKA outcomes, stratified by anesthesia type, prior to implementation of a same-day TKA protocol at Providence Sacred Heart Medical Center (PSHMC) and Providence Holy Family Hospital (PHFH) to establish trends over time prior to the new protocol implementation. This project aimed to answer the question: Among TKA patients, what factors influence length of stay and readmissions after surgery?

Methods: This retrospective project examined adult patients undergoing primary, elective TKA at PSHMC and PHFH. PSHMC is a large level 2 trauma center and PHFH is a community hospital. The total sample size was 6740 patients, with 2609 patients receiving GA and 4131 receiving NA. Measured project outcomes included PACU and postoperative length of stay (LOS), and 90-day readmission rates to the hospital and emergency room. The sample of TKA patients was characterized utilizing appropriate univariate analysis. LOS and readmission outcomes over time were also evaluated, stratified by anesthesia type (GA or NA). This was assessed utilizing unadjusted linear and logistic regression modeling. Independent risk factors for prolonged length of stay (in PACU or in facility) and for increased readmissions at 90 days (to ER or to facility) were also identified. These factors were identified using adjusted linear regression (for length of stay outcomes) and logistic regression (for readmission outcomes) models.

Results: Findings at PSHMC and PHFH align with literature identified trends that LOS following TKA has been decreasing. Hospital stays following TKA at PSHMC and PHFH have decreased significantly over time by an average of 8.16 hours/year (95% CI 7.49-8.82, $P < .001$) for GA patients and 6.76 hours/year (95% CI 6.36-7.16, $P < .001$) for NA patients. Changes in PACU LOS over time were clinically insignificant in both groups. Ninety-day readmissions have decreased over time for both GA (OR 0.90, 95% CI 0.82-0.97, $P < .05$) and NA (OR 0.85, 95% CI 0.78-0.93, $P < .001$) patients. ER visits over time have remained unchanged.

Discussion/Conclusion: These findings, particularly the downward trend in LOS following TKA, are encouraging when considering the recent implementation of a same day TKA protocol. It is also reassuring that as reductions in LOS are observed, there has not been a parallel rise in readmissions, which could suggest that patients were being discharged too soon. Determination of independent risk factors for prolonged LOS and increased readmissions will allow the identification of TKA patients who should likely be assigned to a traditional discharge pathway versus a same day discharge pathway. Examination of practice at these facilities can inform future same-day TKA protocol revisions to promote optimal utilization of limited health care resources. This project evaluated outcomes and their trends over time in the period prior to same-day discharge protocol implementation for select TKA patients. More analysis should be completed in the period following protocol implementation to see what changes the implementation of same-day TKA has had on LOS and readmission outcomes. The main limitation of this study is that as a retrospective study it is subject to confounding biases.

Hypotension During Mechanical Thrombectomy for Large Vessel Occlusion Acute Ischemic Stroke: A Retrospective Observational Project

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Introduction: Literature evidence suggests intraoperative hypotension (IOH) during MT for large vessel occlusion acute ischemic stroke (LVO AIS) is associated with worse outcomes. Specifically, a threshold of a mean arterial pressure (MAP) < 70 mmHg for greater than 10 cumulative minutes is an independent risk factor for poor functional outcomes. The question that guided this project was: What are the rates of hypotension at this regional primary stroke center, and have they decreased over time? This project identified average case MAP, estimated cumulative hypotensive minutes, and identified the proportion of cases with IOH during MT. This project aims to share with anesthesia providers current literature evidence on the impact of blood pressure management as well as evolving rates of hypotension during MT at this regional primary stroke center.

Methods: This retrospective observational project included adult patients >18 years undergoing MT for LVO AIS at this regional primary stroke center. Univariate analysis examined patient demographics, case characteristics, and case average MAP and estimated cumulative minutes under the hypotensive threshold and MAP <70 mmHg as well as the proportion of cases that experienced IOH as defined by MAP <70 for greater than 10 minutes. Estimated cumulative hypotensive minutes were calculated using both noninvasive and arterial line readings. Bivariate analysis examined changes in average MAP, average estimated cumulative hypotensive minutes, and proportion of IOH over time. Binary linear and logistic regression examined unadjusted changes in mean MAP, estimated cumulative hypotensive minutes, and proportion of IOH over time. Multivariable analysis reported fully adjusted changes to project outcomes controlling for literature identified covariates.

Results: Among 442 patients who underwent MT for LVO AIS, 51.6% were female and 48.4% were male, the average age was 72.1 years old, and the two most common comorbidities were hypertension (56.8%) and previous history of stroke (50.5%). The median case duration was 115.0 minutes (IQR 93-141) and all but two cases received general anesthesia. The average case MAP increased from 87.3 to 91.1 mmHg over time, with an adjusted increase of 3.7 mmHg (95% CI, 1.3-6.1, *P* = .003). The average estimated cumulative case hypotensive minutes based on MAP <70 mmHg decreased over time from 17.8 to 11.5 minutes, with an adjusted decrease of 5.5 minutes (95% CI, 1.4-9.6, *P*= .009). The risk of IOH decreased from 51.5% to 34.7% over time, with odds decreasing from 1.0 to 0.5 (AOR 0.5, 95% CI, 0.32-0.78, *P* = .002). Across three identified measurements, measured hypotension decreased over time. When controlling for literature identified covariates, project results remained consistent.

Discussion/Conclusion: During MT, literature evidence has identified a hypotension threshold of MAP <70 mmHg for 10 cumulative minutes as an independent risk factor for poor functional outcomes. Data gathered from this project has demonstrated an increase in MAP over time and a decrease in the rates of hypotension. Furthermore, the estimated cumulative minutes spent under the hypotensive threshold has decreased over time from an average of 17.8 to 11.5 minutes per case. The proportion of patients who experienced IOH during MT has also decreased over time from 51.4% to 34.7%. This data demonstrates hypotension at this primary stroke center is decreasing over time. Future areas of inquiry could include investigation into the prevention and treatment of hypotension with the use of preemptive vasoactive infusions. Limitations of the current project included its retrospective and observational nature. Limitations with EMR data collection precluded full analysis of certain literature covariates including last known well, body mass index, Modified Rankin Score, and Modified Treatment in Cerebral Ischemia score. Hypotension during MT has the potential for detrimental and lasting effects on patients who suffer a stroke. Patients receiving MT have experienced an overall reduction of hypotension rates over time.

Propofol-ketamine Versus Propofol-remifentanil in Office-based Facial Plastic Surgery: Comparison of Postoperative Pain

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Introduction: Numerous intravenous (IV) sedation techniques coupled with local anesthetic infiltration are utilized for office-based surgical procedures. Propofol and remifentanil infusions offer sedation and analgesia but increase the risk of commonly associated opioid analgesic side effects, such as nausea, vomiting, hyperalgesia, and respiratory depression. Recent literature has validated the efficacy of propofol with ketamine as an alternative to opioid use. This research compares postoperative pain scores in patients undergoing submentoplasty (neck lift) and/or rhytidectomy (facelift) procedures in an office-based setting receiving IV sedation with either propofol-remifentanil (PR) or propofol-ketamine (PK). Consider the null hypothesis; the use of a PK anesthetic will have no effect on postoperative pain scores compared to PR in neck and/or facelift surgery.

Methods: This Institutional Review Board-approved retrospective medical record review included a total of 4302 medical records from September 2011 to March 2021 for a single office-based plastic surgery practice. Patient demographics, perioperative medications, perioperative events, vital signs, and perioperative pain scores were reviewed and recorded. Records were excluded if they did not involve neck or facelift procedures, were performed at a location outside of a free-standing office-based facility, the patient was < 18 years old, neither the PK nor PR technique was used, or charting was incomplete. This left a total of 512 records for analysis. Intravenous sedation for the PR group consisted of continuous infusions of propofol and remifentanil, while the PK group received a continuous propofol infusion with ketamine boluses. Postoperative and discharge pain scores were compared between groups using the 2-tailed Man-Whitney U test, with a 0.95 confidence interval and $P < .05$ considered significant.

Results: The PR group consisted of 160 subjects, 12 male and 148 female, aged 40 to 78 years (mean 58 years). The PK group consisted of 374 subjects, 22 male and 352 female, aged 22 to 76 years (mean 58 years). Preoperative pain scores between groups were statistically different ranging from 0 to 7 out of 10 (mean 0.7) in the PK group and 0 to 6 out of 10 (mean 0.4) in the PR group ($P = .014$). Differences in postoperative and discharge pain were not statistically different between PK and PR groups with a mean pain score of 2.33 and 2.52 for postoperative and 2.2 and 2.28 for discharge pain respectively ($P = .11$ postoperative, $P = .29$ discharge). Due to significant differences in preoperative pain scores, a sub-analysis of postoperative pain in subjects with no preoperative pain was performed, showing no statistical difference ($P = .064$). Despite similar pain scores, more postoperative rescue analgesics (opioids and IV acetaminophen) were given in the PK group ($P = .0028$). However, recovery to discharge time was decreased in the PK group ($P < .001$).

Discussion/Conclusion: Although sedation with PK allowed for slightly lower postoperative and discharge pain scores when compared to PR, the differences were not statistically significant. The PK method showed increased use of rescue pain medication postoperatively but allowed for a shorter time from recovery to discharge. These findings provide insight into postoperative pain relief among patients undergoing neck and facelift procedures and support the use of non-opioid anesthetic management. Other findings included no statistical difference for intraoperative IV or postoperative oral acetaminophen administration. Anecdotally, the surgeon and surgical staff reported higher satisfaction with the PK technique citing more consistent stable operating conditions and increased staffing availability due to faster discharge times. No patients from either group required endotracheal intubation. Limitations include the retrospective nature of the chart review, lack of a control group to compare the same procedure under differing IV sedation techniques, incomplete charting, and differing local anesthetic and pain management protocols over time. Results could be complicated by the amount and concentration of local anesthetic used to facilitate other procedures performed concomitantly.

Recommendations for future research include comparing cost, surgical complications, and patient satisfaction between groups.

Incidence, Predictors, and Outcomes of Extubation Failure in Pediatric Congenital Heart Disease Cardiovascular Surgery Patients

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Introduction: Clinicians around the country are moving towards early extubation in pediatric congenital cardiac surgery patients as evidence demonstrates risks of prolonged postoperative mechanical ventilation including but not limited to infection, airway injury, and increased exposure to sedatives. However, whether this practice would lead to more extubation failure (EF) needs further examination. Reintubation of these patients is a high-risk procedure with potential for life-threatening consequences such as profound hypoxemia, hemodynamic instability, and cardiopulmonary arrest. The research team hypothesized perioperative risk factors that may be associated with EF and performed statistical analysis to determine their significance. The purpose of the study was to identify significant modifiable risk factors associated with EF to assist with safer early extubation of this population.

Methods: A single-center, retrospective chart review was conducted at a teaching hospital in the Midwest with patients ≤ 2 years with congenital heart diseases admitted to the pediatric cardiovascular (CV) surgery/transplant intensive care unit post-CV surgery who underwent cardiopulmonary bypass (CPB) between 2007 and 2019 (n = 599). Extubation Failure was defined as the need for re-intubation within 72 hours of extubation, and several perioperative risk factors were identified. Association between the risk factors and EF was studied via statistical analysis using BlueSky software. The Kruskal-Wallis test was used to examine the continuous variables, Fisher's exact test was used for categorical variables, and logistic regression was used for multivariable analysis.

Results: Descriptive statistical analysis was performed to determine the perioperative risk factors and outcomes for EF. Incidence of EF was 6.3% (38 of 599). Risk factors that were found to be significantly associated with EF ($P < .05$) with single variate analysis were further investigated using a logistic regression model adjusted for body weight and STAT category. Risk factors that demonstrated significant association with EF ($P < .05$) using multivariate analysis include: gender, benzodiazepine use within 24 hours prior to extubation, postoperative RBC transfusion, and early extubation. The unexpected finding of gender being a significant risk factor was further investigated with confounding variable analysis and interaction analysis. Gender was shown to be a significant risk factor after adjusting for potential confounders. Hospital and intensive care unit (ICU) length of stay were shown to be prolonged in patients who had EF, but 30-day mortality was shown to have no difference among the sample patients.

Discussion/Conclusion: Low body weight and high STAT category were previously shown to be significant risk factors for EF in multiple studies. Findings from the present study were adjusted by body weight and STAT category to rule out the possibility of them confounding with other factors, and it was found that female gender, use of benzodiazepines 24 hours prior to extubation, and postoperative RBC transfusion of any amount demonstrated positive association with EF. Early extubation, however, demonstrated negative association with EF after adjusting for weight and STAT category. Most previous studies have demonstrated no gender difference in risk of EF, but few suggested that females may have a higher risk of post-extubation stridor likely from small airway size. However, this hardly applies to the sample population of the present study. Due to the small number of patients who experienced EF and newly implemented extubation practice change, this study has limited statistical power to detect risk factors. All hypothesized risk factors, regardless of the findings from this study, should be taken into consideration in clinical practice. Non-significant findings from the risk factor analyses should not be interpreted as evidence of no association. Recommendation for future study is to further evaluate modifiable risk factors of EF with larger sample size across institutions that have implemented early extubation practice for a longer period of time.

Endotracheal Administration of Epinephrine in a Pediatric Cardiac Arrest Swine Model

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Introduction: Euvolemic cardiac arrests in children include blunt trauma, respiratory, drowning, and infectious causes. Regardless of the etiology, rapid administration of epinephrine decreases morbidity and mortality. CRNAs need to know the most effective method of administering epinephrine for pediatric patients in cardiac arrest. Since endotracheal tube (ET) access may be obtained before intravenous (IV) access, the effectiveness of ET administered epinephrine must be investigated. Our aim was to determine mean concentration (MC) over 5 minutes, area under the curve (AUC), maximum concentration (Cmax), time to maximum concentration (Tmax), frequency, and time of return of spontaneous circulation (ROSC) of epinephrine comparing ET and IV routes. There are currently no studies demonstrating the effectiveness of endotracheal epinephrine in an euvolemic pediatric model.

Methods: Design: This prospective, experimental study used male pediatric swine weighing 24-37 kg, which represents the average weight of a child between 5-6 years of age. Intervention: Four groups were used: ET (N = 8), IV (N = 7), and 2 control groups (no epinephrine). All swine were placed into cardiac arrest for 2 minutes and then CPR was initiated for 2 minutes. A dose of 0.1mg/kg of epinephrine was then administered by ET or 0.01 mg/kg for IV and continued every 4 minutes or until ROSC. Defibrillation (if applicable) was begun at 3 minutes and continued every 2 minutes for 30 minutes or until ROSC. Blood samples were collected over a period of 5 minutes. Setting: An approved animal laboratory was used. Statistical Tests: A multivariate analysis of variance was used to determine if there were significant differences between the groups relative to the pretest data, Cmax, Tmax, AUC, MC, and time to ROSC. A Chi-Square was used to determine if there were differences in occurrence of ROSC. The odds of ROSC were calculated.

Results: No significant differences existed in pretest data in any groups of swine or in occurrence of ROSC between the IV and ET groups ($P > .05$). All ET subjects (8 out of 8), 5 out of 7 IV subjects, and 2 out of 5 subjects achieved ROSC in the CPR+defibrillation group. Odds of ROSC were 14x greater for the ET vs IV group. The plasma Cmax was significantly higher for the IV vs ET group ($P < .001$). The means ± standard deviations (SD) for the IV and ET groups were 428.2 ± 38.6 ng/mL and 195.4 ± 32.6 ng/mL respectively. Tmax was significantly shorter for the IV vs ET Group ($P < .001$). The means ± SD for the IV and ET groups were 42.0 ± 10.4 and 145.7 ± 8.8 seconds respectively. There was no significant difference in AUC between the two groups. The means ± SD for the IV and ET groups were 30,324.6 ± 7,985.2 ng/mL and 35,522.5 ± 6,748.7 ng/mL respectively. No significant difference existed in time to ROSC between the IV and ET groups ($P = .616$). The means ± SD in seconds for the IV and ET groups were 398.4 ± 73.4 and 348.6 ± 62.1 respectively.

Discussion/Conclusion: Synthesis and Conclusion: Based on the results of this study, the ET should be considered as a first-line intervention for pediatric cardiac arrest. Studies show that intubation time is approximately 34 seconds compared to a lengthier time for gaining IV access. The chances of ROSC are reduced by 9 percent for each minute of delay in administering epinephrine The valuable time saved using the ET route may translate into a greater likelihood of achieving ROSC. Limitations: One limitation of this study was that the swine model may not be generalizable to humans; however, pigs have similar cardiovascular structure and bone structures to humans. The study also had a small sample size, although there was a large enough sample size to yield statistical difference between groups. Recommendations for Future Research: Recommendations for future research are to replicate this study with a larger sample size and in the adult normovolemic model. Research should also be completed to evaluate the effectiveness of implementing weight-based dosing of epinephrine into the adult advanced cardiovascular life support (ACLS) algorithm.

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Use of Single-Dose Dexamethasone in Patients with Diabetes Undergoing Surgery: A Systematic Review and Meta-Analysis

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Introduction: Postoperative nausea and vomiting (PONV) is a common complication after surgery that may lead to a prolonged hospital stay, increase readmission rates, and adversely impact patient satisfaction. Dexamethasone is a pharmacologic agent frequently used by anesthesia professionals for PONV prevention. However, even a single dose is associated with transient increases in blood glucose concentrations within 24 hours. There is concern among providers that this may lead to hyperglycemia in patients with diabetes. As such, clinicians may be unnecessarily withholding this medication to prevent elevations in blood glucose. Current literature does not commit to the degree in which serum glucose changes post administration. The purpose of this meta-analysis is to examine the effect of single-dose dexamethasone on perioperative blood glucose in patients with diabetes.

Methods: A comprehensive search was conducted within PubMed, Google Scholar, EBSCO, Cochrane Collaboration Database, and the US National Library of Medicine. Grey literature was also explored to reduce bias. Only randomized control trials (RCT) comparing surgical patients with diabetes receiving dexamethasone or a control were considered. The Grades of Recommendation, Assessment, Development, and Evaluation (GRADE) were used to rate the certainty and overall quality of the findings. Statistical analyses were performed using the Review Manager (RevMan 5.4, The Cochrane Collaboration). Outcome measures were extracted and reported as mean difference (MD) and risk ratio (RR).The glucose concentrations were quantified by change in mg/dL from baseline to peak affect. All blood glucose levels were converted to mg/dL for analysis using published conversion factor (mg/dL = 18 × mmol/l).

Results: A total of 1321 surgical participants with diabetes were examined across seven studies. The difference in glucose concentration from baseline was 33.61 mg/dL (MD, 33.61; 95% CI, 17.59 to 49.63; $P < .0001$). As a secondary outcome, levels were assessed at 1–4 hours (early) and 8–24 hours (late) after administration. The mean glucose in the early group was 29.02 mg/dL higher than the control (MD, 29.02; 95% CI, 7.09 to 50.94; $P = .010$). Similarly, blood glucose levels increased by a mean of 30.81 mg/dL in the late groups (MD, 30.81; 95% CI, 9.21 to 52.41; $P = .005$). There was no difference in the surgical site infection (SSI) among the two RCT (n = 1106 patients) that measured (RR, 0.81; 95% CI, 0.59 to 1.11; $P = .19$). Pooled estimates from two RCTs showed no difference in total amount of insulin administered between groups (MD,0.70; 95% CI, -1.17 to 2.57; $P = .46$).

Discussion/Conclusion: Findings suggest that single-dose dexamethasone results in a marginally higher increase in blood glucose level from baseline. Patients with diabetes had an average blood glucose increase of 33.61 mg/dL from preoperative baseline values. The clinical relevance of the high blood glucose level may be operationalized by the incidence of SSI. Although the blood glucose levels were significantly higher in patients treated with dexamethasone, the meta-analysis showed no difference in SSI incidence. This estimate was based on two high-powered RCTs. Limitations of this review include reduced study durations of 24 hours or less, six of the RCTs had small sample sizes, and insulin was administered based on certain studies' definition of hyperglycemia. Patients with diabetes exhibit a more significant hyperglycemic response to dexamethasone given for PONV regardless of dosage when compared to a control. Despite statistically significant changes in blood glucose levels from baseline, little to no evidence was found that the use of dexamethasone increased the risk of SSI. However, caution should be used when extrapolating the findings of this review to the clinical setting because of the small sample sizes, potential publication bias, and substantial heterogeneity in the outcome measures. Nonetheless, clinicians are encouraged to weigh the benefits of dexamethasone use for PONV against the contribution to hyperglycemia.

Improving Knowledge, Attitudes, and Empathy Among Perioperative Clinicians When Caring for Transgender Patients

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Introduction: According to the Office of Disease Prevention and Health Promotion, transgender individuals are at greater risk of contracting HIV and other sexually transmitted infections, mental health conditions, and increased self-harm and suicide, in comparison to the general US population. The most frequently cited healthcare barrier for transgender people is accessing knowledgeable and empathetic providers. Specific to perioperative clinicians, there is a lack of education and training available surrounding the unique needs of the transgender population during the perioperative period. The purpose of this project was to develop and implement an interprofessional educational intervention about perioperative care considerations for transgender patients, and to assess clinicians' knowledge, attitudes, and empathy with pre- and post-intervention surveys.

Methods: This project design was a pre-post survey evaluation of a virtual, interactive, interprofessional educational intervention about perioperative care considerations for transgender patients. Invited clinicians included CRNAs, NPs, RNs, SRNAs, and certified surgical technologists who worked in the perioperative areas at a 673-bed tertiary academic medical center in Boston, MA. Clinician knowledge of the aspects of health care for transgender adults was assessed using 8 multiple-choice and true-false questions. Clinician attitudes towards transgender patients were assessed using 6 Likert-style questions. Clinician empathy (including subscales of affective and cognitive empathy) was assessed using the validated Kiersma-Chen Empathy Scale, which comprises 15-Likert style questions. Participants' pre-intervention survey responses underwent descriptive exploratory analysis while selected inferential statistics were used to assess the effectiveness of the intervention based on participants' pre- and post-intervention survey scores.

Results: Analysis included 112 pre-intervention survey responses from perioperative clinicians (RNs, SRNAs, CRNAs, NPs, and CSTs), and pre-post responses from 44 nurses (cohort 1) and 23 APRNs (cohort 2). Using Pearson Correlations: 1) Significant positive correlations were demonstrated between pre-intervention knowledge and attitudes ($P = .001$), knowledge and empathy ($P < .001$), and attitudes and empathy ($P < .001$) among perioperative clinicians; and 2) significant positive correlations were found between pre-intervention knowledge and attitudes ($P = .024$), knowledge and empathy ($P < .001$), and attitudes and empathy ($P < .001$) among nurses in Cohort 1. Additionally, a paired sample t-test showed a significant increase in Cohort 1's knowledge ($P < .001$) and attitudes ($P < .001$) following the intervention. There was also a significant increase in Cohort 2's knowledge ($P = .009$), attitudes ($P < .001$), and empathy ($P = .014$), in addition to affective ($P = .041$) and cognitive ($P = .034$) empathy, after the intervention.

Discussion/Conclusion: Upon completion of this research project, three main conclusions emerged: 1) educational interventions are effective in improving perioperative clinicians' knowledge and attitudes when caring for transgender patients; 2) educational interventions are effective in improving APRNs' empathy, including subscales of affective and cognitive empathy; and 3) knowledge, attitudes, and empathy when caring for the transgender population are interrelated, as evidenced by the significant, positive correlations identified among them. While this project supports previous research findings that education is effective in improving clinicians' knowledge related to transgender care, this project was the first to demonstrate statistically significant effectiveness in improving the attitudes and empathy of practicing APRNs and those in training. Limitations of the project included omitting survey questions assessing participants' exposure to transgender people, either in the perioperative practice setting or in their personal lives. Some recommendations for future scholarship regarding gender diverse populations include assessing the effectiveness of the intervention for different clinician role groups and

assessing alternative interventions to improve empathy among nurses.

Development of Glutamate Transporter Modulators as a Novel, Non-opioid Treatment for Chronic Pain

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Introduction: Current non-opioid treatments for chronic pain are not fully effective and patients remain heavily reliant on opioid therapy risking misuse. While many mechanisms contribute to the development of chronic pain, dysfunction in glutamate homeostasis plays a large role. This study identified a novel series of potent, selective, positive allosteric modulators (PAMs) which increase the activity of excitatory amino acid transporter 2 (EAAT2), the main transporter in the central nervous system responsible for removing extracellular glutamate. It was hypothesized that the compounds woud provide analgesia in animal models of chronic pain by removing excess glutamate from the extracellular space through increased EAAT2 activity. This novel mechanism would decrease the stimulation of post-synaptic receptors, ultimately leading to decreased transmission of pain signaling.

Methods: This study explored the regulation of glutamate transporters in chronic pain, uncovered potential sex differences, and investigated a new therapeutic modality: EAAT2 PAMs. Experimental compounds must first be tested in animals before human testing in clinical trials. For this study, male and female mice (n = 480) were subjected to a clinically relevant model of chronic pain, the spared nerve injury, which produces mechanical and thermal sensitivities. After nerve injury surgery, the mice were administered different doses of the compounds before behavioral testing (Von Frey assay; dynamic weight bearing assay). The animals were euthanized following behavioral studies, and tissue (brain, spinal cord, dorsal root ganglia) was collected for quantification of protein levels of glutamate transporters. These studies were conducted in a laboratory setting in the Department of Pharmacology and Physiology at Drexel University. Statistical analysis included one-way repeated measures ANOVA, two-way RM ANOVA, Dunnett's Post-hoc test, and Bonferroni's mu.

Results: Several preliminary studies using in vitro and in vivo models were used to demonstrate that the experimental compound, NA-014, targets EAAT2 and provides pain relief in injured animals. Radioactive uptake assays are in vitro assays that measure EAAT activity and provide data of test compounds on the direct stimulation of EAAT function and selectivity. From these measurements, glutamate transporter uptake in the presence of NA-014 was compared to vehicle and there was a dose-dependent increase in glutamate uptake following NA-014 treatment only on EAAT2, revealing that NA-014 is a positive allosteric modulator of EAAT2. For preliminary in vivo studies, the spared nerve injury model was used. Mechanical sensitivity was assessed using the von Frey method to demonstrate analgesic efficacy. When NA-014 was administered in male rodents at 7 days after the surgical procedure, a dose response effect occurred demonstrating antinociception. The study will be performed on a larger scale and expanded to females.

Discussion/Conclusion: The overall impact of this study is to understand the regulation of glutamate transporters after peripheral nerve injury and identify novel therapeutics for chronic pain patients. Allosteric modulation of the glutamate transporter, EAAT2, is an innovative mechanism to provide analgesia by restoring glutamatergic homeostasis. Analgesic effects of the lead compound, NA-014, were demonstrated in male rodents subjected to nerve injury surgery. Future studies are required to understand how EAATs are dysregulated in the brain and spinal cord after nerve injury. Transgenic models of EAAT2 mutants that have increased efficiency of glutamate transport will be used to further elucidate the role of EAATs in the development of chronic pain. In addition, the NA-014 pharmacokinetic profile needs improvement to increase compound solubility, blood-brain barrier penetrance, and decreased plasma clearance. Ultimately, this research is expected to significantly impact clinical approaches for the future management of chronic pain.

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