

Submitter: Ashley Adams

Title: Electroconvulsive Therapy in Guillain Barre Syndrome

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Background: Electroconvulsive therapy (ECT) is a recommended treatment option for patients with bipolar disorder who are refractory to medical management. Succinylcholine has traditionally been the muscle relaxant of choice for ECT given its rapid onset of action and short duration of effect. However, the use of succinylcholine is contraindicated in those with neuromuscular disorders due to increased risk of hyperkalemia and postoperative respiratory failure. We will discuss the use of the nondepolarizing muscle relaxant rocuronium and its reversal with sugammadex for a patient with a history of Guillain Barre syndrome (GBS).

Case Description: A 69 year old female with past medical history of hypertension, GBS in 2015 with no residual weakness, and bipolar II disorder, complicated by multiple psychiatric admissions presented for ECT. Preoperative assessment included both anesthesiology and neurology evaluations. The patient had several surgical procedures requiring anesthesia since 2015 that did not include administration of neuromuscular blockers. Electromyography(EMG) performed in 2021 demonstrated no evidence of residual weakness. The patient was cleared from a neurologic standpoint given resolution of symptoms and normal EMG. Our anesthetic plan was to proceed with general anesthesia using rocuronium instead of succinylcholine because of the risk of hyperkalemia. Premedication included ketorolac, glycopyrrolate and lidocaine. Induction of anesthesia included methohexital and 0.4mg/kg of rocuronium. Intermittent mask ventilation with 100% oxygen was performed for three minutes with concurrent peripheral ulnar nerve stimulation at 1 Hz per second. Bilateral ECT stimulus was given when adequate muscle relaxation was achieved. Postictally, the patient received propofol and muscle paralysis was reversed with 4mg/kg of sugammadex. The patient was monitored for four hours in the PACU for respiratory depression and hypoxia. After three uneventful ECT treatments and monitoring, the four hour postoperative monitoring was discontinued. The patient's mood improved by treatment #5 and after treatment #6, the patient elected for early discharge to home.

Discussion: Succinylcholine is generally avoided for patients with neuromuscular disorders. For patients who require ECT, such as this patient with history of GBS, the use of rocuronium and sugammadex did not result in hyperkalemia, residual weakness or postoperative respiratory failure. This was demonstrated even after multiple ECT treatments.

Submitter: Natalia Adderley

Multidisciplinary approach to an orthopedic patient with high risk of MACE(Major Adverse Cardiac Event) and history of adverse reaction to lidocaine.

Natalia Adderley MBBS, Codruta Soneru MD, Tim Petersen PhD, Lev Deriy MD

Introduction: True allergies to local anesthetics are rare. We investigated a presumed amide allergy in a patient with recent coronary revascularization requiring surgical fixation of a bimalleolar fracture.

Case:

Our case is a 57 year old male with ST segment elevations, triple vessel disease, and history of chronic hypertension and chronic smoking. A right bimalleolar fracture was noted on the day of drug-eluting stent placement. On POD4, a multidisciplinary conference was held. Given high risk of major adverse cardiac events (MACE), Cardiology recommended waiting 4-6 weeks. Orthopedics warned that delay carried high risk of limited mobility and arthritis. Anesthesia suggested performing the procedure under regional anesthesia. He however endorsed 2 episodes of adverse reactions to "lidocaine based" solutions during dental and ophthalmic procedures described as loss of consciousness. The team referred him to Allergology; prick test and intradermal injections with bupivacaine and ropivacaine were negative. He was given the option of surgical fixation under regional anesthesia but later opted to continue physical therapy alone given his good progression.

Discussion:

Local anesthetics (LA) have 3 components: a hydrophilic amine group, lipophilic aromatic group and intermediary link. The latter differentiates the two classes of LA: esters and amides.

The overall incidence of LA allergy is low. One review found only 29 (<1%) true IgE-mediated allergies to LA observed². While esters are more likely to produce allergic reactions due to para-aminobenzoic acid metabolites released after hydrolysis, incidence is higher with the amide group probably due to wider use.

True IgE-mediated allergies to LA are uncommon.² Most adverse events are related to additives (e.g epinephrine), vasovagal syncope, psychomotor responses, procedural trauma reactions and delayed hypersensitivity reactions. Patients with suspected true allergy to LA should have skin testing and challenge tests done to investigate cross-reactivity.

Conclusions: Local anesthetic allergies are uncommon. They are more likely associated with additives or the ester LA class. Our multidisciplinary approach featuring regional anesthesia allowed the procedure to be performed promptly, improving the likelihood of complete functional recovery while reducing risk of MACE. Clinicians are encouraged to confirm suspected allergies to broaden anesthetic options for all patients especially those at high risk of MACE.

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Submitter: Agatep, Christian Mark

Title: Atypical Presentation of Hypocalcemia in the PACU following Parathyroidectomy

Author(s)/Institution(s):

- Christian Mark Agatep
- Sampreeti Chowdhuri
- David Cohen, MD
- Taizoon Dhoon, MD
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Background

Hypocalcemia is the most common morbidity following parathyroidectomy, with an incidence of 15-30%. Typically, a significant decrease in calcium levels postoperatively and symptoms are not evident until the third- or fourth day following parathyroidectomy. We describe a case of symptomatic hypocalcemia that occurred in the first hour following an uncomplicated parathyroidectomy.

Case Description

A 49-year-old woman with medical history of primary hyperparathyroidism with worsening muscle pain, generalized weakness, depression, and confusion was scheduled for parathyroidectomy. She was prescribed Cinacalcet 30 mg/day as bridge treatment until her scheduled surgery.

Parathyroid hormone level (PTH) was drawn pre-operatively (111 pg/mL). The parathyroidectomy was performed under general anesthesia. Three other PTH lab draws were collected intra-operatively every 30 minutes (52 pg/mL→ 55 pg/mL→ 41 pg/mL). Following an uncomplicated procedure, the patient was brought to the PACU in stable condition.

Within one hour, the patient developed sudden onset chest pain, left sided facial pain, decreased bilateral upper and lower extremity weakness, and hypophonia. Blood test showed hypocalcemia (8.1 mg/mL) and EKG indicated prolonged QT interval (480 ms)

The patient was initially administered 1g IV calcium gluconate. The patient's hypophonia resolved within thirty minutes, while the chest pain improved after an hour. However, the patient still suffered from marked muscle weakness. Thus, a second dose of 1g IV calcium gluconate was administered. Upper and lower extremity weakness grossly improved.

A CT head ruled out stroke, hemorrhage, or mass. Repeat blood test revealed calcium levels within the normal range. The patient was admitted overnight for observation. Overnight, the patient's calcium levels remained stable with improved symptoms. The following morning, the weakness had fully resolved. A blood test was again ordered resulting with hypocalcemia (7.7

mg/mL). She was then administered 2g IV Calcium gluconate. After 1 hour, her calcium level (11 mg/mL) significantly improved. She was discharged with oral calcium supplements.

Discussion

Hypocalcemia is a common but potentially dangerous complication of parathyroidectomy. Our patient presented with symptoms of chest pain, facial pain, and generalized weakness which are previously known symptoms of hypocalcemia. However, our patient also presented with hypophonia which, to our knowledge, has not previously been described in patients with hypocalcemia. The hypophonia may be due to the effects of hypocalcemia on the vocal cords and vocal cord musculature leading to poor coordination.

Our case findings highlight the importance for clinicians to note that hypocalcemia may present with atypical symptoms in unexpected timeframes.

Submitter: Matthew Agsalud BS

Title: ACE Inhibitor Induced Vasoplegia

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Background: ACE inhibitor induced vasoplegia is a well recognized problem that manifests as vasoplegic syndrome (1). This is a condition that is characterized by normal to elevated cardiac output and a low systemic vascular resistance. Vasoplegic syndrome is also commonly associated with cardiopulmonary bypass (2). The role of ACE inhibitors in this condition has been debated for many years and has led to differing recommendations about the perioperative use of these medications. Lisinopril a commonly prescribed ACE inhibitor has a half life of 12-13 hours and a duration of action of approximately 24-30 hours. This has led to the recommendation of holding this medication for the day before surgery at many institutions (3, 4). We present a case of a 19 year old patient on an ACE inhibitor for renal protection who presented for a cervical fusion and had refractory vasoplegia after induction of anesthesia despite holding his ACE inhibitor for >24 hours.

Case Description: A 19 year old with a past medical history significant for congenital nonunion of the dens presented for occipital to C2 fusion. His medical history was also significant for chronic kidney disease (stage 3), Factor V Leiden, hypertension, asthma, and a previous right nephrectomy for congenital kidney fusion. During a previous surgery he had significant hypotension intraoperatively which was theorized to be related to his ACE inhibitor. Given this he was advised to hold his ACE inhibitor for 24 hours before surgery. He was intubated with succinylcholine and propofol utilizing a video laryngoscope given his history of atlanto-axial instability. He was started on a total intravenous anesthetic composed of propofol and remifentanyl. He tolerated induction well however rapidly became hypotensive requiring significant vasopressor support to keep his mean arterial pressures above 65. His blood pressure did not respond to fluid boluses. A rescue transthoracic and transesophageal echocardiogram was performed and showed a low afterload state, but was otherwise unremarkable. The decision was made to delay the case to allow for a longer washout period of the antihypertensive medication. He was emerged from anesthesia and was immediately hemodynamically stable without any vasopressor support. A tryptase was drawn and later found to be negative. His ACE inhibitor was held for 5 days and his surgery was completed without incident.

Discussion: ACE inhibitors are an integral part of long term antihypertensive and renal protective strategies. However, in the perioperative period administration of these medications may lead to adverse outcomes such as acute kidney injury, atrial fibrillation, increased mortality, and vasoplegia (5). While many institutions recommend holding ACE inhibitors for 24 hours before surgery there may still be active medication and metabolites still in circulation. Our patient may have been at increased risk of vasoplegic syndrome due to his history of stage 3 chronic kidney disease and therefore prolonged excretion of ACE inhibitors. Other common medications that may lead to vasoplegic syndrome preoperatively are: angiotensin-II antagonists, heparin, amiodarone, aprotinin, and protamine (1). Management of vasoplegic syndrome consists of intravenous volume, catecholamines, and vasopressin. In non-emergent cases cessation of anesthesia may be warranted.

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Submitter: Chelsea Alfafara, MD

Individual- and Community-level Socioeconomic Status and Renal Transplant Outcomes

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Introduction: Prior research has demonstrated a relationship between socioeconomic status (SES) and race and renal transplantation rates and outcomes, with those of lower SES and non-White race experiencing disproportionately lower rates of transplantation and higher rates of allograft failure. This study aims to examine the relationship between race and SES on kidney transplant outcomes.

Methods: This is a retrospective cohort study of 2965 renal transplant recipients from 1999-2021 at a tertiary care center in Arizona. A marker of community-level SES, known as the concentrated disadvantage index (CDI), as well as several individual-level SES markers were analyzed to identify differences in graft failure and mortality. A combination of regression models were used to examine differences between groups based on SES. Survival analyses were used to examine survival by SES adjusting for chosen covariates.

Results: The highest CDI subgroup, or lowest SES, compared to the lowest CDI experienced higher delayed graft failure rates (RR, 1.185, $P < 0.0013$). Public insurance coverage was also associated increased risk of delayed graft failure (RR, 1.33, $P < 0.001$). Black race compared to White race was significantly associated with increased risk of delayed graft failure (RR, 1.404,

P<0.001), increased risk of early graft failure (HR, 1.605, P<0.01), and decreased 3- and 5-year survival rate (HR, 0.678, P<0.035).

Conclusions: Consistent with prior studies, this study demonstrates the inverse relationship between SES and failure rates. Black persons continue to be at increased risk of allograft dysfunction post-transplantation. These findings have the potential to inform individual- and system-level interventions aimed at reducing disparities in renal transplant recipients.

Submitter: Zahir Allarakhia, MD

Title: Airway management for flexible bronchoscopic biopsy of a symptomatic obstructive subglottic lesion

Authors: Zahir Allarakhia, MD; Nicole Yin, MD (Department of Anesthesiology, Harbor-UCLA Medical Center, Torrance, CA, USA)

Background: In patients with obstructive subglottic lesions, the anesthesiologist must balance the need for airway protection with the risks associated with airway instrumentation.

Case Description: A 65-year-old woman with a history of well-controlled hypothyroidism presented with four weeks of progressive audible inspiratory stridor, dyspnea on exertion, and orthopnea. She had no supplemental oxygen requirement sitting up. CT imaging revealed 50% subglottic stenosis of the superior trachea with mild thyromegaly. On flexible laryngoscopy performed by otolaryngology, the anterior wall of the superior trachea was found to be eroded with exposed cartilage, secondary to either granulation tissue or a mass. This precluded her from tracheostomy. Initial rheumatologic and infectious workup of the lesion was inconclusive, and the decision was made to perform a biopsy.

The possibility of airway compromise during biopsy necessitated intubation, yet the patient's tenuous respiratory status precluded asleep intubation, so the decision was made to proceed with awake intubation. The patient was administered glycopyrrolate to minimize secretions, and the airway was topicalized with 4% lidocaine – gargled, nebulized, and sprayed on the posterior pharynx and tonsillar pillars. She was then administered midazolam and started on a low-dose remifentanyl infusion until she was able to tolerate a nearly supine position while maintaining spontaneous ventilation. She was then gently intubated orotracheally with a 7.0 mm endotracheal tube using flexible fiberoptic laryngoscopy. To avoid traumatizing the tracheal lesion, the tip of the endotracheal tube was advanced just slightly past the vocal cords, resulting in the cuff remaining above the vocal cords. A low-dose propofol was then initiated, but promptly discontinued due to a brief period of apnea. The pulmonology team then performed biopsies with a small flexible bronchoscope, during which the patient remained awake and spontaneously ventilating. She was then extubated and had an unremarkable immediate postoperative course.

Discussion: Intubation of awake patients is often uncomfortable, even with extensive topical anesthesia. In stable patients with normal mental status and respiratory drive, it is reasonable to use carefully titrated intravenous anesthetic agents as an adjunct to topical anesthesia to provide adequate comfort and optimize intubating conditions while maintaining spontaneous ventilation. Remifentanyl is an ideal agent for this, given its reliably short context-sensitive half-life.

Endotracheal tube cuffs provide airway protection by occluding the trachea to prevent aspiration. In our patient, the endotracheal tube was not advanced far beyond the cords to minimize the risk of traumatizing the tracheal lesion. For this reason, the cuff remained supraglottic and did not provide this mechanism of airway protection. However, the presence of an endotracheal tube tip past the vocal cords was a reliable conduit for oxygenation and provided a rescue option. In the event of airway compromise due to bleeding or surgical debris, we could rapidly advance the endotracheal tube and inflate its cuff to secure the airway.

Submitter: Ambus, Nicholas

Title

Cast Your Vote—When is Anticoagulation Appropriate with Mechanical Circulatory Support?

Author(s)/Institution(s)

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Background

Short-term mechanical circulatory support (MCS) provides temporary, but essential life-sustaining treatment. It is used in the perioperative period and critical care situations, including cardiogenic shock, and demonstrates a potential survival benefit in patients with heart failure.¹⁻³ Despite its theoretically favorable utility, recipients become prone to juxtaposed risks of both thrombosis and bleeding—a process particularly difficult to manage in patients with numerous contributing and confounding factors.^{1,4}

Case Description

We present a 37-year-old female with a history of single coronary artery, D-transposition of the great arteries, ventricular septal defect status post Rastelli procedure with right ventricle-pulmonary artery (RV-PA) conduit, conduit stenosis and regurgitation, aortic valve insufficiency, mitral valve regurgitation, and ventricular arrhythmias with automatic implanted cardioverter defibrillator, who underwent elective redo-sternotomy with replacement of the RV-PA conduit and mitral valve replacement. Due to complex anatomy and scarring from previous procedures, she underwent a 23-hour procedure with additional aortic root replacement and enlargement, and bypass graft to the right coronary. Intraoperatively, there was compression of abnormally coursing left coronary artery by the new conduit requiring conduit transection and graft placement over left coronary artery, biventricular heart failure requiring conversion to veno-arterial extracorporeal membrane oxygenation (VA-ECMO), and consumptive coagulopathy requiring massive transfusion. Patient was transferred to the intensive care unit, remaining intubated with an open chest. Post-surgical bleeding warranted immediate re-operation. Later return to the operating room for washout with TEE revealed non-occlusive SVC thrombosis, biventricular dysfunction, and thrombosis of the bioprosthetic mitral valve, completely hindering flow. Biventricular assist device (BiVAD) was then placed with right centramag from right RA to PA conduit and left centramag from left atrium via right upper pulmonary vein to aorta. After weaning off IV sedation entirely, her mentation did not improve and imaging demonstrated ischemic large-vessel strokes, likely of embolic etiology. Upon removal of RVAD, 10 days after placement, a thrombosed cast of the RA inflow cannula was seen extending from the right atrium, through the mitral valve, and into the ventricle (Figure 1). Further decompensation and additional complications led to transition to comfort care.

Discussion

The purpose of this case is to highlight the thromboembolic and hemorrhagic risks associated with MCS and the difficulty in determining anticoagulation needs. Current recommendations

encourage the use of anticoagulants and antiplatelet agents to prevent thrombotic events and to maintain circuit flow.⁵⁻⁷ Despite widespread use of anticoagulation, for LVAD, the rate of thrombotic events remain as high as 10% for pump thrombosis and 17% for ischemic stroke.^{6,8} Moreover, the rate of bleeding in some studies exceeds 60%.⁵ The incidence of adverse events are comparable to that of VA-ECMO, however, the need for routine anticoagulation for this therapy is questionable as it results in poorer outcomes.^{3,7,8} In this patient, multiple thrombi formed, occupying the mitral valve, superior vena cava, large cerebral vessels, and RVAD inflow cannula despite consistent anticoagulation upon resolution of initial consumptive coagulopathy. Thus, further studies should aim to understand best practices pertaining to anticoagulation, and how to tailor these regimens to each patient and their risk factors.

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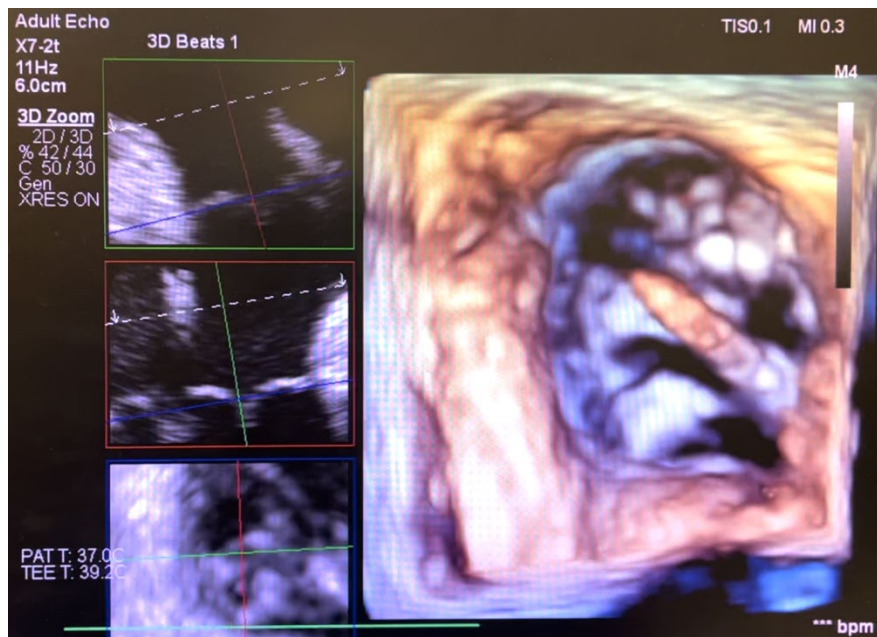


Figure 1: Transesophageal echocardiogram showing thrombosed cast of the RA inflow cannula extending from the right atrium, through the mitral valve, into the right ventricle

Uterine Inversion in a Patient with Myotonic Dystrophy

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Introduction: Uterine inversion is a rare complication of vaginal or cesarian delivery with an incidence of 1 in 3500 to 20,000. It is an obstetric emergency and may lead to severe hemorrhage, shock, and maternal death. The inverted uterus cannot properly contract and the stretched endometrium is more prone to bleeding with increased hemorrhage risk. Risk factors for inversion include prolonged or rapid labor, preeclampsia with severe features, placenta accreta, nulliparity, and macrosomia¹. Myotonic dystrophies (I and II) are disorders characterized by impaired skeletal muscle relaxation, cardiac conduction abnormalities, cognitive impairment, and GI disorders. They frequently complicate pregnancy with higher rates of spontaneous abortion, premature delivery, and infant involvement².

Case Description: A 24-year-old G1P0000 who presented via ambulance roughly one hour following home vaginal delivery. Her past medical history includes myotonic dystrophy and a family history of uterine inversion in a maternal aunt. She was hypotensive on arrival with a systolic blood pressure of between 70 and 90 mmHg, altered level of consciousness, and was actively bleeding. She was emergently taken to the operating room where she underwent RSI with GETA. Her uterus was found inverted and her cervix was dilated to 4-5cm, protruding past the introitus. Sevoflurane assisted with uterine relaxation which was eventually transitioned to a TIVA. A manual sweep showed an enlarged uterine cavity without atony. Her estimated blood loss was 200cc and her blood pressure was maintained with phenylephrine boluses and an infusion. Her post-operative hemoglobin was 6.6 mg/dL and was transfused 1U PRBC. A Bakri balloon was also placed and subsequently removed on POD1. She was discharged POD2.

Discussion: This case offers several practical implications for practicing anesthesiologists. First, it reminds practitioners of the potential use of sevoflurane as an adjunct to aid in uterine relaxation during surgical manipulation of the uterus. Second, it highlights the notable family history of this patient with a maternal aunt who had a similar history of a precipitous home birth and subsequent uterine inversion. It makes sense that the impaired muscle relaxation seen in myotonic dystrophy could contribute to uterine inversion. Lastly, it highlights the complex needs of patients with myotonic dystrophy and the implications it has for pregnancy. They have increased risks of spontaneous abortion, cesarian section, ectopic pregnancy, preterm labor, polyhydramnios, placenta previa, and peripartum hemorrhage³. These patients can benefit from multidisciplinary collaboration between obstetrics, genetics, anesthesiology, and neurology.

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Submitter: Sara Arastoo

Regional Anesthesia for A Patient with von Willebrand Disease undergoing Total Knee Arthroplasty

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Background

Von Willebrand disease (VWD) is the most common inherited bleeding disorder with a prevalence of about 1%. VWD is a quantitative or qualitative defect in von Willebrand factor, a glycoprotein needed for hemostasis. Neuraxial anesthesia (NA) is often used as the primary anesthetic for total knee arthroplasty (TKA), and regional anesthesia (RA) may be used to supplement for post-operative pain, though clearly challenges exist when performing such procedures in patients with VWD. There is little evidence regarding the role of NA and RA in patients with VWD, and what factors should be considered prior to performing such procedures. We attempt to describe considerations when RA is appropriate in the management of patients with VWD for TKA.

Case Description

A 65-year-old female with a history of type 1 VWD, post-operative nausea and vomiting (PONV), mild asthma, and knee osteoarthritis presented for a left TKA with robotic assistance. She had a history of cervical and lumbar spine surgery, hysterectomy, and hip surgery. The patient was 1.73 meters tall, weighed 94.6 kilograms, and had a BMI of 31.7. One week prior to this surgery her factor VIII level was 54% and ristocetin cofactor was 37%, low enough to result in surgical bleeding. Her hematologist recommended administering 28mcg of desmopressin intravenously over 30 minutes prior to surgery. An adductor canal nerve catheter was placed pre-operatively with 15 ml of 0.25% ropivacaine with 5mcg/ml of epinephrine for post-operative analgesia without any complications. Induction of general anesthesia (GA) and intubation were uneventful, and there were no surgical complications. Post-operatively, the patient continued to have a sensory block to cold and sharp and normal lower extremity strength. The catheter remained in place until post-operative day (POD) 3. There was minimal bleeding at the surgical wound, and the adductor canal catheter site remained clean, dry, and intact, without signs of hematoma or ecchymosis. The patient returned 14 weeks later for a manipulation of the left knee due to joint stiffness. Her hematologist recommended following the same desmopressin protocol as her prior left TKA. An adductor canal catheter was again successfully placed pre-operatively for post-op analgesia until POD3.

Discussion

In most cases, anesthesiologists must consider unique factors when determining whether RA is appropriate for patients with bleeding disorders. Typically, RA is performed in patients undergoing total knee arthroplasty for better post-operative analgesia and faster recovery.

We report successful use of a continuous peripheral nerve catheter (CPNC) for post-operative pain control in a patient with VWD. CPNC have demonstrated improvement in post-operative pain control, reduction in the use of opioids, reduction in PONV rates, and earlier participation in physical therapy. However, there remains a lack of controlled studies evaluating safety of NA and RA in this population, and there are no evidence-based guidelines. Both modalities may be useful for patients with VWD, but ultimately each patient must be treated individually with careful attention to provider comfort with anesthetic technique, symptoms of bleeding, factor and platelet levels, responsiveness to desmopressin, and informed consent with shared decision making.

Submitter: Chuck Nguyen

A Case of the Mini's: A Mini-Thoracotomy under Mini-mal Local MAC Anesthesia

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Introduction

Thoracoscopic surgeries have safely been performed under awake anesthesia without the need for endotracheal intubation using regional nerve blocks. Here, we describe the anesthetic preparation of an emergent mini-thoracotomy using local anesthesia and sedation

Case Description

A 50-year-old female was taken to the OR for mini-thoracotomy in the setting of severe sepsis and cardiopulmonary complications including bilateral pulmonary emboli, extensive pneumonia, a large pulmonary abscess, and a left ventricular apical aneurysm with an apical thrombus. The patient had recently undergone embolization of a retroperitoneal hematoma as well as an IVC filter placement secondary to a left-sided femoral thrombus. The patient's bronchoalveolar lavage grew streptococcus viridans and escherichia coli. Surgery was required for source control and it was decided to use local anesthetic through wound infiltration with sedation. Local anesthesia was achieved with a mixture of bupivacaine, lidocaine, and epinephrine. Dexmedetomidine, propofol, and remifentanyl were used for sedation. Using non-invasive positive pressure ventilation, the patient maintained spontaneous respirations with adequate tidal volumes, allowing the operation to be completed without complication.

Discussion

Local anesthesia without a regional nerve block is a viable option for the anesthetic management of complex operations where general and regional anesthesia is contraindicated.

Submitter: Arthur Armijo

Title: A case of Bleomycin-induced skin hyperpigmentation and how to prevent it

Authors: Arthur Armijo¹; Matthew Gomory, DO²; Natalia Adderley, MBBS²; Ricardo Falcon, MD²; Tim Petersen, PhD^{2,4,5}; Anna Fabre, MD³; Codruta Soneru, MD²

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Background:

Bleomycin is an antineoplastic agent often used as a sclerosing agent for malignant pleural effusions and vascular malformations. Its side effect of pulmonary fibrosis[1] receives the most attention, but it also induces skin hyperpigmentation and linear erythema (flagellate dermatitis)[2]. This occurs on skin subject to trivial trauma (eg from adhesive), pressure, sunlight exposure, or possibly due to inflammatory endothelial cell sclerosis [3]. Its toxicity can present as Raynaud's phenomenon, hyperkeratosis, palmoplantar desquamation, and nail-bed changes[4].

Anesthesiologists can mitigate these risks. We present two pediatric cases: one involving venous malformation sclerotherapy producing skin hyperpigmentation, and another in which cohesive bandage (eg. 3M CobanTM) helped prevent this result. Cohesive bandage sticks to itself but not well to skin, hair, or other materials.

Case Presentations:

Our first patient is an 11yo 29.6kg male presented for foot venous malformation sclerotherapy using percutaneous bleomycin foam injection. Venous outflow was prevented with a tourniquet for ~15min. Skin hyperpigmentation at the tourniquet site was noted at ~3mo, remaining 3yrs later.

Our second patient is a 9yo 92.9kg female with a R hand venous malformation. In her case, all tape and tourniquets were avoided. A Tegaderm secured a 2x2 pad to the IV and adhesive was removed from the ECG leads and SpO₂ probe; all were secured by cohesive bandage. After the procedure, there was no evidence of skin pressure or damage. Thus far, no hyperpigmentation or skin lesions have occurred.

Discussion:

The first patient's hyperpigmentation occurred at the tourniquet location and persisted after 3 years. We have used gentle skin guarding since, with no further occurrences.

Hyperpigmentation after this treatment is known (5) and likely related to trivial trauma from tape, jewelry, ECG electrodes, and more. Other hypotheses point to a localized increase in melanogenesis, inflammation, and localized toxicity, especially with higher doses (6).

Bleomycin is often advocated over other sclerotherapy agents, presenting less risk of intense inflammatory or ulcerative reactions (7). Avid use of sunscreen and avoidance of even trivial pressure/trauma are paramount to preventing hyperpigmentation.

Conclusion:

Our first case demonstrates the hyperpigmentation with trivial trauma from bleomycin sclerotherapy; the second shows novel cohesive bandage-based mitigation. Cohesive bandage is a safe and effective irritation-free way to secure equipment.

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Submitter: Roman Austin

Critical hypocalcemia in severe postpartum hemorrhage

Roman Austin MS, Michael Miera MS, Tim Petersen PhD, Codruta Soneru, MD

Postpartum hemorrhage (PPH) is a leading cause of maternal mortality, with incidence 1-3%. Blood transfusion is common, but can cause hypocalcemia due to citrate preservative chelating calcium ions. Resulting complications can include tetany, seizures, or arrhythmias.

Our patient was a 97kg 37yo G3P2002 s/p Cesarean section for arrest of labor and subsequent cesarean hysterectomy for postpartum hemorrhage due to a posterior uterine tear with 8L blood loss prior to OR, and 8L in OR. Total blood products given during her resuscitation included 35 units of packed red blood cells, 26 units of FFP, 4 units of cryoprecipitate, and 4 units of platelets. A norepinephrine infusion was titrated to maintain MAP >65. Just prior to transfer to OR the calcium measured 0.68, first ABG revealed a Ca^{+2} of 0.37. Hypocalcemia continued throughout the case despite administration of a total 14g calcium, with nadir at 0.29. At the end of surgery it increased to 1.75, followed by a subsequent drop despite discontinuing blood products. Other than this unusual hypocalcemia, the patient tolerated the procedure well with stable BP. She was extubated in TSI the following evening and transferred to L&D for the remainder of postpartum care.

Half of circulating calcium is ionized, 40% is bound to plasma proteins (e.g. albumin), and the remainder to anions such as sulfate, citrate, and phosphate¹. Blood products are supplemented with citrate to prevent coagulation. Any resulting hypocalcemia is usually transient because citrate undergoes rapid liver metabolism. However, massive transfusion causes a large influx of citrate which may be compounded by impaired citrate metabolism due to hypothermia, hypoperfusion, and liver dysfunction resulting in profound hypocalcemia¹. She was found to have a transaminitis, but not severe, (200s).

Other proposed mechanisms include intracellular calcium influx due to ischemia/reperfusion as well as increased sympathetic activity reducing calcium homeostasis². Importantly, hypocalcemia has been associated with increased mortality and severity of postpartum hemorrhage²⁻⁴ and identified as an independent predictor for multiple transfusions⁴. Hyperglobulinemia can be a cause of low free calcium, but albumin levels were within normal limits. Determining calcium levels at admission has been proposed as a way to identify those at hypocalcemia risk in massive transfusion due to severe PPH⁴.

The extent of hypocalcemia in this patient was remarkable. Curiously, the following days her calcium level was also low, (0.48 lowest value), despite continuous calcium supplementation (about 3 g/day) the following 4 days until discharge home (1.09 at discharge).

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Factors associated with delayed extubation and the effect on postoperative outcomes of multi-level spinal fusion surgeries

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Introduction: Multi-level spinal fusion surgeries are extensive operations that require prolonged anesthesia times and intraoperative hemodynamic stabilization. Although extubation immediately following surgery is ideal, delayed extubation, or postoperative extubation outside of the operating room, may be necessary to maintain airway integrity or hemodynamic stability. Delayed extubation is associated with longer hospital stays and increased risk of complications such as bronchopulmonary infection. We analyze the pre- and intra-operative factors associated with increased incidence of prolonged intubation and the effects of such an extubation strategy on postoperative outcomes in patients who underwent multi-level spinal fusion.

Methods: Our institutional electronic medical record was queried for individuals who underwent spinal fusion surgery of ≥ 3 levels by a singular surgeon from January 2013-May 2018. Pre-, intra- and post-outcomes were collected which included patient history, blood products given, hospital length of stay (LOS), ICU LOS, time to first physical therapy (PT) and occupational therapy (OT) sessions, and incidence of postoperative pneumonia. Multivariable Poisson regression with robust variance estimate was used for binary variables and negative binomial regression was used for continuous variables.

Results: 265 patients were included, of which 60% were female. Median age [IQR] was 64 [55-72] years. Of these, 52 (19.6%) remained intubated for one or more days following surgery. Multivariable regression analysis showed that patients with a history of renal insufficiency (IRR 2.05, 95%CI 1.11-3.78), those with a history of smoking (IRR 1.85, 95%CI 1.14-2.98), and those with a history of hypertension (IRR 1.73, 95%CI 1.00-2.98) were more likely to have delayed extubation. Each additional unit of pRBC given was associated with a 31% increased incidence of delayed extubation (IRR 1.31, 95%CI 1.11-1.54), while additional units of FFP were associated with a 15% decrease in this rate (IRR 0.85, 95%CI 0.73-0.98). Delayed extubation was not significantly associated with an increase in hospital length of stay. However, it was associated with longer ICU stay (IRR 1.56, 95%CI 1.16-2.10), longer time to PT (IRR 1.34, 95%CI 1.07-1.67), and longer time to OT (IRR 1.39, 95%CI 1.14-1.71). Of patients receiving delayed extubation, 4 were diagnosed with postoperative pneumonia vs. 0 in the immediate extubation group ($p < 0.01$).

Conclusions: This study highlights the importance of pre-operative screening and patient history in the determination of extubation strategy in patients undergoing spinal fusion. We show that history of renal insufficiency, smoking, and hypertension are significantly associated with delayed extubation.

Judicious judgment is important in pursuing such an extubation strategy, as delayed extubation was associated with a detrimental increase in several post-operative outcomes.

Submitter: Sammy Baho

Title: Local Anesthetic Systemic Toxicity Resulting from a Thoracic Erector Spinae Plane Block

Author: Sammy Baho, MD (LCDR MC USN), Anthony Scherschel, MD

Institution: Naval Medical Center, San Diego – Department of Anesthesia

Abstract:

We present a case of sudden onset Local Anesthetic Systemic Toxicity (LAST) manifested by tonic-clonic seizures in a patient undergoing a pre-operative T4 Erector Spinae Plane Blocks (ESPB) for bilateral reduction mammoplasty. ESPBs are a relatively new regional technique touted for their safety related to its lack of proximity to major vessels and utilization of ultrasound image guidance. Our patient underwent a non-technically challenging ESPB with liposomal bupivacaine under continuous ultrasonography and suffered an unexpected episode of LAST. There is limited published literature on the incidence of LAST following ESPBs. We report our encounter and management of the incident and emphasize the need for diligence anytime Local Anesthetics (LA) are being used.

Background:

Erector Spinae Plane Blocks (ESPBs) are a relatively new regional technique touted for their safety related to its lack of proximity to major vessels and employment of ultrasound image guidance. The incidence of Local Anesthetic Systemic Toxicity (LAST) occurring following an ESPB is rare. In particular, there are no documented cases of LAST following a thoracic ESPB.

Case Description:

This case involves a 22-year-old female, ASA class I, who presented for bilateral reduction mammoplasty with pre-operative bilateral T4 ESPBs. Her weight and height were 79 kg and 175 cm, respectively, with a Body Mass Index (BMI) of 25. Her pre-anesthetic evaluation was notable for a history of neck and back pain symptomatically treated with nonsteroidal anti-inflammatory drugs (NSAIDs). She denied any previous surgical history and reported use of a contraceptive patch. She also endorsed an allergy to Zafemy, another form of a contraceptive patch.

After obtaining consent, she was seated upright using a Pivotal Health Solutions (PHS) Epidural Positioning Device for support. Standard ASA monitors were applied, and a pre-procedure time out was then performed, followed by administration of IV midazolam (2mg) and alfentanil (250 mcg).

A GE Logiq E Ultrasound linear probe was used to identify anatomical landmarks and intended target for a left sided T4 ESPB. The skin was cleaned with chlorhexidine and anesthetized with 2% lidocaine (2ml). A 20-gauge 100mm Arrow Ultra Quick Tuohy was advanced with real time ultrasound visualization during the entire procedure. After advancing the needle to the left sided T4 transverse process, negative aspiration was confirmed then 0.25% bupivacaine (20ml) with 0.13% liposomal bupivacaine (10ml) was injected slowly in aliquots of 5ml with intermittent aspiration and without significant back pressure. Spread of Local Anesthetic (LA) cranially and caudally was observed. Of note, the patient remained comfortable throughout the procedure with no significant alterations in responsiveness or vital signs.

Four minutes later, a right sided T4 ESPB was initiated, using the aforementioned description. Meaningful communications were maintained with the patient after the left sided and through the initial stages of the right-side block. One minute after removing the Tuohy needle from the right side, the patient became unresponsive and promptly developed tonic-clonic seizure activity. The patient became tachycardic (HR 120s), hypertensive (BP 130/83) and maintained a normal pulse oximetry (SpO₂ > 95%). Given the symptomatology and proximity of events following LA injection, there was a high index of suspicion for LAST. The patient was immediately placed in the left lateral decubitus position. She was then administered lipid emulsion therapy (100ml bolus followed by 250ml infusion) and midazolam (4mg) which resulted in cessation of her seizure activity. Due to continued unresponsiveness, she was induced with 50mg propofol and 50mg rocuronium and intubated to secure her airway. A focused cardiac ultrasound revealed no evidence of wall motion abnormality, pericardial effusion, tamponade, or gross valvular abnormalities.

Patient was transported to ICU where she began to move spontaneously, respond to verbal commands, and was extubated approximately 90 minutes after the onset of seizures. The patient had a work-up in the ICU for other causes of seizures which was unremarkable, she remained in the ICU overnight for monitoring and was transferred to the ward the following day with subsequent discharge. The surgical case was canceled and postponed to a later date.

Discussion:

LAST is a potentially fatal complication that can occur in the setting of regional anesthesia with a mortality rate of nearly 10%.¹ ESPBs are a comparatively new field block with evolving roles for post operative analgesia for surgeries in the chest, abdomen, and spine. As a field block, a large column of LA is administered in a non-vascular plane under ultrasound guidance. While considered safe, with a low complication rate, existing literature has described two case reports of LAST occurring following Lumbar ESPB for spinal surgery.^{2,3,4,5}

Our patient underwent a non-technically challenging thoracic ESPB and experienced a sudden onset of LAST. In review of the etiology of this event the differential included medication error, allergic reaction, undiagnosed seizure disorder, and inadvertent intravascular injection. The clinical conclusion was that despite negative aspiration prior to injection and no visualization of vessels, an unrecognized intravascular injection transpired. To our knowledge, this is the first documented example of LAST following a Thoracic ESPB requiring treatment with lipid emulsion therapy.

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Title:

Patient and Nursing Perspectives of Acupuncture Therapy in the Perioperative Setting

Authors/Institutions:

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Introduction:

Postoperative pain management and postoperative nausea and vomiting are a persistent challenge for both healthcare providers and patients. Acupuncture has proven to be an effective and safe modality in the management of these symptoms and has the potential to play a key role in perioperative care.¹⁻³ As of 2016, The American Pain Society could not recommend nor discourage the use of acupuncture and related interventions in the clinical guidelines for the management of postoperative pain due to insufficient evidence of their effectiveness.⁴ This study aims to provide more data on the feasibility, efficacy, and perioperative receptibility of acupuncture in the recovery room.

Methods:

In a retrospective case-control study, 22 patients who underwent elective procedures and received acupuncture therapy in the postanesthesia care unit (PACU) were compared to 110 case controls. Indications for acupuncture therapy included refractory pain, nausea, or anxiety. Patient satisfaction and improvement in symptoms following acupuncture was assessed. PACU nurses and patients were queried on their perspective of this therapy. Demographic data, perioperative opioid consumption, pain score in the PACU, incidence of postoperative nausea, PACU length of stay, and unintended hospital admission were assessed. Comparisons were made between the groups with/without acupuncture using Wilcoxon rank sum test or Fisher's exact test as appropriate.

Results:

The most common indications for acupuncture were for pain (68%), anxiety (27%), postoperative nausea or vomiting (27%). A total of 78.9% (15/19) of patients felt improvement in their symptoms. 57.9% (11/19) reported improvement in their pain, 21.1% (4/19) reported improvement in their nausea, and 36.8% (7/19) reported improvement in their anxiety. 68.4% (13/19) were satisfied with their acupuncture therapy and 77.8% (14/18) would always or often recommend acupuncture to future patients undergoing surgery. Patients did not perceive a downside to receiving acupuncture and 63.2% (12/19) would consider therapy again if covered by insurance. 57.9% (11/19) would consider acupuncture therapy if it was very low cost and 15.8% (3/19) would consider acupuncture if it was 100% cost to the patient. Of the recovery nurses that cared for patients that received acupuncture in the PACU, 94.7% (18/19) felt that it was generally helpful, 78.9% (15/19) did not believe it was at all disruptive, and 94.7% (18/19) would like to see acupuncture available as an adjunct therapy in the postoperative setting.

Conclusions:

In summary, this study shows that a majority patients who elected to receive acupuncture therapy in the PACU were satisfied with their treatment and would recommend to future patients undergoing surgery. Recovery room nurses that cared for the patients receiving acupuncture felt it was helpful, not disruptive, and would like to see it utilized in the postoperative setting. Patient who received therapy did report an improvement in their symptoms despite reporting higher pain scores and significantly increased postoperative opioid use. These findings highlight the feasibility of offering acupuncture therapy in the postoperative setting from a patient's and recovery nurses' perspective.

Submitter: Corey Benjamin

Title: The Complex Management of an Exposed Neuraxial Catheter

Background: Unmonitored neuraxial catheters infusing local anesthetic place a patient at serious risk for complications, including infection and local anesthetic systemic toxicity (LAST). In patients on anticoagulation, the benefits of neuraxial anesthesia are weighed against the risk of withholding antithrombotic or of continuing anticoagulation with an increased risk of spinal epidural hematoma.

Case Description: We present a case of an 88-year-old female with a history of atrial fibrillation on apixaban for anticoagulation, transient ischemic attack and coronary artery disease who was transferred by EMS from the US-Mexico border to our emergency department with a chief complaint of acute encephalopathy. Per family and outside hospital records, the patient presented to a Mexican hospital with abdominal pain 1 week prior to current presentation. A colonoscopy performed showed rectosigmoid ulcerations, pseudomembranes and areas of necrosis. She was diagnosed with *Clostridioides difficile* colitis complicated by ileus. She was started on antibiotics and an epidural catheter infusion of ropivacaine 0.2% at 5 milliliters per hour for “opioid sparing” in setting of ileus. She developed confusion 3 days prior to current presentation and was transferred to the intensive care unit. Per family request, she was transferred at the U.S./Mexico border for further care in the United States.

Vitals upon presentation were notable for atrial fibrillation with heart rate 140 beats per minute; she was afebrile and normotensive. Physical exam was notable for nonspecific back pain, confusion, agitation, AAOx1 (to name) and no focal neurological deficits. An exposed neuraxial catheter was discovered in the patient’s lower back attached to an empty ropivacaine infusion pump. The catheter appeared to be placed in the epidural space at the L3-L4 level, incidentally seen on CT abdomen/pelvis. Laboratory results at this time were notable for an anti-Xa apixaban level of 109 ng/mL and white blood cell count of 12.8 1000/mm³. The infusion pump was disconnected; the catheter site was sterilized, redressed and left in place because the patient’s last dose of apixaban could not be determined. She was transferred to the ICU for acute encephalopathy. Thromboelastography (TEG) performed 24 hours after presentation displayed normal coagulation; other laboratory data at this time notable for anti-Xa level <0.04 IU/mL and platelet count greater than 150,000. The epidural catheter was removed 24 hours after presentation and the patient underwent Q1 hour neurochecks for the next 72 hours. The patient’s encephalopathy improved and she was AAOx3 within 24 hours of catheter removal with full strength in her bilateral lower extremities throughout admission. The patient had continued abdominal pain and colitis despite antimicrobial treatment and developed oropharyngeal dysphagia. After multiple goals of care discussions, antimicrobial therapy was discontinued and she was discharged to hospice care.

Discussion: This case illustrates the complicated discovery and management of an encephalopathic and anticoagulated patient who presented with an exposed neuraxial catheter in an unknown location with unknown length of local anesthetic infusion. Determining the catheter’s location, patient’s anticoagulation status and post-removal observation were critical for management.

A Perfect Storm: A Perioperative Complication of Acquired QT Prolongation

William J Binder Jr MD, PharmD, David Seamans MD, Molly Kraus MD

Introduction:

Patients may present perioperatively with a prolonged corrected QT (QTc) interval. Prolonged QTc is defined as ≥ 470 ms in adult males and ≥ 480 ms in adult females. Understanding the physiology, risk factors, and consequences of long QT syndrome (LQTS) is important for anesthesiologists. Acquired QT prolongation is more prevalent than congenital LQTS and possesses a separate pathophysiologic mechanism. The majority of acquired QT prolongation is secondary to adverse effects of medications or electrolyte abnormalities. Acquired QT prolongation can increase the risk of polymorphic ventricular tachycardia and torsade de pointes (TdP), potentially leading to sudden cardiac death.

Case Report:

A 53-year-old female with a history of chronic opioid use, diverting ileostomy, and chronic anemia presented for total hip arthroplasty. Pertinent home medications included quetiapine, trazodone, cyclobenzaprine, hydromorphone 8mg three times daily, and methadone 80mg twice daily. Anesthesia was induced with midazolam, fentanyl, lidocaine, propofol, and rocuronium. After intubation, sevoflurane was used for maintenance. Brief episodes of hypotension were addressed with ephedrine and phenylephrine. She received cefazolin and tranexamic acid per institutional protocol. Analgesia was maintained with preoperative oxycodone and acetaminophen and intraoperative intravenous ketamine (50 mg) and Dilaudid (1mg). Intraoperative course was uncomplicated.

In the PACU, the patient arrived awake and alert complaining of intense surgical pain which was treated with bolus dosed hydromorphone. The patient required 5mg IV hydromorphone over 1.5 hours, therefore two additional boluses of ketamine 10mg were administered. PACU resident was contacted for intractable pain and frequent ectopy on telemetry. An electrolyte panel was ordered however not immediately performed secondary to concurrent administration of packed red blood cells. She was started on a hydromorphone PCA and ketamine infusion. An ECG obtained revealed critical QTc 560. Upon re-evaluation, the patient became bradycardic to the upper 30's with increasing ectopy. Shortly thereafter she was unresponsive with polymorphic ventricular tachycardia on telemetry. Resuscitation commenced with chest compressions, epinephrine, magnesium, and defibrillation with return of spontaneous circulation (ROSC) in 7 minutes. Stat labs revealed a potassium of 2.6mmol/L. She was alert and oriented after ROSC. The patient had not previously communicated known electrolyte abnormalities in the setting of chronic ostomy output. During subsequent hospitalization, her chronic opioid regimen was revised, and all QT prolonging agents were discontinued. She was discharged home on hospital day 6.

Discussion:

Incidence of postoperative QTc prolongation may be as high as 80% according to one study. QTc prolonging agents, hypokalemia, and possibly hypothermia contributed to acquired QTc prolongation in this case. The patient had recently taken high dose methadone, quetiapine, and trazodone with a likely prolonged QTc at baseline. She received intraoperative and postoperative ketamine due to intractable pain which increases TdP risk due to sympathomimetic properties. Correction of significant hypokalemia may have prevented the arrhythmia; however, this was not known prior to arrest. Lastly, postoperative

hypothermia may have contributed to QT prolongation through prolonged recovery of inactivated sodium channels. In conclusion, QT prolongation can lead to significant morbidity/mortality and anesthesiologists must be knowledgeable in the management of patients with acquired QT prolongation.

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Submitter: Mira Bishawi

Title: “Pulmonary Arterial Hypertension and Atrial Septal Defect: A double edged sword in the management of Right Ventricular Dysfunction”

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Background: The majority of congenital atrial septal defect (ASD) cases follow an uncomplicated course, however this can change in the presence of pulmonary arterial hypertension (PAH). It is unclear whether these patients have a primary PAH with an accompanying ASD or whether the PAH is a consequence of the ASD. A secundum ASD typically results in a left to right intracardiac shunt, which can lead to right ventricular dilation and ultimately reverses the shunt, resulting in Eisenmenger’s Syndrome.¹ Subsequently, RV volume overload can lead to tricuspid annular dilation that progresses to tricuspid regurgitation and atrial arrhythmias. The increased pulmonary artery pressures associated with an increased pulmonary vascular resistance increases RV afterload and leads to RVH and increased RV diastolic pressures. Over time, the eccentric remodeling, contractile dysfunction and inability of the right heart to compensate, is what eventually leads to right heart failure.² Both PAH and large ASD can cause RV dysfunction, and thus, it becomes a topic of concern to evaluate whether ASD closure will truly improve RV function in this subset of patients.

Case Description: 68-year-old female with past medical history of large septum secundum, suspected group 1 PAH, and atrial fibrillation (Afib), presenting with a 1-month history of worsening dyspnea, orthopnea, and a 10 lb weight gain. Pre-operative work-up included a transthoracic echocardiogram which showed severe pulmonary hypertension with a right ventricular systolic pressure (RVSP) measuring 77 mmHg based on estimated RA pressure of 15 mmHg. MRA chest showed a large secundum type ASD with Qp:Qs 1.8, noting bidirectional flow, severe RV enlargement and depressed biventricular systolic function. Right heart catheterization with RA 18; RV 86/3/15; PA 82/31/51; PCWP 21/23/19. The patient underwent surgical closure of the septum secundum, tricuspid repair with annuloplasty and MAZE procedure. Post-operative course was complicated by cardiogenic and distributive shock followed by acute mixed hypoxic and hypercapnic respiratory failure. Postoperative RV systolic pressure was noted to be 79 mmHg with severe enlargement of RA, RV and severely dilated LA.

Discussion: The coexistence of severe pulmonary hypertension and a secundum ASD poses a clinical conundrum. It is possible that the closure of the ASD takes away the pop off valve that essentially allows for a right to left shunt that could improve cardiac output in the setting of increased physical activity.³ Some studies report that closure of the ASD can improve atrial arrhythmias and improve pulmonary hypertension, while others suggest that a subset of patients will still suffer from persistent pulmonary hypertension and RV dysfunction.⁴ Overall, PAH associated with an ASD poses a high morbidity and mortality risk and the long-term effects of ASD closure in this subset of patients are limited. Thus, one must consider these in the perioperative period to optimize the respiratory function and ultimately protect the right ventricle.

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Submitter: Ashlynn Black

Flu unresponsive to steroids in a 15 month old or something else?

Authors: Ashlynn Black, Aibek Mirrakhimov MD, Allison Price MD, Antoinette Esce MD, Tim Petersen PhD, Ricardo Falcon MD, Codruta Soneru MD

Subglottic stenosis (SGS) is an infraglottic airway narrowing with incidence of ~11% in pediatric population.¹⁻⁴ Prolonged endotracheal intubation, large endotracheal tube, tube movement and acid reflux are risk factors.³ The pathophysiology involves local ischemia/necrosis after trauma, leading to fibrotic scarring.¹ Mild/moderate cases are asymptomatic, typically presenting with cough. More severe cases may exhibit biphasic stridor, hoarseness, difficulty feeding, coughing or choking while eating, or failure to thrive.³

A 15 months male presented with stridor, increased work of breathing, and hypoxia. Two months prior he was admitted with acute hypoxemic respiratory failure from RSV and intubated for 5 days. Three weeks prior, he contracted influenza and visited urgent care (UC) several times for stridor; steroids and albuterol were ineffective. The night prior to ER visit, he choked while eating, gagged, and vomited. He had increased work of breathing but good SpO₂ overnight. The morning of presentation, parents woke to him choking/gagging with SpO₂ 58% and called 911.

He received racemic epinephrine and dexamethasone en route to ER. In ER, multiple intubation attempts with decreasing ETT sizes proved unsuccessful. We placed an LMA, and transferred him emergently to the operating room.

Bronchoscopy revealed Grade 3 SGS (1.5mm opening). It was dilated with 3.5 bronchoscope, and 3.5 ETT was easily passed over rigid endoscope before transfer to pediatric ICU.

SGS intervention is open surgery or endoscopic dilation.³ Perioperative optimization reduces need for laryngotracheal repairs or persistent SGS. Some anesthesiologists prefer volatile anesthetics, other prefer TIVA induction to decrease coughing risk from inhalational induction.⁵ Avoid neuromuscular blockade during rigid bronchoscopy.⁵ Ketamine and sevoflurane maintenance may decrease respiratory depression and promote bronchodilation.⁶ A ventilating bronchoscope or face mask may be used for ventilation.⁵⁻⁶ Approximately 10% of patients experienced airway complications with laryngeal mask and 7% with tracheal intubation; 5% had adverse events with face mask.⁶

Suspicion for SGS should arise when a patient with a history of intubation presents multiple times to UC with URI symptoms or stridor. It is common that diagnosis of SGS is delayed due to similar presentation with URI. Fortunately, a quick diagnosis of SGS was made based on previous intubation history and failure to pass decreasing ETT size. Patient was transported emergent to the OR, and underwent a successful dilatation of the airway.

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Submitter: Jourdan Broadfoot

Women Authorship Trends in the Highest-Impact Anesthesiology Journals from 2005-2021

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Introduction: Although women and men have matriculated into medical schools in similar proportions since the 1980's, recent data indicates that anesthesiology is lagging in gender equity, especially in academic leadership roles.^{1,2} As promotion in academic medicine is strongly influenced by publications, understanding whether a lack of women authorship is contributing to this gender gap is crucial.^{3,4} This paper aims to assess how woman authorship trends have changed in the last 16 years, including during the COVID-19 pandemic.

Methods: The five highest impact journals in anesthesia were identified as *Journal of Clinical Anesthesia*, *British Journal of Anaesthesia*, *Anesthesiology*, *PAIN*, and *Regional Anesthesia & Pain Medicine*. Corresponding journal impact factor scores were 9.4, 9.16, 7.89, 6.96, and 6.288, respectively. Number of total authors including women, men, and unknown gender authors as well incidence of women first and/or last author was documented from articles published in 2005, 2010, 2015, 2020, and 2021. Difference in proportions of total women authors by year was

assessed with mixed logistic regression models with random intercepts for each article. For all other variables, N (%) is used to represent a count and proportion of articles, and changes in the proportions by year were assessed using Cochran–Armitage test for trend. Influence of senior author gender was assessed using p-values from chi-square tests.

Results: This analysis shows that women are gaining representation in anesthesia publications. Overall, there was a statistically significant increase in the total number of women authors and women first and last authorship. However, as of 2021, women still only represented ~40% of total and first authors and ~24% of last authors. Additionally, increase in first/last woman authorship was not present in all journals when stratified.

Conclusions: This study confirms that women are slowly gaining representation in academic publications in the top anesthesiology journals. In the last 15 years, there has been an upward trend, not only in the number and proportion of women authors, but also in women first and last authors. There was a statistically significant relationship between women senior authors and articles with 50% or more women authors, indicating that woman mentorship is contributing to closing equity gap. While this is an encouraging trend for gender equity in academic anesthesiology, further progress must be made. As of 2020, women still make up just 24.0% of senior, or last, authors in these journals. This falls short of the goal for equitable representation, as women represent 26% of anesthesiologists.¹⁵ This disparity is particularly important as senior authorship is an important component of advancing in academic medicine and leadership.^{4,5} This data presents a starting point for further investigations into gender disparities within anesthesia to continue the forward progression for women in academic medicine.

Paradoxical Air Embolism through Intrapulmonary Arteriovenous Shunting during Orthotopic Liver Transplantation: A Case Report

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Background: Paradoxical air embolism (PAE) occurs from air entering systemic circulation through a right-to-left shunt. Patients presenting for orthotopic liver transplantation (OLT) frequently have some degree of pulmonary arterial vasodilation and intrapulmonary shunting (IPS) even in the absence of hepatopulmonary syndrome (HPS)¹. Subclinical PAE during orthotopic liver transplantation is not uncommon, but serious complications are rare²⁻⁴. Here we present a case of severe biventricular dysfunction following allograft reperfusion during OLT due to coronary artery PAE from IPS.

Case Description: A 60-year-old male with history of end stage liver disease secondary to non-alcoholic steatohepatitis, mild coronary artery atherosclerosis, hypertension, hyperlipidemia, and insulin-dependent type 2 diabetes presented for OLT with utilization of normothermic machine perfusion of the donation after circulatory allograft.

Induction of anesthesia was uneventful, and baseline TEE revealed normal biventricular function, moderate IPS with air bubbles seen coming from the pulmonary veins, and no patent foramen ovale consistent with the preoperative transthoracic echocardiogram (TTE).

Surgery proceeded uneventfully throughout the dissection and anhepatic phases. Hemodynamics were maintained with minimal vasopressor support upon initial liver reperfusion, however there appeared to be air bubbles transiting the pulmonary system. Air bubbles were seen in the left atrium, LV, and seen coming from the left upper pulmonary vein (Fig 1). No interatrial shunting was appreciated (Fig 2). Bubbles were also seen crossing the aortic valve and into the sinus of Valsalva (Fig 3). Significant ST-segment depression and hypotension developed approximately 6 minutes after reperfusion with blood pressure decreasing to 63/34 and CVP rising to 30. TEE showed severe RV and LV dysfunction, anteroapical wall motion abnormalities, and functional mitral regurgitation.

The patient required high doses of support with epinephrine, vasopressin and norepinephrine. Inhaled nitric oxide was initiated to optimize RV function. Intra-aortic balloon pump placement was considered, however there was a significant improvement in biventricular function, resolution of ST-segment changes, and substantial reduction in vasopressor and inotropic requirements over the ensuing 30 minutes.

The transplant was completed successfully with continued improvement in hemodynamics and ventricular function and the patient was taken to the ICU in stable condition. Post operative troponins were elevated, however ECG showed normal sinus rhythm with no ischemic changes. Post operative TTE showed a LVEF of 57%, normal RV function, no significant valvular disease, and mild apical wall motion

abnormalities. The patient was subsequently extubated with no neurologic deficits and did not require any coronary artery intervention. He was discharged to home on post operative day 7.

Discussion: There are many causes of hemodynamic instability at the time of liver reperfusion and TEE is a powerful tool to aid in diagnosis and perioperative management. This case demonstrates the possibility of clinically significant PAE through IPS in a patient without HPS or any documented preoperative hypoxemia and should be considered in cases of hemodynamic instability in liver transplantation, especially if air is visualized within the left heart on TEE.

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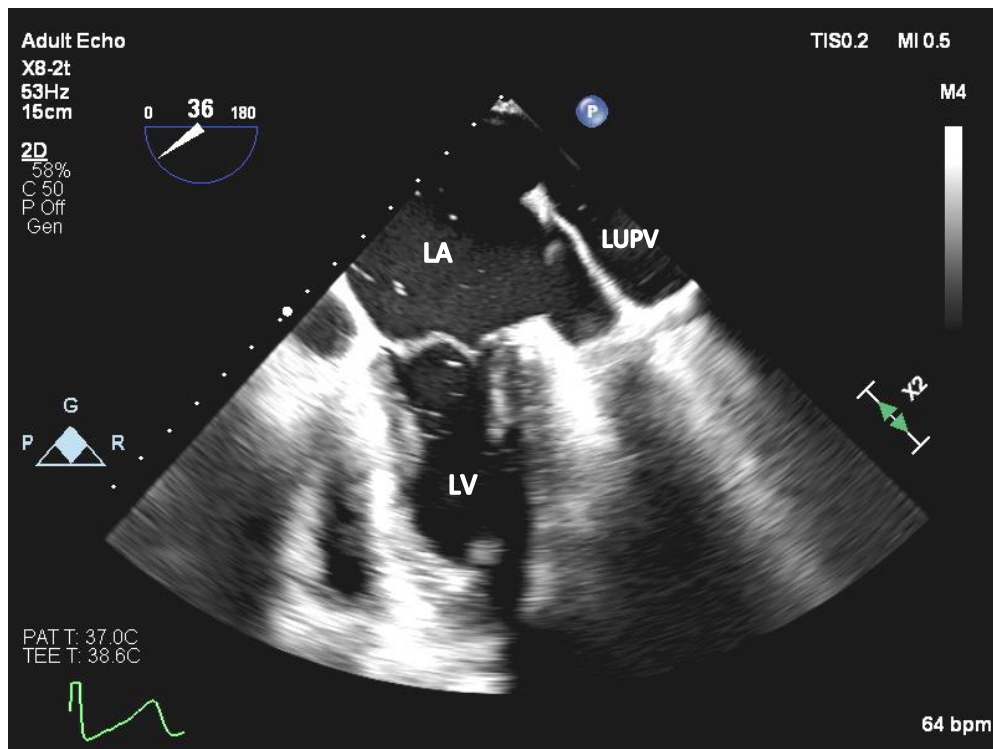


Fig 1. Mid esophageal view of the left atrium and left ventricle with air bubbles seen emerging from the left upper pulmonary vein. LA, left atrium; LV, left ventricle; LUPV, left upper pulmonary vein.

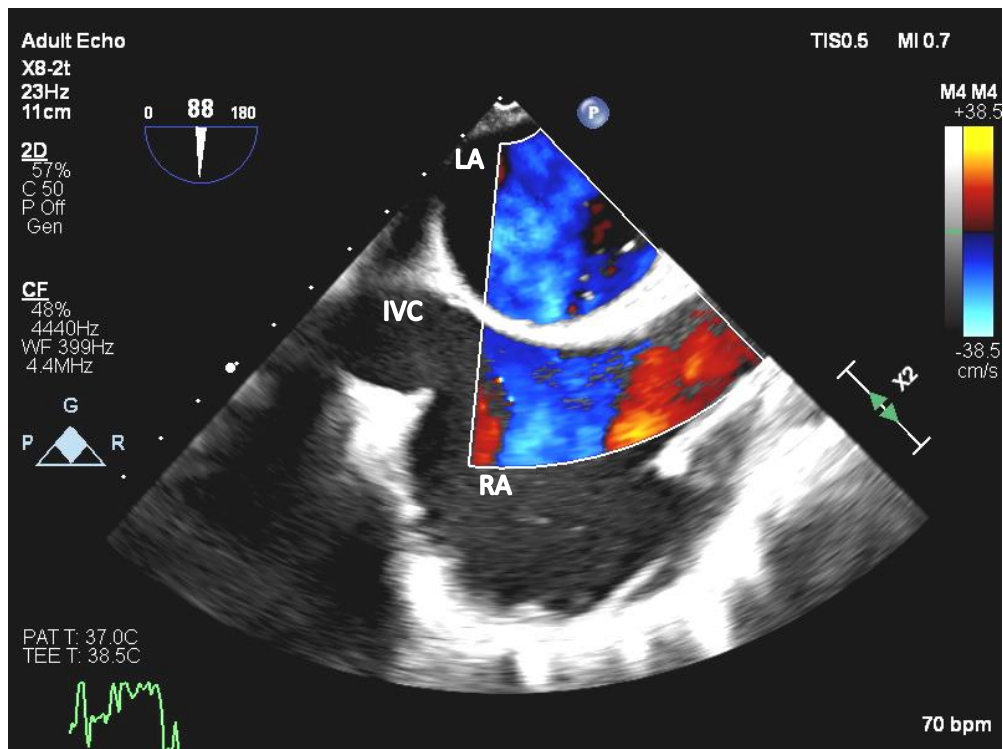


Fig 2. Midesophageal bicaval view with color flow Doppler over the interatrial septum showing no atrial septal defect or patent foramen ovale. RA, right atrium, LA, left atrium, IVC, inferior vena cava.

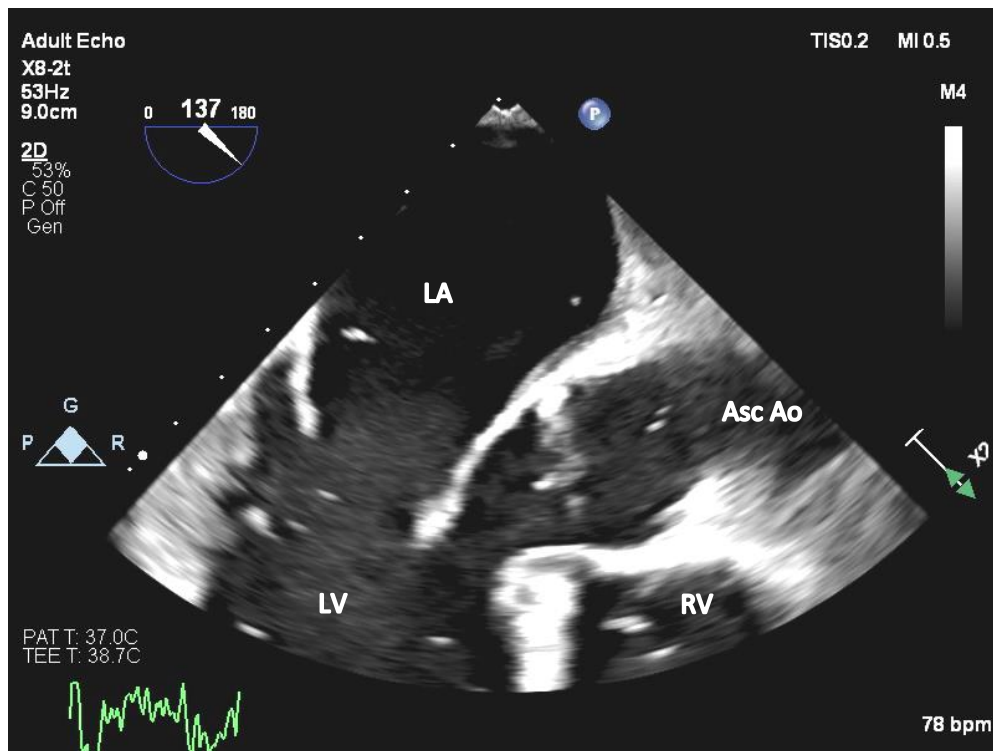


Fig 3. Mid esophageal long axis view in diastole showing air bubbles within the LA, LV, RV, sinus of Valsalva and ascending aorta. LA, left atrium; LV, left ventricle; RV, right ventricle; Asc Ao; ascending aorta.

Title: Massive Subcutaneous Emphysema and Cardiopulmonary Collapse in Recovery Unit after Tracheostomy

Authors: Aaron R Brussels, MD, Tarrah A Folley, MD

Learning Track: Perioperative Challenges and Emergencies

Background:

Elective open surgical tracheostomy (OST) is a common and often well-tolerated procedure, whether in isolation or in conjunction with more intensive airway surgery. We present an infrequently described association of massive subcutaneous emphysema, pneumomediastinum, bilateral tension pneumothorax, ensuing cardiopulmonary collapse and effective resuscitation following partial displacement of de novo OST.

Case Description:

A 63 year old man underwent extensive surgical resection and reconstruction for floor of mouth cancer with OST and free flap construction. Postoperatively, he developed increasing respiratory distress and required bag mask ventilation per tracheostomy. Shortly after, arterial blood pressure and end-tidal carbon dioxide began to drop, and the patient developed cardiac arrest. After two rounds of advanced cardiopulmonary life support (ACLS), return of spontaneous circulation (ROSC) was achieved but not sustained and ACLS resumed. Following recognition of massive subcutaneous emphysema and tension physiology, bilateral finger thoracotomy was performed with immediate ROSC. The patient and flap survived.

Discussion:

Among early tracheostomy-related complications, dislodgement of the tracheostomy tube with subsequent development of a false passage is one of the most catastrophic. Early recognition of airway compromise in a post-OST patient is imperative and false passage should be ruled out if possible: serious outcomes such as pneumomediastinum, pneumothorax, cardiopulmonary arrest and death can be prevented if identified and addressed early.

Submitter: Joshua Calvano

Uvular edema and persistent pain after an uneventful robotic surgery

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Introduction:

Uvular edema is a rare cause of postoperative sore throat, typically associated with airway instrumentation. Symptoms are generally mild, and recovery usually complete. The mechanism is thought to be impingement by an instrument against the hard palate or posterior pharynx leading to ischemia and resultant edema, and possibly ulceration and necrosis.

Case:

We present a 28-year-old female with abnormal uterine bleeding and pelvic pain who presented for a robotic total laparoscopic hysterectomy and bilateral salpingo-oophorectomy. Previous surgeries included three cesarean sections, laparoscopic appendectomy, tubal ligation, and a diagnostic laparoscopic, with no post-operative complications noted. Preoperatively she was Mallampati 2 with an otherwise normal physical exam. After uneventful induction and easy mask ventilation she was intubated with MAC 3 and 7.0 ETT. Laryngoscopy view was grade 1 with no abnormalities. She was intubated for 2.75 hours; recovery was uneventful.

On POD 5, she returned to ED with incision site pain and odynophagia that began after discharge home. After evaluation for infection and pharyngitis, ED discharged her with viscous lidocaine and tylenol/ibuprofen for throat pain. Odynophagia continued on routine followup (POD 7) causing reduced oral intake. Exam showed increased uvular hyperemia and edema, for which Anesthesia was consulted.

Discussion:

Uvular trauma can happen after esophagogastroduodenoscopy or any airway instrumentation. Literature also shows associations with intraoperative snoring in deep sedation, aggressive suctioning, prone positioning, and scopolamine allergy.

Symptoms range from mild pain to life-threatening airway obstruction. Outcomes range from swelling to necrosis. Treatment is usually conservative, including hydration, steroids, and NSAIDs. Topical epinephrine or local anesthetics can also help.

In uvular necrosis, the addition of steroids and antibiotics might be considered to prevent ulceration.

Conclusion:

Uvula trauma can result from direct instrument pressure or blind suctioning during extubation. Uvular edema can also be caused by infections or allergic reactions. Our patient was at risk due to intubation, suctioning, and scopolamine patch. The delayed onset and duration of pain argues against allergic reaction. Her injury was likely from direct pressure by the ETT.

The aim of this report is to increase awareness that postoperative uvular edema can cause severe sore throat or even airway obstruction requiring ETT intubation.

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A Case of Uvular Edema

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Background:

Uvular edema is a rare cause of life threatening postoperative airway obstruction. Outside of the operating room, uvular edema can have a wide variety of causes including trauma, infection, drugs, and allergic/non-allergic angioedema (1). In the postoperative period, uvular edema is usually secondary to trauma from endotracheal intubation (2). However, rare cases of uvular swelling during procedures utilizing local or conscious sedation without placement of an airway have occurred (3,4). Below, we describe an interesting case of uvular edema following monitored anesthesia care (MAC) for a colonoscopy.

Case Description:

A 40 year-old female with past medical history of obesity (BMI 47.4kg/m²), GERD, and hidradenitis suppurativa presented for colonoscopy for work up of rectal bleeding. Her only known allergies were to Latex and Bactrim. The procedure was performed under MAC with propofol (starting dose at 180 mcg/kg/min with titration down to 70 mcg/kg/min), Precedex (two separate boluses of 8 mcg) and a simple face mask for oxygenation. Shortly after the propofol infusion started, the patient began snoring and coughing. Glycopyrrolate was given as secretions were thought to be the cause and the airway was gently suctioned, however minimal secretions were removed. The patient continued to cough throughout the duration of the procedure, which was otherwise uneventful. Postoperatively, the patient was afebrile, hemodynamically stable, and had an oxygen saturation of 97-99% on room air, but complained of throat pain. Upon exam, her uvula was noted to be significantly enlarged. She was given IV diphenhydramine and dexamethasone without improvement in symptoms and sent to the ED for further workup. She was seen by ENT who scoped her and noted a swollen and erythematous uvula with an inferior hematoma. ENT concluded that the cause of her uvular swelling was likely secondary to trauma from suctioning. Interestingly, the patient reported that she had similar symptoms in the past after receiving sedation for wisdom teeth removal. Ultimately, the patient was discharged home with viscous lidocaine for pain control.

Discussion:

This case highlights that although rare, uvular edema can occur after cases of sedation where an airway is not inserted. It is unclear what caused the patient's uvular swelling as no one inciting factor is obvious. Potential causes include mechanical trauma from suctioning, as was suggested by ENT after examination. Although a possibility, airway suctioning was minimal. Additionally, reports of negative pressure trauma from snoring have resulted in uvular swelling (3), but in this case the patient's snoring was not severe and was short lasting. Lastly, it is interesting to note the patient's history of similar symptoms post sedation after wisdom teeth removal. A final possibility could be an allergic reaction. Although there have been rare reported cases of allergy to propofol, the most common reaction is anaphylaxis (5,6), and swelling did not improve with decadron or diphenhydramine. The above case demonstrates the importance of

understanding the multiple causes of uvular edema during anesthesia, and raises the importance of early recognition to avoid life threatening airway obstruction.

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Submitter: Kayla Canteras

ABSTRACT

Title: Patient Blood Management: An Initial Analysis Demonstrating an Association Between Preoperative Anemia and Perioperative Red Blood Cell Transfusion in Patients Undergoing Cardiac Surgery

Author(s)/Institution(s): Kayla Canteras, BS; Alexander Qin, BS; Nicholas Knowland, MD; Melissa McCabe, MD; Department of Anesthesiology, Loma Linda University Medical Center

Introduction:

Cardiac surgery patients who receive more blood products tend to have worse outcomes. Preoperative anemia management and patient blood management may optimize postoperative outcomes, length of stay and perioperative blood product use. Through retrospective evaluation this quality improvement project assesses which factors are associated with blood product transfusion in cardiac surgery patients at one institution. This analysis is intended to inform a strategy for management of preoperative anemia with the future aim of reducing perioperative blood product administration and hospital lengths-of-stay.

Methods:

A total of 680 patients at Loma Linda University Medical Center who underwent cardiac surgery (coronary artery bypass grafting (CABG), valve procedure, and combined CABG and valve operations) from January 2020 to June 2021 were analyzed. Descriptive statistics included: hemoglobin levels, length of stay, blood product transfused, age, procedure urgency and sex. Multivariable logistic regression analyses were performed evaluating hospital length of stay and Red Blood Cell (RBC) transfusion as outcomes. CABG procedures were used as the reference group. Transfusion counts were converted to binary transfusion events due to the high proportion of patients receiving 0 units.

Results:

Isolated CABG was most common, a total of 388 patients, followed by 236 valve procedures, and 66 combined CABG/Valve procedures. RBC transfusions were administered to 139 CABG only patients, 99 valve only patients and 39 combined procedure patients. Females accounted for 47.4% (184/388). Cardiac surgery patients with a preoperative hemoglobin level below 10g/dL were 32.8-fold more likely to receive perioperative RBC transfusions compared to those with a hemoglobin level of 10g/dL or higher ($p<0.01$). Every year increase in age was found to increase the odds of receiving perioperative RBC transfusion by 1.03 ($p<0.01$). In the intraoperative phase of surgery, patients with preoperative hemoglobin less than 10g/dL were 18.27 times more likely to be transfused with RBCs compared to patients with higher preoperative hemoglobin levels.

Other factors that increased the odds of perioperative RBC transfusion included undergoing combined valve and CABG procedures [3.29 times more likely to be transfused with RBCs, $p<0.01$], urgent/emergent cases [2.04 times more likely than elective, $p<0.01$], and female sex [2.38 times more likely, $p<0.01$]. In the length of stay model, preoperative hemoglobin $<10\text{g/dL}$ was associated with 6.19 days longer postoperative stay across all procedures ($p<0.01$).

Conclusions:

At our institution, cardiac surgery patients with a hemoglobin level less than 10g/dL are more likely to receive RBC transfusion than patients with higher hemoglobin levels after controlling for the procedure type, age, urgency, and sex. This suggests that preoperative anemia treatment to a goal hemoglobin level greater than 10g/dL could potentially optimize patient perioperative transfusion. Additionally, female cardiac surgery patients were more likely to receive RBC transfusions than men. Future work will investigate whether the sex association is better accounted for by body surface area and will further stratify hemoglobin levels to assess how much lower hemoglobin increases transfusion rates. The results will inform development of a perioperative cardiac surgery anemia protocol to improve the outcomes for our institution's cardiac surgery patients.

Post-Partum Broken Heart: Case Report

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Background:

Takotsubo or Stress Cardiomyopathy, (TCM) is characterized by transient acute heart failure with left ventricular dysfunction mimicking acute coronary syndrome in the absence of obstructive coronary disease.¹⁻⁴ Analyses of the International Takotsubo Registry, including 1,750 patients, illustrated 89% were female with a mean age of 66.8 years and a significantly higher incidence of TCM in patients with neurologic or psychiatric disorders.³ Serotonin–norepinephrine reuptake inhibitors have been involved in triggering TCM.¹¹ An ECG may show ST segment elevation/depression, T-wave inversion, abnormal Q waves and other changes.^{2,3} Apical or left mid-ventricular ballooning or hypokinesis with compensatory hypercontractility of the basal wall with decreased ejection fraction are the echocardiographic findings.^{3,12} The incidence of TCM in the perioperative period is 1 in 6,700 cases. Various surgical procedures have been involved in patients developing TCM, and although frequently associated with general anesthesia, it has also been reported with regional anesthesia and sedation.^{17,18} Intraoperative triggers reported to cause TCM are mainly related to intensive catecholamine discharge, such as laryngoscopy, intubation, extubation and light levels of anesthesia.

Case Description:

22-year-old woman, BMI 35kg/m², 3 weeks post-partum with a history of depression and migraines, presented for a rectal examination under anesthesia. Her medications were notable for sumatriptan and venlafaxine. She received midazolam and, in the OR, standard monitors illustrated normal vitals. General anesthesia was induced uneventfully, and the patient was easily intubated and maintained with sevoflurane. Immediately after placement in lithotomy, severe bradycardia ensued which was treated with glycopyrrolate 0.2 mg; subsequent supraventricular tachycardia developed with hypertension reaching 220/110's. Increments of Esmolol were given without response. The blood pressure decreased after administration of labetalol and the short surgical procedure was then completed. Immediately after discontinuation of sevoflurane, the patient developed acute pulmonary edema, hypotension, and ST segment depression. A norepinephrine infusion was started, and the patient was transferred intubated to the SICU. An ECG showed findings consistent with acute coronary ischemia. A chest CT scan showed opacification of the pulmonary arterial system, consolidation and ground glass opacities affecting all lung lobes. An echocardiogram showed severe mid-left ventricular hypokinesis, severely reduced LV-ejection fraction of 38% and elevated LV-filling pressures. The NT-proBNP was elevated at 456 pg/ mL. Based on these findings, the patient was diagnosed with Takotsubo stress cardiomyopathy. On POD1, the patient was weaned off the norepinephrine infusion and

extubated later that day. A repeat ECG and echo on POD2 showed normal findings, and the patient was discharged without sequelae.

Discussion:

The pathophysiology of TCM is still not fully understood; however, it seems that a catecholamine surge caused by severe emotional or physical stress is the common denominator.^{6,7} The term “broken heart syndrome” reflects the association of the syndrome with profound emotional stress. Women of postmenopausal age are more commonly affected, but TCM is also reported in those young and pregnant.^{6,8} Troponin is elevated in most patients but to a lesser degree than in patients presenting with acute myocardial infarction. Level of NT proBNP is a reliable predictor of short- and long- term complications.¹³ Usually, TCM is reversible with a favorable prognosis. However, severe complications including left ventricular wall rupture and death have been reported.¹⁵ Treatment is mainly supportive to manage symptoms.¹⁴ In the patient described here, the ECG and Echo were pathognomonic signs, along with an elevated NT proBNP allowed for a quick diagnosis without the need to perform unnecessary cardiac catheterization.

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It has become increasingly apparent that patient outcomes and access to medical care are related to clinician workforce diversity^{1,2,3}. In response, the Accreditation Council for Graduate Medical Education (ACGME) recommends promoting diversity among physicians through self-education toolkits, community outreach, research, and residency program accreditation requirements⁴. Over the past several years, residency programs have trialed different models to expand program diversity. Increasing GME diversity is challenging, and unidimensional diversity initiatives usually fail⁵. The Department of Anesthesiology at the University of Utah has, over the last five years, applied a multi-pronged approach to promote equity, diversity, and inclusion among residency applicants. This has included partnership between Graduate Medical Education (GME) and Undergraduate Medical Education (UME) programs to prioritize diversity, participation within student-led organizations - especially Underrepresented in Medicine (URM) organizations like Historically Black College and/or University (HBCU), Student National Medical Association (SNMA) and Latino Medical Student Association (LMSA). Another major focus has been on the development of inclusive recruitment strategies by prioritizing interviewer diversity through inclusion of chief residents and more female faculty. A more holistic review of applicants has been encouraged by removal of applicant picture, self-identified race, and gender during the screening process, creation of a standardized rubric with input from our Department's Justice Equity Diversity and Inclusion (JEDI) committee, and situational judgement testing during interviews. With these efforts, program residents during the 2021 and 2022 Match were comprised of 47-56% women and 26-27% URM relative to an applicant pool of about 30% women and 22% URM.

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Submitter: Samuel Chambi

Background

Laryngotracheal stenosis is a known complication of prolonged intubation or trauma arising from tracheal inflammation and scarring. It may present as hypoxia, respiratory distress, and stridor. Supraglottic and glottic stenosis are associated with inspiratory stridor, while biphasic stridor is pathognomonic for subglottic tracheal stenosis.

We present the care of a parturient with symptomatic tracheal stenosis, following COVID-19 pneumonia. This case provides insight into the anesthetic considerations for managing tracheal stenosis while balancing fetal well-being.

Case Description

A 28-year-old female with a history of COVID-19 pneumonia requiring intubation with mechanical ventilation, presented to the emergency department at 36 weeks gestation in respiratory distress. She describes progressive exertional dyspnea for 2 months and was observed to have biphasic prolonged stridor, prolonged inspiration, and increased work of breathing. Flexible video laryngoscopy demonstrated Cotton-Myer Grade 3 subglottic stenosis, correlating with a 71-99% tracheal obstruction.

Her oxygen saturation remained above 95% on room air, although after admission she had worsening respiratory distress and she transiently required 10 liters per minute oxygen via face mask to maintain her saturation. She was weaned to room air after treatment with racemic epinephrine. There were no signs of fetal distress. After a multidisciplinary meeting, the obstetric, otolaryngology, and anesthesiology physicians coordinated an urgent cesarean delivery and tracheal dilation.

On the day of surgery, the patient tolerated room air and supine positioning without dyspnea despite the degree of stenosis. With airway equipment and the otolaryngology team on stand-by, a lumbar epidural was placed between the 3rd and 4th interspaces. It was titrated to effect with two separate boluses of Lidocaine 2% with epinephrine and sodium bicarbonate up to 10ml initially. She received a total of 18 mL throughout the case. The patient was positioned supine, and 2 L/min oxygen was administered via nasal cannula. Her baby was delivered by repeat cesarean section and APGARs were 8 and 8 at one and five minutes, respectively. Oxytocin was administered to augment uterine tone. Epidural morphine 3 mg was administered for postoperative pain control.

Following abdominal closure, the patient was preoxygenated via face mask. A rapid sequence induction with propofol and succinylcholine was performed, and she was intubated with a 4.0 MLT under direct laryngoscopy. She underwent a coblator excision with Kenalog injection, upsized to a 6.0 ETT, and successfully extubated to face mask without complications.

Discussion

The prevalence of severe COVID-19 in the obstetric population may increase the incidence of tracheal stenosis among young females. Pregnancy alters minute ventilation to support the developing fetus as the upper airway becomes edematous and friable. Tracheal stenosis and COVID-19 introduce additional concerns affecting airway patency, airway management, oxygenation, ventilation, and surgical positioning.

Tracheal stenosis has not been well characterized in the obstetric population. This case highlights perioperative considerations and provides a framework for anesthetic management. We advocate for multidisciplinary coordination and believe it is paramount for safe perioperative care. Even with neuraxial anesthesia, contingent plans for airway management including advanced airway equipment, multiple sized endotracheal tubes, and emergency support from otolaryngology must be considered.

Submitter: Jessica Chan

Acute Right Ventricular Failure From CO₂ Embolism During Endoscopic Vein Harvesting

Haiyan Guo, D.O., Jessica Chan, D.O., Bradlee Bachar, M.D.

Abstract

Carbon dioxide (CO₂) embolism occurs when the CO₂ gas enters the blood circulation. Most cases of CO₂ emboli are small, subsequently asymptomatic and self-resolving. Clinical signs of CO₂ embolism are hypotension, tachypnea, tachycardia, bradycardia, dyspnea, hypercapnia, and hypocapnia. In severe cases, CO₂ can also obstruct the pulmonary circulation, leading to cardiovascular collapse and death.

Transesophageal echography (TEE) can aid in diagnosing CO₂ embolism when immediate diagnosis and treatment of the condition can be life-saving.

Carbon dioxide embolism is most commonly associated with laparoscopic surgeries, but it can also occur in other laparoscopic procedures including endoscopic vein harvesting. Endoscopic vein harvesting (EVH) is a procedure to harvest a blood vessel to use as a conduit during coronary artery bypass graft surgery (CABG). In this article, we present a case of symptomatic CO₂ embolism during endoscopic vein harvesting and our prompt anesthetic management. This case also highlights the importance of early diagnosis of CO₂ embolism with the aid of TEE in helping with resuscitation effort.

Submitter: Jimmy Chang

Tracheal agenesis is a malformation of the respiratory system resulting in an interrupted or absent trachea below the larynx with a presence or absence of a tracheoesophageal fistula. This rare congenital anomaly presents as an unexpected emergency at birth with neonatal respiratory distress and high mortality rate. We describe a 2-day old male who was intubated at birth for respiratory distress and extubated the next day, but he immediately decompensated. Re-intubation attempted by multiple specialties were unsuccessful due to lack of end-tidal CO₂ despite visualization of endotracheal tube passing through the vocal cords. Patient was emergently taken to operating room for neck exploration and possible tracheostomy. However, ENT found a blind pouch below the vocal cord with a distal esophageal fistula into the trachea. At this point, the surgery was aborted and patient was brought back to NICU on nasal CPAP. After family discussion, patient was put on comfort care.

Title: Anesthetic Management for Hepatectomy in a 14 month old with Hepatoblastoma

Authors: Philip Cheng M.D., Robert Wong M.D.

Institution: Cedars Sinai Medical Center

Background:

Hepatic tumors account for 1% of all pediatric malignancies. Even though perioperative morbidity and mortality can be as high as 19% in these patients, recent advances in anesthesia and surgical management have significantly reduced the operative risks. Anesthesiologists taking care of these patients should be familiar with their associated perioperative comorbidities, the risks involved in these procedures, and how to manage them.

Case Description:

14 month old female presented with a large abdominal mass, which was confirmed on imaging to be of hepatic origin without evidence of extrahepatic disease. Biopsy of the mass was done confirming the diagnosis of hepatoblastoma. Patient was started on chemotherapy consisting of Cisplatin, 5FU, Vincristine, and Doxorubicin. After the chemotherapy, the patient developed metabolic derangements, hypertension, and acute kidney injury. Alpha fetal protein levels were markedly reduced after chemotherapy. On the day of surgery, metabolic panel was within normal limits with a normal creatine level. Patient underwent an uneventful mask induction with two peripheral intravenous lines, an arterial line, and a right internal jugular vein central line. Patient was maintained on sevoflurane with cisatracurium for paralysis and fentanyl for pain control. An epidural catheter was placed but not activated. Dopamine infusion and blood transfusion was started to maintain adequate perfusion pressure as slow continuous oozing and manipulation of the liver caused the patient to be hypotensive. At the end of the procedure, the patient lost 300cc of blood with 160cc of red blood cells and 80cc of fresh frozen plasma given. Dopamine was weaned off at the end of the case and the patient was extubated and taken to the PICU.

Discussion:

It is not uncommon for patients with hepatoblastoma to have undergone neoadjuvant chemotherapy, which can have multiple systemic effects. As a result, in addition to routine blood workup, a thorough cardiorespiratory assessment is required to ensure adequate functional reserve. Liver function should also be assessed as patients with preexisting hepatic impairment can also have increased risks for blood transfusions and mortality. Intraoperatively, an arterial line is placed for frequent arterial blood gas sampling and beat to beat blood pressure monitoring as sudden drops in blood pressure can occur from rapid blood loss and displacement of the liver out of the abdominal cavity. In addition to adequate large bore venous access, a central line for central venous pressure (CVP) monitoring and rapid transfusion should be established. It is important to note that surgical retractors and increased intrathoracic pressures can artificially increase CVP in these cases. Massive hemorrhage is always a risk, and may require massive blood transfusions or cause electrolyte abnormalities.

These can be fatal if not monitored and treated in a timely manner. Anesthesiologists taking care of kids with hepatic tumors for hepatic resection should be familiar with all the risks and unique challenges associated with the surgical procedure, and how to manage them appropriately so as to minimize the morbidity and mortality of these patients.

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Initiating patients with opioid use disorder (OUD) on medication treatment of OUD (MOUD) has been shown to improve outcomes, increase retention in treatment, and decrease morbidity and mortality (Sordo L et al. *BMJ*. 2017;357:j1550). A hospital stay can be a valuable opportunity to start a patient on MOUD though it is not often considered in the preoperative time period.

Buprenorphine, a mu-opioid partial agonist, can make acute pain management complicated in those receiving full agonist opioids due to risk for precipitated withdrawal. We report a case of a hospitalized patient with OUD who was initiated on buprenorphine while receiving full agonist opioids for acute pain prior to receiving emergent spine surgery.

A 53 year-old man with OUD presented with subacute neck and back pain with associated neurologic symptoms worsened after a ground level fall three days prior. Imaging showed C5-C6 discitis osteomyelitis with associated phlegmon causing stenosis. The patient reported smoking fentanyl daily for the past six months and had last smoked fentanyl two days prior to presentation. Initially, pain management consisted of potent full mu opioid agonists (IV hydromorphone PCA and PO oxycodone) supplemented by oral non-opioid analgesics (acetaminophen and tizanidine). Despite escalating doses of opioids, pain control deteriorated on day four. The patient was also scheduled for surgical intervention of the infection, raising concerns for worsening pain postoperatively. The decision was made to start the patient on an IV ketamine infusion and to start a slow induction with buprenorphine. In the days leading to surgery, the daily buprenorphine dose was gradually increased from 1 mg to 6 mg per day. Pain control improved and the patient did not display withdrawal symptoms. On day seven, the patient went to the operating room for C5-C6 corpectomy. On day eight, the patient returned to the operating room for a C3-T1 laminectomy and posterior fusion. In the 10 days following surgery, the buprenorphine dose was slowly increased from six to 18 mg per day, ketamine was weaned off, and the full mu agonists slowly tapered down. Pain control remained acceptable throughout the patient's admission. The patient was discharged on day 28 to acute rehabilitation with a course of oxycodone and buprenorphine treatment which he continues on to this day.

Though the current guideline is to continue a patient's buprenorphine through surgery, there are no current guidelines regarding initiating buprenorphine preoperatively (Kohan L et al. *Reg Anesth Pain Med*. 2021;46(10):840-859). It is challenging to co-manage pain and OUD in hospitalized patients with acute pain needs in the perioperative time period, leading to hesitance amongst providers. This case describes an uncommon case in which MOUD with buprenorphine was initiated preoperatively. Buprenorphine was selected in this case due to patient preference. Early introduction of buprenorphine allowed for a long acting opioid for better control, while aggressive induction was intended to protect the patient from opioid related side-effects. We suggest that slow induction of buprenorphine for MOUD is feasible without worsening a patient's pain.

Submitter: Thomas Cho

Lateral Intubation in the Sitting Tripod Position for Cervicofacial Necrotizing Fasciitis

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Introduction

Cervicofacial necrotizing fasciitis (CNF) is a rare and aggressive deep neck space infection associated with a mortality rate of 40 to 76%. Because mortality in CNF occurs most frequently due to hypoxia and asphyxia, appropriate and rapid airway management is crucial in increasing the survival rate. Here we describe the anesthetic preparation and management of a patient with significant airway anatomy distortion due to CNF.

Case Description

58-year-old male with no prior medical care presented to the ED after one week of progressive dyspnea and a foul odor emanating from his neck. Patient was emergently taken to the OR due to impending airway loss. Patient with an ASA risk stratification score of 4 E, Mallampati class IV, a thyromental distance of less than 3 finger breaths, and severely limited range of motion of the neck. After application of nebulized local anesthetic, the patient seemed to acutely decompensate in respiratory efforts and began to tripod. Due to the severe distortion of the patient's airway anatomy, it took three attempts in order to successfully intubate the airway awake in the sitting tripod position via video laryngoscopy using a GlideScope® from the right side of the patient. A fiberoptic scope was used to confirm the appropriate placement of the reinforced ETT and visualization of the airway. Necrotic white fluid and thick mucus were aspirated from the bilateral main bronchi. The surgical team then performed a controlled tracheostomy and the ETT was removed after ventilation via tracheostomy was confirmed with end-tidal CO₂. Surgical debridement of roughly 80 cm² of necrotic/devascularized tissue was performed, extending from the body of the mandible to the root of the neck and laterally to the left SCM. Further debridement was limited due to proximity to critical structures. The patient was transferred to the ICU and then returned to the OR the following day for a total laryngectomy as the entire voicebox was necrotic.

Discussion

Emergent, thorough, and extensive surgical intervention is the only way to increase the survival rate of patients diagnosed with necrotizing fasciitis, a well-known rapidly expanding infection of soft tissues. Whenever possible, in the setting of airways with the potential for impending collapse, the airway should be secured prior to tracheostomy in order to have a safe approach to the tracheostomy and prevent loss of ventilation, hypoxic injury, and possibly the airway itself. In impending airway collapse, the airway may need to be maintained in the sitting position. Intubation is possible laterally in the sitting position with a GlideScope if the patient cannot ventilate in the supine position.

Submitter: Erika Chow

Title: Retrospective analysis on an observational study to extract electroencephalogram signatures for anesthesia-associated dreaming

Authors: Erika T Liao, MD¹, Laura Hack, MD¹, Makoto Kawai, MD¹, Harrison Chow, MD¹, Boris Heifets, MD¹

Institution: ¹Stanford Medical Center, Stanford CA

Introduction: Dreaming under anesthesia has been known to be a phenomenon since ether was discovered but has largely been a curiosity and novelty. Individual case reports have shown varying dream content and triggers for dreaming, but little has been done to study dreaming under anesthesia. Leslie et al. in 2009 found that dream recall was associated with suppression of alpha band power, and in five minutes of presumed dream time, intraoperative electroencephalograms (EEG) showed more high frequency 20-40Hz power and reduced spindle activity in dreamers compared to non-dreamers. Building off this prior work, we wanted to replicate the EEG findings to develop a method of inducing dreaming under anesthesia.

Methods: Patients undergoing surgery at Stanford Medical Center in Stanford, CA consented to be asked about their dream content under anesthesia on emergence. English-speaking patients undergoing monitored anesthesia care with intraoperative EEG monitoring using Sedline had epochs selected from the Sedline data during maintenance anesthesia as well as just prior to emergence. Epochs underwent processing by fourier transform analysis, and multivariate regression analysis was performed to identify EEG markers associated with dreaming.

Results: 153 patients were asked about their dreams under anesthesia, of which 69 English-speaking patients had intraoperative EEGs. 9 patients had no recorded dream data, 20 patients reported no dreams, 10 patients remembered having dreams but not the dream content, 30 patients reported 1 dream, and 1 patient reported multiple dreams. Preliminary analysis of extracted epochs showed increased beta EEG activity in patients who reported having dreams in the minutes leading up to emergence.

Discussion: A case report has previously been published from Stanford Medical Center of a patient who was able to resolve symptoms of post-traumatic stress via dreaming during anesthesia. This initial analysis is laying the groundwork for 1) finding the EEG signatures of dreaming to target inducing dreams in patients under anesthesia, and 2) standardizing a protocol for how to achieve the dreaming EEG signatures. Further data is continuing to be collected and extracted epochs from the larger database will be input into a machine learning algorithm to determine if the extracted EEG signatures are predictors for dreaming under anesthesia as well as dream recall. Once a protocol is defined, we can then reliably recreate dreaming under anesthesia and determine if it can have a therapeutic psychiatric benefit for patients.

Submitter: Sampreeti Chowdhuri

WARC Abstract

Title: Retrospective Review of Surgical Site Infections, Complications, and Short- & Long-Term Mortality in Patients with Human Immunodeficiency Virus-1 Undergoing Cardiothoracic Surgery

Authors:

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Introduction:

There are approximately 1.3 million persons infected with the Human-Immunodeficiency Virus-1 (HIV) living in the United States with 55,000 new infections annually. Previous studies have found that patients infected with HIV are at an increased risk for cardiovascular disease, such as premature atherosclerosis. The development of cardiovascular disease in HIV+ patients has become one of the most significant issues in patients who receive long-term antiretroviral therapy. Previous studies have sought to evaluate the risk-benefit of performing cardiac surgery in patients infected with HIV. Some concerns include the determination of risk when performing procedures in an immune-compromised patient and whether or not HIV disease itself affects the potential benefit of cardiac surgery in the context of life-expectancy. With the advent of newer antiretroviral agents, there is a need to re-evaluate post-operative outcomes and complications in HIV+ patients undergoing cardiac surgery. This study sought to evaluate presurgical HIV-related immune characteristics and elucidate outcomes in HIV+ patients who underwent open heart cardiac surgery.

Methods:

This study was a retrospective study performed at a single tertiary medical center and was IRB approved. All HIV+ patients who underwent open heart cardiac surgery from January 1, 2000 to December, 31, 2019 were evaluated and followed for a period of two years postoperatively. Demographics, HIV history, immune characteristics, intraoperative and postoperative outcomes were extracted from the patient's electronic health record, STS database and our institutional HIV Registry Databank. Descriptive and analytic statistics were performed to compare HIV+ patients who had undetectable versus detectable HIV viral loads.

Results:

Patient characteristics, co-morbidities, and outcomes were compared in patients with detectable viral load (DL) versus undetectable (UDL) viral load at the time of surgery. The majority of patients underwent either a CABG, valve, or CABG + valve surgery. 90.2% of patients with UDL viral load were being treated with HAART at the time of surgery, versus only 9.8% of DL patients ($p = 0.02$). However, there was no significant differences between CD4+ cell counts between patients with DL vs UDL viral loads ($p = 0.83$). Additionally, both groups had a wide range of CD4+ counts with both groups having a wide range of CD4+ counts (137 – 1733 cells/mm³ in UDL patients vs 224 – 1467 cells/mm³ in DL patients). There was a significantly higher prevalence of Type II diabetes in patients with DL viral loads ($p = 0.03$). Patients with UDL viral loads had lower platelet counts prior to surgery ($p = 0.07$). During the peri-operative course, blood products were used more frequently in patients with a DL viral load ($p = 0.08$). Post-operatively, no patients had surgical site infections within 30 days of surgery or sternal wound infection within 90 days of surgery. 2-year mortality rate post-operatively was 9.7% overall with no differences between the two groups.

Conclusion:

We evaluated preoperative characteristics and postoperative outcomes of HIV+ patients undergoing open-heart cardiac surgery. We found that there were significant differences in patient comorbidities between patients with DL versus UDL viral load, including higher incidence of Type II diabetes and lower platelet count. The latter finding was also associated with higher blood product transfusion. Most importantly, we found that HIV+ patients had positive outcomes overall including low 2-year mortality rates and no incidence of post-operative surgical site/sternal wound infections. Our findings indicate that well-managed HIV+ patients on antiretroviral therapy who undergo cardiac surgery experience low rate of complications similar to that of non-HIV+ patients.

Title: Establishing a standardized thoracic epidural ultrasound protocol to improve procedural efficiency and trainee learning curve at an academic institution: a preliminary protocol

Author(s)/Institution(s): Julia Rose Collins, MD, Andrew Gray, MD, PhD. University of California, San Francisco Department of Anesthesia and Perioperative Care

Introduction: Placing a successful epidural for perioperative analgesia can pose challenges for even the experienced provider, especially in the upper thoracic region due to anatomic overlap between spinous processes. The loss of resistance (LOR) technique has remained the most common method for placement of thoracic and lumbar epidurals in the perioperative setting. Often performed blind with poor external landmarks, mastery of this tactile technique remains a steep learning curve for trainees. The ease, safety, and success of pre-operative thoracic and lumbar epidurals may be improved with knowledge of individual patient anatomy. Creation of a standardized pre-procedure epidural ultrasound protocol represents a feasible, cost-effective, and low-risk intervention to improve average epidural procedure time, number of needle passes, success rate, and serve as an educational tool for trainees learning neuraxial techniques.

Prior studies have demonstrated the utility and feasibility of utilizing neuraxial ultrasound as a procedural aid, however with varying success (1,5,6). Sonoanatomy of the neuraxial spine - in particular, visualization of the ligamentum flavum-dura mater complex in the parasagittal oblique view - has been well-described (2) and correlates well with other gold-standard cross-sectional imaging (4). The use of ultrasound represents a cost-effective and accessible alternative in the perioperative setting. Pre-procedure neuraxial ultrasound has shown to improve novice trainee learning curve for placing lumbar epidurals in obstetric anesthesia (3).

Methods: This pre-procedure offline ultrasound protocol was developed to optimize operator success by gathering select measurements prior to initial needle entry utilizing the paramedian approach. (1) Scan in transverse medial plane (transverse interlaminar view) and make a longitudinal skin mark to orient to midline. (2) Obtain paramedian sagittal view oblique (PMSO) view ("sawtooth") of lamina by moving probe 1-2 cm lateral from midline and tilting probe inwards towards midline to visualize the ligamentum flavum-dura mater and anterior complexes (parallel thin hyperechoic lines between interlaminar spaces). (3) Make a longitudinal skin mark centering probe on lamina. (4) Measure perpendicular distance from skin to lamina (primary end-point for initial skin entry). (5) Measure distance between skin and ligamentum flavum dura-mater complex to estimate distance to LOR.

Results:

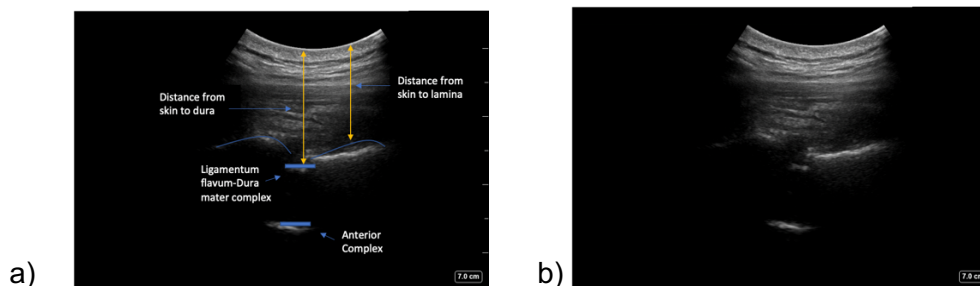


Figure 1. Posterior medial sagittal oblique view demonstrating “sawtooth” view of thoracic laminae. Thin hyperechoic lines demonstrate ligamentum flavum-dura mater complex and anterior complexes. Measurements from skin to lamina and dura, respectively, demonstrated in a) annotated image and b) original image. Images obtained using curvilinear ultrasound probe (8-3MHz).

Conclusions: Our preliminary proposed ultrasound protocol demonstrates a standardized approach to pre-procedural ultrasound mapping of the neuraxial spine to aid in placement of thoracic epidurals. Further study is needed to investigate feasibility of implementing this protocol, impact on average procedure time, number of needle passes, epidural success rates, and trainee learning curve. Future applications of neuraxial ultrasound may include real-time direct needle imaging.

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Submitter: Jason Cosman

Myxedema Coma Case
WARC 2023

Anesthetic Management in a patient with Myxedema Coma

Jason Cosman MD, Jane Ahn MD

UCI Health Department of Anesthesiology and Perioperative Care, Orange, CA

Background/Case Description:

A 60-year-old previously undoctored female with myxedema coma was scheduled for emergent exploratory laparotomy for bowel perforation secondary to ileus. The patient was found after being unconscious for several days and was severely hypotensive, hyponatremic, and hypothermic. She was found to be severely hypothyroid and despite dexamethasone and levothyroxine replacement therapy, she developed severe ileus resulting in bowel perforation. Upon presentation to the OR for emergency laparotomy, the patient was somnolent and hypertensive with a normal heart rate and body temperature of 36°C. She was treated with 100 mg of hydrocortisone prior to induction. Rapid sequence intubation was performed with propofol, lidocaine, and rocuronium, after which the patient became significantly hypotensive with MAPs in the 50 mmHg range. The patient was started on norepinephrine and vasopressin drips. The patient was warmed with Bair hugger and room temperature was increased after body temperature dropped to 35°C shortly after induction. After surgery commenced, the patient was transported to the ICU intubated with vasopressor and inotropic support due to septic shock and suspected adrenal crisis secondary to myxedema coma.

Discussion:

Myxedema coma is a rare and severe form of hypothyroidism characterized by stupor or coma, hypoventilation, hypothermia, hypotension, and hyponatremia. This is a medical emergency with a mortality rate of 25-50%. Patients should be started on thyroid replacement therapy urgently after diagnosis and surgery should be done only in life threatening situations, such as the bowel perforation as seen in our patient. Anesthetic considerations include hydrocortisone therapy due to blunted stress response from adrenal suppression and aggressive fluid and electrolyte therapy. Rapid sequence intubation should also be performed due to gastroparesis seen in these patients. Thyroid hormone is critical for myocardial contractility, and a deficiency in this hormone leads to bradycardia, decreased cardiac output, and increased PVR as seen in our patient. Inotropic support is often needed perioperatively. Cardiac depression is secondary to catecholamine resistance and downregulation in beta-adrenergic receptors, making this depression refractory to inotropes in some cases. From a pulmonary standpoint, ventilation response to hypercapnia and hypoxia is depressed and these are potentiated by sedatives, opioids, and general anesthesia. In severe hypothyroidism and myxedema coma, there should be a low threshold to keep the patient intubated as these patients are prone to respiratory demise after anesthesia. Hypothermia secondary to reduction in metabolic rate is common, and close attention to body temperature is necessary to avoid complications associated with hypothermia.

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Submitter: Gabriel Crocker

TEE To The Rescue: A Case Of Symptomatic Right Atrial Compression

Transesophageal echocardiography (TEE) and point of care transthoracic cardiac ultrasound are skills emphasized by the American Board of Anesthesiology and are critical to anesthesia practice. We present a case of a 73-year-old male with known hepatic cysts causing mass effect on his inferior vena cava (IVC) and right atrium (RA) where TTE and TEE were used for preoperative and intraoperative assessment and hemodynamic management.

Submitter: Jacob Dangerfield

Title: Small Group Sessions facilitated by GME Wellness Counselors increases likelihood a resident will reach out to Wellness Counselors in a time of need

Author: Jacob Dangerfield, M.D. Jennifer DeCou, M.D. H. Cameron Norris, M.D.

Institution: University of Utah Health

Introduction:

Burnout, anxiety, and depression are three conditions that are prevalent in medical providers. This is especially the case in the field of anesthesia where providers are often isolated from their peers due to the nature of the practice of anesthesia. These conditions occur in both attending providers and resident providers, and may be more likely to occur in residents. With this concern, many Graduate Medical Education Offices have a Wellness Center with no cost resources including free counseling from a certified therapist. There are often stigmas surrounding such counseling and therapy, and because of this many residents do not access these free resources in a time of need. To address these issues, we hypothesized that carrying out Small Group Resiliency Sessions with residents that are facilitated by GME Wellness Counselors would improve resident perceived peer support and make it more likely that a resident will reach out to the Wellness Counselors in a time of need.

Methods:

Working with Residency program leadership and the GME Office of Wellness, we were able to organize and schedule small group resiliency sessions with GME Wellness counselors during protected resident didactic time. These sessions were small groups including the members of one's class (i.e., CA-1s on their own) that were facilitated by the GME Wellness counselors. After these sessions, we surveyed residents who attended using a short Google Forms survey and using a Likert Scale, asked residents about some outcomes from the session.

Results:

Results from our survey showed that the residency sessions were not only well received by residents but had multiple positive outcomes. This survey was sent to 19 residents, and we had a 52% response rate. We found out through this survey that these small group resiliency sessions with GME Wellness counselors had a perceived positive impact on resident personal well-being and increased perceived peer support from classmates as well as made residents more likely to reach out to Wellness Counselors in the future. Perceived positive impact on well-being was found in 80% of resident respondents, improved perceived peer support in 70% of respondents, and 90% of resident respondents stated that this session increased their likelihood of reaching out to GME Wellness Counselors.

Conclusions:

Through this study, we can conclude that our hypothesis was correct in that Small Group Resiliency Sessions with anesthesiology residents that are facilitated by GME Wellness Counselors improves a resident's perceived peer support and improves the likelihood that a resident will reach out Wellness Counselors in a time of need. We believe these findings are very important as they address two important factors that can aid in decreasing a provider's risk for experiencing burnout, anxiety, and depression.

Submitter: Jessica Dawson

Project Category: Education and Emerging Technology or System and Practice-Based Projects

Project Title:

Anesthesiologist for a Day – A Hands-On Workshop to Inspire High School Students

Author(s)/Institution:

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Introduction:

The World Health Organization expects a deficit of 15 million healthcare workers worldwide by 2030. Project Lead the Way (PLTW) is a pipeline program that creates longitudinal relationships with local high schools to inspire students to pursue careers in science, technology, engineering, and math (STEM). PLTW high school graduates are nearly 3 times as likely to major in STEM fields compared to non-PLTW graduates. These reproducible workshops occur yearly in-person or virtually and strive to use existing anesthesia training equipment.

Methods:

As COVID-19 restrictions lifted, we adopted an in-person hands-on workshop approach from December 2022-January 2023 for three high schools in California. The workshop consisted of two stations; intubation and ventilation. The intubation station required two intubating mannequins with realistic vocal cord positioning. In our institution, these mannequins were already purchased to assist early anesthesia trainees with laryngoscopy technique. Students were able to practice direct laryngoscopy with and end tidal tubing. Students received real-time feedback from mannequin that was able to expand during an esophageal intubation as well as lung expansion during appropriate tracheal intubation. Students were instructed on intubation technique and airway anatomy. The second station involved ventilation with ambu bags and child mannequins. Students were instructed to feel for a pulse on themselves and then how to recognize if someone needed chest compressions or rescue breaths—life saving transferrable skills that could be used outside of workshop..

Results:

Between three high schools, over 100 students attended the Project Lead the Way anesthesia workshop in the 2022-2023 season. The workshops were easily reproducible across high schools. Five anesthesia residents and faculty led these workshops. No pre-training was required for the anesthesiology

residents/physicians. Photos from the sessions illustrate student engagement in course material.

Conclusions:

Workshops can be applied to non-US high schools to encourage critical thinking and application of STEM principles. Workshop materials can be sourced from existing training equipment.

Distributive Shock in the Setting of Suspected Intraoperative Carcinoid Crisis

Marcus Dee D.O., Heather Werth M.D.

Introduction

Intraoperative carcinoid crisis is a rare potentially catastrophic complication of neuroendocrine tumors that requires prompt recognition and must be distinguished from other causes of distributive shock in the operating room.

Case Presentation

A 67 year old male with history of hypertension and neuroendocrine tumor of the uncinate pancreas presented for pancreaticoduodenectomy. Preoperative workup for abdominal pain and pancreatitis had revealed a 3.4 x 2.6 cm cystic lesion with ring enhancement. Pathology of the biopsy conducted with endoscopic ultrasound showed cell findings suggestive of well-differentiated neuroendocrine tumor. MRI of abdomen and PET scan did not provide evidence of tumor metastasis. A non-secreting neuroendocrine tumor was suspected due to lack of systemic symptoms and therefore no preoperative hormonal labs were collected.

After an uncomplicated induction and intubation, an arterial line was placed. Ten minutes after antibiotic administration and incision, the patient experienced an abrupt drop in mean arterial pressures from the 80's to the 40's. The anesthetic was lightened, temporizing norepinephrine and fluid boluses were administered. There were no signs of vena cava compression or hemorrhage by the surgical team. The Edward's Lifesciences HemoSphere monitor showed a significant decrease in systemic vascular resistance (pre-incisional 1600 to 500's), with adequate preload and contractility. Due to the low suspicion of tumor secretory function, treatment for possible anaphylaxis was initiated. Antihistamine, steroids and epinephrine were administered to the patient with improvement in hemodynamics. Alternative antibiotics and paralytics were selected however patient remained persistently vasoplegic. Throughout the case, vasopressor support was gradually weaned and patient was successfully extubated at the end of the case.

Discussion

Carcinoid syndrome is the result of a hormonally-secreting neuroendocrine tumor releasing amines (serotonin, histamine), polypeptides (bradykinin), and prostaglandins. Clinical features include cutaneous flushing, pruritus, diarrhea, bronchospasm and right sided-cardiac valvular pathologies. For tumors arising in the gastrointestinal tract, hepatic clearance of released mediators usually delays systemic manifestations until the tumor has metastasized to the liver. Perioperatively, stress such as direct surgical manipulation and exposure to anesthetics can result in the profound release of vasoactive hormones and precipitate hemodynamic collapse known as carcinoid crisis by overloading hepatic metabolic capacity.

Known secreting neuroendocrine tumors are often managed preoperatively with somatostatin analogues to minimize systemic symptoms. Despite prophylaxis, carcinoid crisis can still occur in up to 35% of surgeries and has become a topic of debate. Acute intraoperative carcinoid crisis is managed with intravenous fluid resuscitation, vasopressor support, somatostatin analogues and serotonin antagonists. Care must be taken to distinguish it from other types of distributive shock such as anaphylaxis as exposure to direct acting beta agonists such as epinephrine can worsen tumor hormone release.

Summary

Carcinoid crisis can occur even in asymptomatic patients with suspected non-secreting neuroendocrine tumors undergoing surgery provoked by anesthetics and direct tumor manipulation.

Title: ANESTHETIC CONSIDERATIONS IN JOB SYNDROME

Authors: Jonathan Harper MS4, Paul Delgado MD, Candace Chang, MD

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BACKGROUND:

Hyper-immunoglobulin E Syndrome (HIES) is a rare disease that occurs in less than 1 per million people¹. The disease, first described 1966 by Davis et. al., was coined Job's Syndrome, after the biblical character who was smitten with "sore boils from the sole of his foot unto his crown."² This initial report shared findings of two pediatric female patients with eczema, recurrent infections (otitis media, pneumonia, cellulitis), and "cold" staphylococcal abscesses. The syndrome was further characterized in 1972 by Buckley et. al. who noted elevation of IgE levels in two adolescent boys and subsequently coined the term, Hyperimmunoglobulinemia E. Now called HIES, the disease is classified by a mutation in the signal transducer and activator of transcription 3 (STAT3), part of the JAK/STAT signal transduction pathway and a downstream signaling target of interleukin 6 (IL-6). Thus, the alteration of STAT3 has broad immune consequences resulting in diverse clinical symptoms. Since the original classification and further characterization of the disease in 1966 and 1972 respectively, clinical phenotypes of STAT3 mutated HIES include eczema, recurrent "cold" staphylococcal abscesses, fungal skin infections, pneumonia, pneumatoceles, scoliosis, pathologic fractures, retained primary teeth, aneurysm, and Chiari malformations.^{3,4}

Despite the unique presentation of HIES, merely 300 cases have been reported in the medical literature (Khan 2016). Furthermore, very few cases are reported in the anesthesiology literature, which are listed below.

- Tapper and Giesecke presented a case report in 1990 of spinal anesthesia for an acute bowel obstruction in a child with HIES and pneumatoceles and empyema.⁵
- Kulkarni et. al. detailed a general anesthetic technique for a 10 year old male child who underwent operative drainage of multiple abscess sites in 2012.⁶
- Miller and Mann published a 1990 case report explaining general anesthesia used (Nitrous oxide and isoflurane) for the drainage of a hip abscess in a pregnant female at 38 weeks' gestation with HIES.⁷
- de Resende et. al. published a case report in 2011 of a 13 year old male who presented for elongation of the femur, did well with sevoflurane, which was chosen as opposed to neuraxial anesthesia due to concern for infectious risk with neuraxial anesthesia.⁸

CASE DESCRIPTION:

A 31 year old male with a past medical history of Hyper-immunoglobulin E Syndrome, “Job Syndrome”, morbid obesity, obstructive sleep apnea, recurrent soft tissue infections, chronic antibiotic use was admitted from the emergency department the Burn Intensive Care Unit for surgical management of an acute necrotizing soft tissue infection affecting his left posterior thigh. The patient underwent four surgeries requiring general anesthesia during this hospitalization including multiple jet and incisional debridements and wound vacuum placements. His course of anesthesia is described below.

Preoperative Course:

The patient received a transdermal scopolamine patch for post-operative nausea and vomiting (PONV) prophylaxis, which he had experienced in prior surgeries. He was also administered 2 mg of midazolam prior to entering the operating room for anxiolytics. Intravascular access included two peripheral venous catheters.

Intraoperative Course:

Standard ASA monitors were used throughout the case. The patient was induced with fentanyl, lidocaine, and propofol. Rocuronium was used for paralysis. He was intubated with a 7.5 mm endotracheal tube using video laryngoscopy. The maintenance anesthetic used was sevoflurane. For additional PONV prophylaxis, the patient was administered 8 mg of dexamethasone and 8 mg of ondansetron. For analgesia, the patient received a total of 250 mg of fentanyl, and 1 mg of hydromorphone. Lactated ringer crystalloid was administered throughout the entire case for a total of 3,000 mL. No antibiotics were initiated in the operating room as the patient was receiving scheduled doses of broad-spectrum antibiotics including Clindamycin, Meropenem, Vancomycin, and Ampicillin and Sulbactam. Throughout the surgery the patient’s blood pressure was maintained with several doses of phenylephrine. He was extubated in the operating room and returned to the Burn ICU without any complications.

Immediate Post Operative Course

There were no immediate complications during the recovery from anesthesia period. The patient able to participate in an exam, was not in pain, and was not nauseous. His vital signs after emergence from anesthesia were in the normal range.

Remainder of Hospitalization

The patient had three repeat debridement procedures with placement of a wound vacuum during his hospitalization. His final procedure prior to discharge was removal of the wound vacuum. He was discharged to his home with home health services on oral antibiotics. Over the next several months, the patient had multiple admissions for similar reasons that required surgical intervention.

DISCUSSION

- Hyper-immunoglobulin E Syndrome (HIES) is a rare disease in which a paucity literature is available regarding anesthetic management.
- It is characterized by recurrent infections affecting multiple organ systems, including integumentary (cellulitis, abscesses), pulmonary (pneumonia, empyema), skeletal (osteomyelitis, scoliosis), among many others.

- This patient's history of recurring infections led to frequent hospitalizations and surgeries to manage his symptoms. This cycle of frequent infections and subsequent hospitalizations led him to pursue a mostly sedentary lifestyle, which then led to subsequent medical issues including morbid obesity, obstructive sleep apnea, and frequent acute kidney injuries.
- We purposefully avoided a propofol infusion as the primary anesthetic as the theoretical risk of microbial contamination causing an iatrogenic infection would likely be higher in a patient with HIES. Moreover, maintenance with volatile anesthetics allowed for a more hemodynamically stable intraoperative course as compared to a total intravenous anesthetic. This is pertinent in this patient population as sepsis can be an associated problem during their operative course.
- Neuraxial/regional anesthesia would likely not be a first choice anesthetic in this patient, but one must consider the risks of neuraxial anesthesia in patients with HIES including abnormal curvature from the spine, as scoliosis is a common associated feature of HIES, and overlying skin and soft tissue infections that could cause an infection in or around the spinal column.
- In summary, Job Syndrome is a rare condition that affects multiple organ systems and may lead to multiple surgeries in this patient population. Its effects on multiple organ systems can impact the anesthetic plan, and thus anesthesiologist should be aware of the implications that this syndrome can present.

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Submitter: Linnea Dixon

Safety of epidural placement for labor analgesia in the setting of known cerebellar lesion

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Background: The safety of epidural placement for labor analgesia in the setting of an intracranial lesion is highly debated. Space occupying lesions can range from benign to fatal¹ in the setting of an accidental dural puncture. Many studies reference the risk for increased intracranial pressure as a contraindication to neuraxial anesthesia^{2,3}. However, not every brain lesion causes elevated ICP. A detailed review of patient history, physical, and imaging findings should be conducted to carefully determine which patients are candidates for neuraxial analgesia in the setting of intracranial lesions.

Case Description: A previously healthy 26-year-old G2P1001 at 37w3d gestation was admitted to the University of Utah labor and delivery ward for induction of labor in the setting of a new brain lesion warranting workup. She had originally presented at 33w gestation with 2 weeks of headache. Preeclampsia was ruled out and her symptoms resolved with a headache cocktail. She represented 3 days later. Neurology was consulted and imaging was pursued. Noncontrast MRI and MRV showed "a nonspecific (1.7x1.7cm) T2/FLAIR hyperintensity within the left medial cerebellar hemisphere." Neurosurgery was consulted and she was scheduled for outpatient imaging and follow up postpartum. She elected induction of labor to expedite workup of her lesion. The patient expressed strong desire for labor epidural. The anesthesia team discussed the safety of this option with the obstetric and neurosurgery teams. Multidisciplinary review of imaging was ultimately reassuring against risk for herniation. Ultrasound was utilized to visualize landmarks, the epidural was placed easily, and labor and delivery proceeded uneventfully.

Discussion: To effectively care for patients with intracranial lesions, anesthesiologists must understand risk factors for clinically significant tissue shifts⁴. In a comprehensive review, Leffert and Schwamm discuss common generalizations that are not backed by evidence, including the misconception that every space occupying lesion is associated with increased ICP⁴. This is relevant to discussion of the current case, as the patient had a strong desire for epidural. The multidisciplinary team that reviewed her case to determine her candidacy included neurosurgery, radiology, anesthesiology, and obstetrics. Given that positionality was not an exacerbating or alleviating factor, she had no vision changes, paresthesias, or focal neurologic deficits, and her imaging was overall reassuring against increased ICP, epidural was felt to be a feasible option. A thorough consent detailing risks and benefits was obtained. The patient declined alternatives including IV remifentanyl PCA⁵. Pre-puncture ultrasound was utilized to visualize depth to the dura and appropriate angle. While it is unclear whether preprocedural ultrasound increases success rates⁶, knowing where to expect loss of resistance and the appropriate angle served as another data point to avoid accidental dural puncture. The epidural was placed easily without complication, and labor and delivery proceeded uneventfully. To summarize, it is exceedingly important to risk stratify individuals with intracranial lesions in order to prepare for high-risk patients and provide the benefits of neuraxial analgesia to low risk patients. A thorough discussion regarding risk of increased ICP and herniation should be conducted with a multidisciplinary team and the patient.

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Submitter: Jack Dubuque

Provider understanding around communication of patient's end of life wishes in the perioperative period.

The ASA published guidelines around perioperative DNR in 2001 in order to clarify how clinicians should ethically consider patients' wishes. Other perioperative societies such as the American College of Surgeons and the Association of Registered Perioperative nurses have similar guidelines. Despite this, confusion persists amongst all groups regarding how to discuss patient wishes as well as carry out such wishes. This project utilized a semi structured interview technique to obtain data about how patients' end of life issues are obtained and addressed. The interview groups included perioperative nurses, anesthesiologists, and surgeons. While the sample size was small, several important inconsistencies were identified. We then went on to solicit personal narratives from anesthesiologists in our organization to identify specific instances where patient wishes around end of life care were addressed. Our project identified several deficiencies as well as strategies for improvement in this important area. Targets for quality improvement include provider education both formally and informally, improving the EMR to better highlight this information, and developing simulation to practice these important conversations across all provider groups. Initial efforts at improvement undertaken with this project are amending our EMR, EPIC, to better clarify conversations around patients' end of life wishes at the time of surgery as well as a formal resident lecture on ethics and end of life issues.

Airway Management of Local Anesthetic Induced Angioedema

Tyler Dunn, M.D., Ryan Craner, M.D.

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Background:

Local anesthetic allergies are exceedingly rare but can present with airway implications requiring advanced airway techniques including awake fiberoptic intubation in which local anesthetics can not be used for topicalization or nerve blocks requiring intravenous medications for patient sedation.

Case Description:

A 41-year-old male presented to the ED with angioedema and respiratory distress due to a presumed allergic reaction to an over the counter, local anesthetic containing cold sore medication. He was treated with sub-cutaneous epinephrine, diphenhydramine, and intravenous steroids, but continued to have progressive edema. Given his tenuous airway, we kept the patient spontaneously ventilating and performed an awake fiberoptic intubation without local anesthetic topicalization. The patient was sedated with midazolam, dexmedetomidine and ketamine. With incremental doses of sedatives, the glottis was visualized with the fiberoptic bronchoscope through the oropharynx. The endotracheal tube was passed without difficulty.

Discussion:

Local Anesthetic Allergy:

A true IgE mediated allergy is rare, occurring in 29 patients of a case series of 2,978 patients from 1950 to 2011. It was more frequent with ester local anesthetics (procaine, tetracaine, benzocaine) which is thought to be due to the metabolism to para-amino-benzoic acid (PABA). There is no cross reactivity between esters and amides. It is more common for local anesthetics to cause delayed swelling, localized dermatitis, or mucosal inflammation from delayed-type (type IV) hypersensitivity, appearing within 72 hours of administration specifically from methylparaben which is a preservative.

Dexmedetomidine:

Many medications including remifentanyl, midazolam, and propofol have been used for awake fiberoptic intubation but these agents can cause respiratory arrest, loss of airway control or cardiovascular depression. Dexmedetomidine is a selective alpha-2 agonist with properties of sedation, anxiolysis, analgesia and inhibition of salivary secretion. Commonly administered at a loading dose of 1 mcg/kg followed by an infusion. High doses result in bradycardia and a biphasic response in mean arterial pressure especially in patients with intrinsic bradycardia, hypovolemia, or severe ventricular dysfunction which can be combatted with low dose ketamine for cardio stimulation. In a systematic review, He et al. have shown that dexmedetomidine reduces patients discomfort and recall with no differences in airway obstruction, desaturation or adverse cardiac events compared to remifentanyl or propofol. In a multicenter study, Bergese et al. evaluated sufentanyl with midazolam compared to dexmedetomidine with midazolam showing that the dexmedetomidine group required significantly less midazolam and all patients were kept spontaneously ventilating.

Title

Type 2 Complex Regional Pain Syndrome after Adductor Canal Saphenous Nerve Block

Author(s)/Institution(s)

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Background

Complex regional pain syndrome (CRPS) type 2, also known as causalgia, is a chronic pain condition secondary to nerve injury, most commonly in the limbs. The signs and symptoms of CRPS type 2 can include severe burning or stabbing pain, swelling, allodynia, changes in skin color and temperature, and stiffness or weakness in the affected limb. The diagnosis may also be supported by nerve conduction studies, thermography, and bone scintigraphy. Treatment for CRPS type 2 may include a combination of physical therapy, occupational therapy, and medications, such as NSAIDs and SNRIs. In some cases, nerve blocks, peripheral nerve and spinal cord stimulation may be used to help manage pain. Overall, CRPS type 2 is a complex and challenging condition to manage, and treatment typically requires a multidisciplinary approach.

Case Description

In this case study, we will discuss a 34-year-old female who developed CRPS Type 2 after an adductor canal saphenous nerve block. Initially, the patient was evaluated for right patellofemoral syndrome with subluxation and underwent right knee arthroscopy with right tibial tubercle transfer. For the procedure, an adductor canal saphenous nerve block was performed. Following the block and procedure, she experienced persistent numbness from the medial thigh extending to her foot in the distributions of the right medial femoral cutaneous and saphenous nerves with subjective weakness of the right quadriceps muscles. After initial management by her PCP for 6 months with physical therapy and gabapentinoids, she was referred to a neurologist due to progressive painful paresthesias in the prepatellar skin as well as allodynia, especially with activity. EMG/NCS confirmed a femoral neuropathy on the right proximal to the takeoff of the vastus medialis, predominantly affecting sensory function with early. Additionally, atrophy of the vastus medialis muscle and reduced right patellar reflex were noted. Two years following the injury, she was referred to our pain clinic with repeat EMG consistent with prior findings. After evaluation, a saphenous nerve block was performed with 6ml of 0.25% bupivacaine and 2ml lidocaine 1%. Patient reported excellent coverage of her pain for the duration of the block and subsequently a peripheral nerve stimulator was implanted adjacent to the saphenous nerve with a 27 G 1.5 in linear array electrode at 50 milliamps at 100 hertz. The PNS remained for 49 days and throughout this timeframe and to date she reports 80% relief of pain, 80% improvement in functional status, and 50% increase in quadriceps strength

Discussion

Intraneural injection of local anesthetic or injury to the nerve while performing a blockade is a theoretical risk factor for the development of CRPS type 2. However, there are no prior publications of this potential complication. As such, providers should be aware that while rare, CRPS type 2 from direct nerve injury during nerve blockade is a potential complication. In conclusion, this case study highlights

the importance of awareness of CRPS while performing nerve blocks, and recognition that peripheral nerve stimulation may be an effective alternative for treatment resistant symptoms.

Association between Pulmonary Hypertension and Sickle Cell Disease Depending on Genotype, Age, and Sex

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Background. Pulmonary hypertension (PH) is associated with an increased risk of perioperative mortality after non-cardiac surgery. One review reported a 3.5- 8% mortality rate in patients with PH, which is 2-4 times higher than 1.8%, the rate of perioperative mortality reported for the general population. PH is also a common complication of sickle cell disease (SCD), experienced by 10-33% of patients depending on the method of measurement. While SCD is well-recognized as a perioperative risk factor related to acute anemia and vaso-occlusive events, PH is another major consideration for potential complications. Among SCD patients, PH was found to be an independent risk factor for mortality where, for every 10mm Hg increase in mean pulmonary artery pressure, the likelihood of death increases 1.7 times.

Aims. To evaluate the association between PH and SCD by genotype, age, and sex at the population level in the United States.

Methods. We conducted a retrospective case-control analysis using data from the IBM Truven Health MarketScan Commercial and Medicare Supplemental claims database for years 2015-2019. We included patients who had at least 6 months of continuous insurance coverage. Patients with non-SCD chronic hemolytic anemias and pregnant women were excluded. PH was defined as having at least one inpatient or two outpatient visits with a PH-related ICD-10 code. SCD genotypes included HbSS, HbSC, HbS/ β -thalassemia (HbSth), and all other genotypes (HbOs), which were identified based on ICD-10 codes. Odds ratios (ORs) quantified how strongly PH (outcome) is associated with SCD (exposure) and were calculated for each subgroup combination of age, sex, and SCD genotype.

Results. 49,138,203 patients were included in the analysis, 18,310 of which were diagnosed with SCD, and 65,335 were diagnosed with PH. ORs ranged between 4.2 and 717.7 with a median of 43.7 [Q1Q3: 17.3, 99.9]. Men had higher median OR than women, (75.8 [Q1Q3: 28.7, 110.6] vs. 34.7 [Q1Q3: 11.9, 97.3], Figures 1 and 2. The most significantly elevated ORs were roughly between ages of 15 to 45 for both sexes.

Across genotypes, the highest median OR was in HbSS genotype, 55.0, and the lowest was in HbSth, 28.1; in HbOs and HbSC genotypes, ORs were 53.1 and 34.1 respectively.

Conclusion. Evaluating a large cohort of patients, we found that SCD is associated with a substantial increase in the likelihood of PH, by 1-2 orders of magnitude, especially in younger men. Because of the well-established perioperative risk associated with PH, this finding highlights the need to routinely consider, and potentially screen for, PH in any person with SCD who is proposed for a procedure with sedation or under general anesthesia.

Fig. 1. ORs describing the association between SCD and PH by age and genotype among men

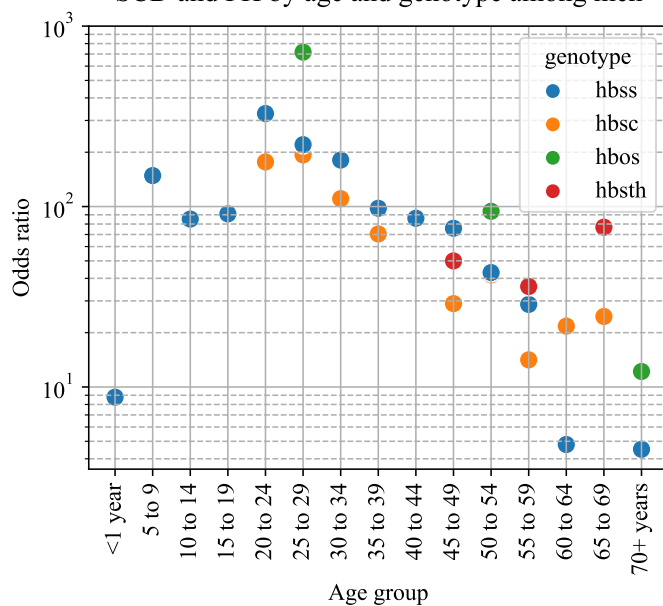
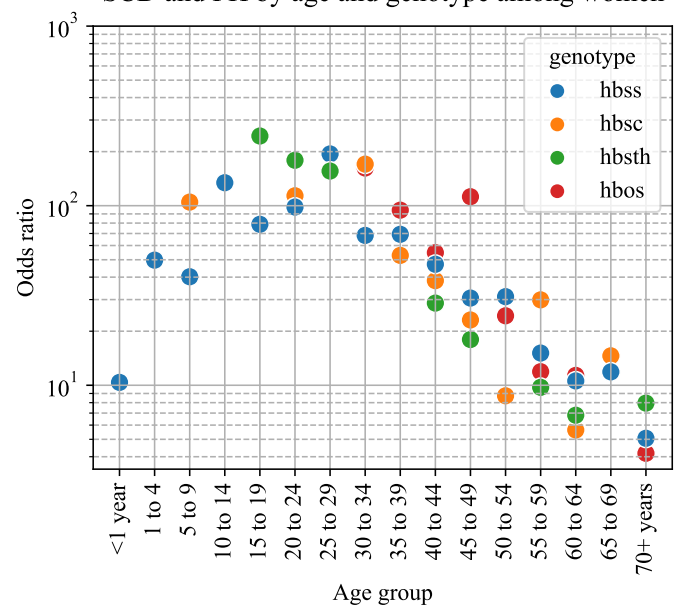


Fig. 2. ORs describing the association between SCD and PH by age and genotype among women



Title

Taking Care of BIS-ness, Recognition and Management of Acute Intraoperative Hypotension

Authors/Institutions

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Background

A 36 year old female with an unremarkable past medical history, G2P0 at six weeks gestational age, presented to the emergency department with acute onset abdominal pain. Hematocrit on presentation was 29.7% and blood pressure in the emergency department was 77/44, which improved to 100/60 with a fluid bolus. The obstetrics team diagnosed a ruptured ectopic pregnancy and she was emergently transferred to the operating room for a laparoscopic salpingectomy.

Case Description

The patient underwent an uneventful intravenous induction of general anesthesia. Her vital signs had remained stable since her initial fluid bolus in the emergency department and the decision was made to complete the case with noninvasive blood pressure monitoring. A Bispectral Index (BIS) monitor was utilized during the case to monitor the depth of anesthesia. The patient was placed in steep Trendelenburg position to optimize surgical field visualization.

Total intraoperative blood loss was estimated to be 600 mL and the decision was made to transfuse one unit of packed red blood cells. The patient remained hemodynamically stable throughout the operation with her BIS index maintained between 40 and 60. Upon successful completion of the salpingectomy the position of the patient was leveled to aid with surgical closure.

Upon leveling, the patient's BIS index dropped precipitously from near 60 to the low 20s. This was likely due to the reduced preload which came with leveling with subsequent intracerebral hypoperfusion resulting in less EEG activity. The decision was made to treat her hypotension without waiting for a noninvasive blood pressure reading. She was given 5 mg of ephedrine with a fluid bolus and her BIS level returned to the desired range of 40 to 60. The case was completed without complication and the patient was extubated and uneventfully transferred to the post-anesthesia care unit.

Discussion

The BIS monitor, according to its manufacturer, was developed as a means to process EEG information and provide an index which can be interpreted as a direct measure of a patient's level of consciousness and provide insight into the effects of anesthesia independent of cardiovascular reactivity. A sudden change in BIS index not related to the administration of anesthetic medications should indicate some other physiological change has occurred which has altered cerebral function.

This case demonstrated a drop in BIS index correlating to a reduced preload for the heart likely resulting in reduced cardiac output and subsequent transient hypotension. As noninvasive blood pressure monitoring was being used during the case, the drop in BIS index was the first indication of hypotension. This case demonstrates that the BIS monitor can also serve a secondary purpose of monitoring for acute changes in blood pressure and cerebral perfusion.

**Effect of deep versus light general anesthesia on postoperative pain and cognitive function:
a meta-analysis with trial sequential analysis of randomized controlled trials**

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Abstract

Background: The association between the depth of general anesthesia and postoperative outcomes remains controversial. This meta-analysis was conducted to determine the effects of deep vs. light anesthesia on postoperative pain, cognitive function, recovery from anesthesia, and postoperative complications.

Methods: PubMed, EMBASE, and Cochrane library databases were searched until February 20, 2021 for eligible randomized controlled trials. The co-primary outcomes were postoperative visual analog scale (VAS, 0–10) pain scores and the incidence of postoperative cognition dysfunction (POCD). Meta-analyses were performed using a random-effect model. Publication bias was assessed using Egger's and Begg's tests. Trial sequential analysis (TSA) and Grading of Recommendations Assessment, Development and Evaluation (GRADE) were utilized to assess the reliability and level of evidence.

Results: A total of 23 trials with 10262 patients were included. Deep anesthesia was associated with lower VAS pain scores at rest within 1 hour postoperatively (weighted mean difference = -0.72 points, 95%CI = -1.25 to -0.18 points, $P = 0.009$, $I^2 = 33\%$) and at 8 and 24 hours postoperatively, as well as on movement at 8 hours postoperatively. The incidence of POCD during 1–7 days (risk ratio = 1.37, 95%CI = 0.82 to 2.28, $P = 0.23$, $I^2 = 65\%$) or 1–3 months postoperatively did not differ between the two groups. No publication bias was detected. The TSA suggested sufficient evidence for VAS pain scores, but not for the incidence of POCD. The GRADE level of evidence was rated as moderate to low for the primary outcomes. In addition, deep anesthesia was associated a delayed recovery profile, without affecting postoperative complications or 1-year mortality.

Conclusion: Deep anesthesia was associated with reduced postoperative pain during the first 24

hours after surgery. The depth of general anesthesia itself may not influence cognitive function, postoperative complications, or long-term mortality.

Title: Ultrasound-Guided Phrenic Nerve Block for Intractable Hiccups Following COVID-19 Infection

Authors: Florendo, Edmund MD and Furukawa, Kenneth MD

Institution: University of California, Davis

Background:

COVID-19 mononeuritis and persistent hiccups have been recognized as a rare but significant complication of the virus. Mononeuritis is characterized by inflammation and damage to multiple peripheral nerves, leading to a range of symptoms, including persistent hiccups. The management of persistent hiccups is a significant challenge, often requiring a multi-disciplinary approach. One potential approach to managing persistent hiccups is the use of a phrenic nerve block. The phrenic nerve is a nerve that regulates the diaphragm and is involved in the production of hiccups. By blocking this nerve with local anesthetics, it may be possible to alleviate persistent hiccups.

Case Description:

A 42-year-old female patient presented to the emergency department with severe and persistent hiccups occurring every 3-5 seconds. The hiccups commenced two weeks after contracting COVID-19, where she experienced symptoms of fever, chills, myalgias, sore throat, and congestion. Despite being prescribed oral baclofen by her primary care physician, the patient failed to achieve relief. The patient was subsequently evaluated and discharged with oral valium, however, this too failed to provide any improvement. The patient was admitted to the emergency department and underwent a comprehensive workup and multi-disciplinary evaluation, including laboratory testing and imaging studies, including a CT head, neck, chest, and MRI brain. The results of the evaluation did not identify any underlying causes for the patient's symptoms. The acute pain service was consulted and recommended a nerve block, which was performed with a single injection of 1% lidocaine around the phrenic nerve, resulting in elimination of the hiccups for eight hours. A second injection of 0.25% ropivacaine was performed and provided the patient with 14 hours of relief. A phrenic nerve catheter was then placed with an infusion of 0.1% ropivacaine, providing the patient with continuous relief. As a more permanent solution, the patient received a vagal nerve stimulator.

Discussion:

The presented case highlights a rare but significant complication of COVID-19, specifically persistent hiccups resulting from nerve mononeuritis. This condition presents a significant challenge in terms of management, requiring a multi-disciplinary approach. In this instance, the phrenic nerve was targeted via a nerve block utilizing local anesthetic, which resulted in successful alleviation of the persistent hiccups.

Tracheo-esophageal Fistula Induced Hypercarbia During Upper Endoscopy

Calvin Fung, DO, Chuck Nguyen, MD, & Ioana Pasca, MD

Department of Anesthesiology, Riverside University Health System

Abstract

This case involves a patient with a history of distal esophageal adenocarcinoma status post neoadjuvant chemotherapy, proton radiation trial, and transhiatal esophagectomy complicated by esophageal anastomotic stricture. For the patient's esophageal stricture, he has had multiple stent placement and exchanges with balloon dilations every 4 to 6 weeks. He presented to the emergency department with dysphagia, poor oral intake, and difficulty managing secretions. He was admitted to the hospital for acute hypoxic respiratory failure secondary to aspiration. During CO₂ insufflation for upper endoscopy, he was found to have extreme elevations of end-tidal CO₂ concentrations indicating a possible fistula. Endoscopy and bronchoscopy confirmed the presence of a tracheo-esophageal fistula (TEF). This case presents a patient with elevated end-tidal CO₂ suggesting TEF, showing that capnography can be one simple modality to aid in diagnosing TEF. This early detection of TEF during esophagoscopy can prompt the use of a fiberoptic bronchoscope to visualize TEF and correctly position the ETT cuff below the TEF to prevent aspiration. High levels of EtCO₂ can help diagnose TEF in the perioperative setting, ultimately leading to better anesthesia management and avoiding perioperative complications.

Title: Community assessment of capacity and access to surgical and anesthesia services in rural Guatemala

Authors: Jakob Gamboa M.D.¹, Jesse Fioravanti M.D.¹, Anthony Bolaños M.D.², Colby Simmons D.O. M.B.A.¹

1. Department of Anesthesiology, University of Colorado, Aurora, CO
2. Trifinio Center for Human Development, Coatepeque, Guatemala

Methods: A community needs assessment was performed at the Trifinio Center for Human Development Clinic through verbal interviews with individuals who live in the southwest region of Coatepeque, Guatemala. After obtaining consent, questions regarding prior experience with surgery, community trends, and perception of access were answered and recorded by team members. Results were compiled and categorical data was compared.

Results: Fifty individuals from separate households were interviewed, of which 60% were female. Fifty-eight percent of respondents reported a member of the household having previously undergone surgery, with Cesarean section being the most reported (59%). Neuraxial anesthesia was performed for 70% of the Cesarean sections, with nearly all individuals identifying the provider as a physician anesthesiologist (unknown, n=2). The perceived commonest surgeries performed in this region were Cesarean section (70% respondents), appendectomy (56%), cholecystectomy (24%), herniorrhaphy (22%), trauma (8%). The nearest surgical center for all individuals was in Coatepeque, Guatemala. The average distance, in time travelled, required to travel to Coatepeque is 1.13 hours (SD=0.86), with a maximum time of 5 hours (n=2). The nearest urban centers for specialized surgical care reported was Quetzaltenango (98% respondents, distance ~2 hours) and Guatemala City (30% respondents, distance ~5 hours). Though surgery through the national public hospital is free, preferable surgery at private hospitals was reported as “expensive” by all respondents with costs typically ranging from 3000-10000 Quetzals (US \$384.60-\$1282.05). Ninety-two percent of respondents report inadequate access to surgical and anesthesia care in their communities, with the most reported barriers including costs (83.3% respondents), travel/geographical distance (52.4%), understaffing (5%), and delayed services (5%).

Conclusions: There is an increasing demand for surgical and anesthesia services for a large population of individuals living in the rural communities of western Guatemala, especially with increasing rates of Cesarean sections among community members. Cost and distance to surgical centers are the primary perceived barriers to accessing care among individuals. There remain opportunities to expand access and care options for surgical and anesthesia services to reduce morbidity and mortality among Guatemalans in the southwest Coatepeque region.

The Airway Device that Obstructed the Airway

Abstract

Since their development, laryngeal mask Airways (LMA) have been employed for their reliability, ease of use in emergency and trauma settings, and decreased postoperative complications. Few cases have been reported of LMA malfunction, usually due to inadvertent damage from either the patient or the physicians, none from structural integrity. This paper describes a novel case of a single use LMA malfunction during an intramedullary rodding procedure. Twenty minutes after successful intubation with an LMA, prior to surgical start, the patient was difficult to ventilate. LMA repositioning was attempted, unsuccessfully, with the shaft of the device coming out of the patient's mouth, the head remaining in the back of the throat. Subsequent successful ETT tube intubation allowed the case to proceed, uneventfully. Structural failures of LMA devices are rare, but even the rare chances of airway failure necessitate the inspection of the structural integrity of the device. Inspection and rapid detection of the failures of an LMA can prevent further complications of the management of the airway.

Abstract submission for WARC 2023
Category: Medically challenging case
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Title: When Big Bowels cause Big Problems: A Case Report of Ileus causing Abdominal Compartment Syndrome and Hemodynamic Collapse after Esophagogastrectomy

Authors/Institutions:

Stephen Giacomazzi MD/UC San Diego Medical Center, Benjamin Beal MD/UC San Diego Medical Center, Ron Barak MD/UC San Diego Medical Center

Background:

Although abdominal compartment syndrome (ACS) is known to cause obstructive shock physiology, ileus as the cause of ACS is not a common occurrence seen clinically. In this case report, we present a patient who developed ACS causing catastrophic hemodynamic collapse from severe ileus after a Ivor Lewis esophagogastrectomy for esophageal cancer.

Case Description:

74 year old male with recently diagnosed esophageal cancer status post neoadjuvant chemoradiation with esophageal stent placement and PEG tube, presenting for Robotic assisted Ivor Lewis esophagogastrectomy. Past medical history includes atrial fibrillation, sick sinus syndrome status post dual chamber pacemaker, and hypertension. The patient underwent an uneventful surgery with general anesthetic and was extubated without complication.

On postoperative day 3 the patient developed catastrophic shock with severe hypotension, abdominal distention, and respiratory distress along with bilious output from his chest tube as well as feculent material from OG tube. CT revealed diffuse, severe ileus involving the small and large intestine without major chest pathology. He was emergently intubated, requiring high driving pressures and FiO2 as well as vasoactive support including epinephrine, norepinephrine, vasopressin, methylene blue and amiodarone infusions. He was brought emergently to the operating room for exploratory laparotomy for presumed ACS.

During the emergent exploratory laparotomy, the colon was found to be 22cm in diameter and was decompressed with a 14 gauge angiocath, no ischemic areas were noted, and the esophageal anastomosis was intact. After several additional days of consistent metabolic acidosis, development of ARDS, development of AKI requiring CRRT, and vasoplegia, his oxygen and vasoactive requirements began to downtrend and the patient eventually was stabilized and discharged from the ICU.

Discussion:

The rates of postoperative ileus causing ACS as well as the rates of ACS causing hemodynamic collapse have not been well elucidated. ACS is defined as new end-organ dysfunction with sustained intra-abdominal pressure (IAP) >20mmHg with or without abdominal perfusion pressure (APP), defined as APP = mean arterial pressure (MAP) - intra-abdominal pressure (IAP), less than 60mmHg. ACS carries an extremely high mortality if untreated and unacceptably high mortality despite treatment, which obviates its prompt recognition and treatment. Common causes of abdominal compartment syndrome include situations requiring large volume resuscitation (trauma, sepsis, surgery, pancreatitis, burns), liver transplantation, abdominal hemorrhagic conditions (ruptured AAA, pelvic fracture with bleeding). This case outlines the importance of promptly recognizing and treating an uncommon cause of hemodynamic collapse from postoperative ileus-induced ACS.

Title:

Retained Peripheral Nerve Catheters: A Case Series

Authors:

Regine Goh MD, Meera Reghunathan MD, Brady K Huang MD, Karen Y Cheng MD, Katharine Hinchcliff MD, John Finneran MD

Institution: University of California San Diego

Background:

Continuous peripheral nerve blocks provide postoperative analgesia following painful orthopedic surgery of the extremities. A rare complication of perineural catheter insertion is catheter knotting or breakage during attempted removal. Previous reports have described various methods to remove retained peripheral nerve catheters, ranging from non-invasive techniques such as positioning changes and saline boluses to more invasive techniques using fluoroscopically guided instruments or open surgical procedures. We present two cases requiring surgical intervention for catheter remnant removal, review published literature regarding diagnosis and treatment of retained perineural catheters, and propose strategies to reduce the risk of retained nerve catheters.

Case Description:

The first case describes a 47 year-old man with multiple orthopedic injuries that received a sciatic nerve catheter for postoperative analgesia. Removal was difficult, and the provider tried multiple methods including administering a saline bolus via catheter and placing a dilator over the catheter. An attempt with increased traction ultimately resulted in breakage inside the patient's leg with approximately 6 cm of catheter retained. A radiograph showed a looped catheter fragment located in the lateral thigh. The following day, the patient was taken to the operating room by the general surgery team. The anesthesia team used ultrasound to mark the position of the fragment in concordance with the radiograph. The catheter was surgically removed and found to be knotted. The patient had no further symptoms related to the retained catheter.

The second case describes a 78 year-old woman with a retained infraclavicular nerve catheter with delayed detection. Four months after surgery with nerve catheter removal on post-operative day 3, the patient complained to her primary care provider of dull constant pain over her deltoid and mild shoulder weakness. A radiograph and 3D CT renderings were obtained, and surgical removal of the fragment was successful. The patient reported near resolution of her shoulder pain and had full deltoid strength 2 months after surgery.

Discussion:

Although our literature review suggests that nerve catheters are rarely retained, 11 of 20 patients with retained catheters had the catheter advanced more than 8 cm beyond the needle tip. All 20 patients underwent either open surgical removal, ultrasound guided removal or fluoroscopy- guided removal, and there were no long-term sequelae. We recommend the following risk mitigation strategies for providers placing or caring for patients with regional nerve catheters. (1) Never allow the catheter to extend more than 3 cm beyond the needle tip. (2) Provide written or electronic instructions regarding catheter removal that contain pictures of what the catheter tip should look like when removed, or have a mechanism for observed removal by a healthcare provider. (3) If a deep retained catheter is identified and advanced imaging is desired, consider obtaining a CT scan with 3D rendering.

A Case of an Erosion of a Carotid to Carotid Bypass Graft Into the Esophagus

Mariana Gomez MD¹, Colby Tanner MD¹, Dorothea Hall MD¹

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Abstract:

With advances in medical and surgical practice, the lifespan of adult congenital heart disease (CHD) patients continues to improve. It is estimated that in 2010, 1.4 million adults live with congenital heart disease in the United States¹. Many of these adult congenital heart disease patients will require care under general anesthesia for both cardiac and non-cardiac surgery. While taking care of some of these complex cardiovascular patients, the anesthesiologist will require careful pre-operative planning prior to surgical intervention.

We present a case of an adult woman with corrected CHD that was transferred to our institution for higher level of care for bacteremia resistant to medical therapy. During admission, she was found with an erosion of a carotid to carotid bypass graft into the esophagus. Prior to proceeding with surgical intervention, she underwent a left internal carotid artery balloon occlusion test with interventional neuroradiology with neuropsychological testing that did not demonstrate any negative effects. She subsequently underwent excision of the carotid to carotid and carotid subclavian bypass with right carotid vein patch repair, ligation of the left common carotid artery, esophageal repair, tracheostomy, and g-tube placement. In preparation, arterial line and femoral central line were placed, an EMG endotracheal tube was utilized in anticipation of neck dissection, and cerebral oximetry monitors to monitor relative changes in global perfusion bilaterally. Two hours after removal of subclavian graft removal, a new asymmetric drop in left sided cerebral oximetry was detected. Doppler US demonstrated a patent right common carotid artery without dissection, thrombosis, or damage to flap with unobstructed flow. Hemodynamic goals were increased with improvement of left cerebral oxygen saturation. Heparin drip was started given concern for possible thrombosis. Once the patient was awake in the ICU, neurologic exam showed no immediate sequelae from her perceived unilateral decrease in oxygen saturation.

This intervention required collective coordination across multiple specialties for a successful intervention. Pre-operative testing including an EGD and IR balloon occlusion test were critical to attain baseline data. This information assisted with intraoperative interpretation of monitors and facilitated communicating new acute findings with surgical teams, leading to a successful intervention for a complex cardiovascular patient.

Word count: 354

References:

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Safety and efficacy of intraoperative methadone for pain control in patients undergoing elective intracranial surgery: a retrospective study

Authors: Graf, Justin MD*; Propp, Dennis MD*; Vandse, Rashmi MD*

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Introduction: Patients undergoing intracranial surgery experience substantial perioperative pain. Opioids are the mainstay of postoperative pain management. Methadone can be an attractive alternative to short acting opioids in this patient population as it has rapid onset of action along with providing extended periods of analgesia. Although methadone has shown to be an effective and safe analgesic in various non-intracranial surgeries, there is no data on methadone use in craniotomy patients. We present our single center experience on the use of methadone for patients undergoing various intracranial surgeries.

Methods: A retrospective chart review was conducted on all patients who underwent craniotomy and received methadone as part of their perioperative analgesic regimen.

Results: A total of 63 patients were enrolled in this study ranging 18 to 81 years. The intraoperative methadone dosage ranged from 5 to 20 mg. For the infratentorial group, median total MME on POD 1, 2, and 3, was 30.5, 17, and 0.8, with mean pain scores of 3.56, 3.91, and 2.71, respectively. For the supratentorial group, median total MME on POD 1, 2, and 3, was 17.85, 15.4, and 1.2, with mean pain scores of 2.31, 1.68, and 2.21, respectively. Patients identified prior to surgery as chronic opioid users had significantly higher pain scores and average opioid use. Although seven patients (11%) had brief periods of respiratory depression ($\text{SPO}_2 < 90\%$ or Respiratory rate < 8 /min), none required administration of naloxone or airway interventions. Comparing our results with the historical control revealed lower pain scores and MME in our study.

Conclusion: Our results suggest that a single dose of intraoperative methadone is well tolerated by patients undergoing various types of intracranial surgeries with minimal side effects, including in elderly patients (greater than 65 years).

WARC Submission

Title: Atypical Presentation of Subcutaneous Emphysema Mimicking Allergic Angioedema

Authors: [Daniel Grier, MD](#); Yaron B Gesthalter, MD; Matthias Braehler, MD, PhD

Affiliated Institution: University of California, San Francisco

Category: Perioperative Challenges

Background:

Subcutaneous emphysema is an infrequent consequence of pleural procedures, occurring in 6.8% of pleuroscopies¹. Severity can range from local effect to severe with neck and face involvement leading to airway compromise, highlighting the importance of early recognition. However, its presentation can be misinterpreted as various conditions—all of which are potentially life-threatening and must be managed promptly.

Case Description:

A 53-year-old male with a history of atopy and newly diagnosed stage IV lung adenocarcinoma presented for pleural biopsy and right tunneled pleural catheter placement (TPC) under monitored anesthesia care. A right erector spinae plane block was performed prior to the biopsy without complications. The patient tolerated the procedure well and recovered in the PACU with stable hemodynamics, saturating well on 2 l/min oxygen via nasal canula. Two hours after surgery he developed left cheek tingling, followed by left periorbital swelling that progressed down his left lateral neck just distal to his clavicle. His voice subsequently changed and he endorsed difficulty swallowing. Vital signs remained stable with no increased oxygen requirement. On examination, his skin was edematous with minimal crepitus. Given prior atopy concern for allergic angioedema, prompted administration of intravenous diphenhydramine, famotidine, methylprednisolone, and small boluses of epinephrine. Chest x-ray was notable for a trace apical pneumothorax on the right and subcutaneous emphysema around the TPC. The TPC was re-connected to the chest drainage system with minimal leak. Nasolaryngoscopic exam by Otolaryngology revealed a moderately swollen uvula and epiglottis, with a patent supraglottis.

The patient was then admitted to the ICU for 24-hour airway observation. Serial chest x-rays ultimately demonstrated subcutaneous emphysema extending to the left neck. An allergic reaction was considered less likely given that tryptase and angioedema workup were unremarkable. The swelling subsided over his five-day admission and the patient was discharged home and doing well on two week follow up.

Discussion:

Facial and neck edema is a potentially life-threatening condition, and a broad differential should always be considered. This case demonstrates how subcutaneous emphysema can have an atypical distribution with symptoms that can mimic an allergic reaction. In this case the subcutaneous emphysema was contralateral to the side of his pleuroscopy with voice changes related to epiglottis and uvula involvement. Though this case lacked many manifestations related to mast cell mediated release (urticaria, pruritus, bronchospasm, and hypotension), angioedema can be the only sign of anaphylaxis and warrants consideration.² This supported the decision to initially treat this case as an allergic reaction while awaiting further investigation. Given that there was no instrumentation of the lung for this case, the postulated cause of the subcutaneous emphysema was a small adhesion that may have torn after the lung shifted position from the fluid removal. When managing soft tissue swelling that involves the airway, it is important that providers maintain a high level of clinical suspicion and close monitoring of vital signs, as various conditions can present similarly and lead to severe hemodynamic and respiratory dysfunction.

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Atypical Presentation of Intraoperative Anaphylaxis

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Declarations of Interest: None to disclose

Anaphylaxis is a well-known, serious complication in the operating room with the potential for catastrophic results. Given the complex pharmacology associated with general anesthesia it is essential that practitioners are familiar with the presentation and potential causative agents. In this case report we present a patient with separate intraoperative events, both concerning for anaphylaxis. While both events were thought to have stemmed from the same underlying etiology, they presented very differently. The symptoms of the first event were primarily ST elevations and supraventricular tachycardia while the second presented more typically as refractory hypotension accompanied by wheezing and a rash. It is thought that variations in perioperative medications may have been responsible for the difference in presenting symptoms. While there is great variability in the presentation of anaphylaxis, severe cases can be life threatening and prompt intervention is essential for patient survival. In situations where symptoms are refractory to medical therapy, VA-ECMO can be used as a salvage technique until histamine and cytokine levels return to baseline and hemodynamic stability can be achieved with medical therapy alone. This case shows a typical and possibly atypical presentation of intraoperative anaphylaxis as well as a rarely used treatment modality with VA-ECMO. The possibility of unrecognized anaphylaxis during the first operative visit suggests that there may be utility in sending tryptase levels in the event of any intraoperative code.

Effectiveness of Ultrasound Teaching Sessions to Anesthesia Residents in Kigali, Rwanda

Abhinav Gupta MD, Travis Reece-Nguyen MD MPH FAAP, Françoise Nizeyimana MD, Ana Maria Crawford MD MSc FASA

Background

The Stanford Anesthesiology Global Health Equity teaching elective in Kigali, Rwanda is a four-week, in-person elective for Stanford residents to teach intraoperative skills and participate in weekly simulation and didactic sessions with the anesthesiology trainees at the University Teaching Hospital of Kigali (CHUK). The partnership began in January 2006 between the University of Rwanda, Canadian Anesthesiologists' Society – International Education Foundation, and the American Society of Anesthesiologists.

The rotation objectives are to educate and empower local anesthesiology trainees through intraoperative teaching, simulation, and hands-on ultrasound sessions. Over four weeks in Rwanda, the team led simulations including Pediatric Advanced Life Support (PALS), neuraxial anesthesia, peripheral intravenous catheter placement, and more. Furthermore, the team designed ultrasound teaching sessions focusing on regional anesthesia and gastric ultrasound.

The purpose of this study was to evaluate the effectiveness of hands-on ultrasound sessions across cultural and language barriers. The goal was to investigate the retention of knowledge and skills after completing the 4-week rotation to improve the education of anesthesia residents abroad and ensure future Stanford residents receive support to lead global health teaching initiatives.

Methods

We designed a pre- and post-session quiz that reviewed ultrasound images of common lower extremity regional anesthesia blocks and gastric ultrasound. The Rwandan anesthesiology residents completed the quiz before and after the interactive, hands-on session and then their collective group scores were compared. A free-text section was also included to obtain their suggestions/comments of our teaching content and efficacy.

Results

Overall, there was a 25% increase in the average total score from the pre- to post-session quiz. 73% of Rwandan trainees answered questions about lower extremity regional anesthesia anatomy correctly on the pre-test compared to 93.8% on the post-test (20.8% increase). Similarly, only 37.5% of trainees answered a question about gastric ultrasound anatomy correctly before our session compared to 87.5% answering correctly afterward (50% increase). There was abundant, positive free-text feedback regarding the ultrasound and simulation sessions. Furthermore, trainees suggested more simulation in non-OR settings, including the ICU.

Discussion

Anesthesiology residents at CHUK demonstrated retention of new information taught through hands-on ultrasound sessions led by Stanford anesthesiology residents as evidenced by a marked improvement in their pre vs. post quiz results. Future global health teaching electives should include interactive sessions such as simulation and ultrasound. Furthermore, residents should continue to be supported on these trips by their respective departments and institutions.

A Parturient with Factor VII Deficiency: A Case Report

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University of Arizona College of Medicine- Tucson¹

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Introduction

Factor VII deficiency is a rare bleeding disorder, present in 1 in 500,000 people¹. Limited cases of factor VII deficiency management during the intra- and postpartum period have been reported; thus patient care requires a multidisciplinary collaboration between obstetric, anesthesia, and hematology teams. Herein, we report a case of factor VII deficiency in a pregnant female with a history of postpartum hemorrhage (PPH) requiring packed red blood cell (PRBC) transfusions and arterial embolization, and discuss therapies for management.

Case Presentation

The patient is a 27-year-old G3P1011 with history of factor VII deficiency and PPH, who presented at 39w0d for repeat cesarean section (RCS). Past medical history includes a CS during her first pregnancy in which she required 1 unit (u) of PRBC transfusion postoperatively; 1 week later she had significant PPH requiring 20u PRBCs and placement of uterine artery coil. At this time, she was seen by a hematologist and diagnosed with factor VII deficiency (factor VII level at 40%). On presentation for this CS, labs were remarkable for Hgb 11.9, factor VII 97%, PT 12.6.

After discussion with hematology, she was given 2u of fresh frozen plasma (FFP) prior to delivery. In case of PPH, she would get recombinant factor VIIa (rFVIIa) every 2 hours until hemostasis. The CS was performed under general endotracheal anesthesia, with delivery of a viable infant and estimated 800 ml blood loss. No bleeding complications were noted in the postoperative period. On discharge, the patient had Hgb 8.4, factor VII 46%, PT 13.6. Patient had stable levels of PT for 2 weeks following discharge.

Discussion

As demonstrated in this case, management of factor VII deficiency during pregnancy is important as the uterus and placenta are rich in tissue factor, making hemostasis more dependent on factor VII and the extrinsic pathway¹. Fixed standards of care protocols are needed for peripartum management. Management options include FFP and rFVIIa. FFP can be used for its low cost, easy availability, and effect expected for 4-6 hours after administration. However, it can have limited effectiveness due to risk of circulatory overload with overuse². rFVIIa remains the most widely accepted therapeutic option for this condition.¹ More studies are needed to assess thrombosis risk in FFP versus rFVIIa. Overall, this case presented a rare blood disorder that required careful

consideration in peripartum care. Future research should address these gaps in standard management.¹

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Submitter: Bryan Hamilton

Airway Management for Robotic Circumferential Tracheal Mass Resection

Introduction

Surgical management for primary tracheal tumors remains a challenge for thoracic surgeons and anesthesiologists. Most procedures are being performed by thoracotomy or sternotomy which necessitates an extended hospital stay, increased patient pain and discomfort. Here we describe the surgical procedure and airway management for a patient with a mid-tracheal mass who underwent circumferential tracheal resection via a completely robotic, minimally-invasive approach.

Case Report

A 41-year-old female with no past medical history presented with a progressive cough and small volume hemoptysis. A flexible bronchoscope revealed large exophytic, friable, partially obstructing mid-tracheal mass. Pathology confirmed tumor diagnosis as grade 2/3 mucoepidermoid carcinoma followed by a tumor board recommendation for surgical removal.

The patient underwent general anesthesia with single-lumen endotracheal intubation. The ETT was then advanced into the left mainstem bronchus and left sided one-lung ventilation was achieved. The thoracic cavity was accessed via 4 surgical ports followed by docking of the robotic surgical system. After lung retraction and dissection of surrounding tissues, the paratracheal space was opened and the trachea was mobilized. Tracheostomy was then performed distal to the lesion. A reinforced ETT was introduced into the thorax through a 3rd intercostal space, midaxillary line port. Then the ETT was inserted through the new tracheostomy site into the left main bronchus guarded by tube exchange as the oropharyngeal ETT was simultaneously retracted to the proximal trachea together with tube exchange, just above the level of planned resection. The ventilator was connected to the trans-thoracic ETT and ventilation was resumed to the left main bronchus. The trachea was completely transected above and below the lesion and tracheal reconstruction was performed. Following completion of the posterior wall anastomosis, the trans-thoracic ETT was removed and oropharyngeal ventilation was reestablished. After checking for anastomotic leak, the patient was then returned to two-lung ventilation. Following port incision closure, ETT was replaced with LMA. Bronchoscopy was performed by surgeon to assess the anastomosis with satisfaction. Patient was extubated and transferred to the PACU in stable condition. She was discharged home without complications on POD 7.

RDC: A Legend Near a Trilogy of Sternotomies s/p Tetralogy of Fallot

Shamsu Hashi & Matthew Dudley

UCSF Anesthesia

Case: 67yM with Tetralogy of Fallot s/p repair (1960), subaortic membrane s/p resection of subaortic membrane, LVOT myectomy, AVR with St. Jude mechanical valve, enlargement of RVOT s/p placement with pulmonary homograft (1996), AV block s/p PPM 1996 with replacement in 2005 upgrade CRT-P 2012, CAD s/p PCI DES of ostial LAD /OM3 (2019), 5.1cm ascending aortic aneurysm, and LV failure (EF ~20-25%) referred for admission by his cardiologist for volume overload in the setting of renal dysfunction requiring IV diuresis, ICD evaluation, desire to restart sacubitril-valsartan, and heart transplant evaluation.

Background: The first blue baby operation led to a modest improvement in cyanosis and couple months of survival. Here we present an interview with patient RDC born 1955 with congenital cyanotic heart disease repaired at age 4. We celebrate his six-plus decades of survival and focus on his reflections of a fruitful life.

Discussion:

RDC has never had a full breath in his 67 years of life. Everyone always wants him to be cautious, but all he wants is to make it as normal as he can. RDC is a husband and father of a 14-year-old girl. A music festival owner often organizing for 13,000+ attendees. He admits he can't climb a mountain but has led an active life with some compensation.

Prior to his initial repair he recalls squatting and feeling frail. Occluding his tracheostomy site to speak with his parents, the newspaper clippings of him, and the frequent follow up visits stand out the most of his postoperative course. To the naked eye he was like any other normal kid in the park by the summer following his repair. He played baseball in high school and tennis most of his adult life. He managed to avoid much interaction with the medical system 19-40 years of age prior to his subaortic membrane surgery.

Previously he was able to take his dog on a two-mile walk, but a recent hernia surgery and worsening renal function leading to discontinuation of his sacubitril-valsartan, MRA and SGLT2 have led to some functional decline. Exercising is difficult now, but he can climb a flight of stairs and attend to his ADLs.

Reasons stated for his transplant ineligibility: highly allosensitized, high-risk surgical candidate (ie, prior sternotomy x2, ascending aortic aneurysm), with multi-organ dysfunction involving the kidneys and the liver. RDC is disappointed with the decision and plans to seek a second opinion.

Conclusion: Congenital heart defect repairs done at the infancy of cardiac surgery can have a long and meaningful survival.

On March 8, 1960 the patient underwent correction of the Tetralogy of Fallot using extracorporeal circulation. A tight infundibular type of pulmonary stenosis and a large muscle band extending from the anterior ventricular wall to the right lateral wall was found. The muscle band was divided and excised and the infundibular stenosis was excised including a large part of the crista supra-ventricularis. By using intermittent aortic occlusion a Cacron patch was sutured into the inter-ventricular septal defect which measured approximately 1.5 cm. in diameter. At the conclusion of the operation, cardiac contraction was very satisfactory and the pressure was well maintained after closing the ventriculotomy.

Figure 1: Excerpt from the original Virginia Medical College discharge summary. 49-day admission c/b respiratory failure requiring tracheostomy on POD2

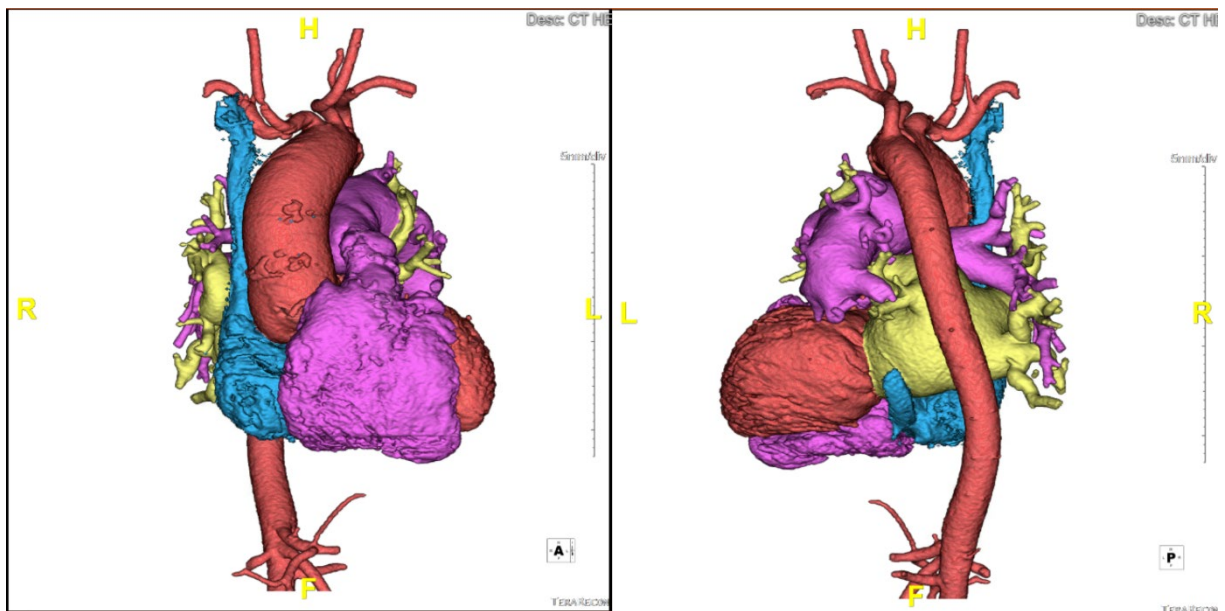


Figure 2: 3D CT heart reconstructions done 5/3/21. On most recent TTE: severely reduced LV function, normal RV function, severe TR, & moderate MR.

Pressures				
Site	Sys/A Wave	Dias/V Wave	Mean\EDP	HR
RA	4	11	8	69
PA	39	11	23	63
RV	51	2	6	69
PA	37	11	23	63
PCW	11	30	15	69
ART	93	55	69	69
RV	51	6	69	

Oximetry		
Site	Hgb	Saturation
RA	8.1	54.4
PA	8.1	55.5

Cardiac Output	
	Fick
Cardiac Output L/min	4.43
Cardiac Index L/min/m	2.43

Resistances and Indexes (Woods Units)		
	PV	SV
Resistance	1.8	13.760000610
		3516
Index	3.29	25.08

Figure 3: RHC 2/14/23 showing elevated filling pressures, mild pulmonary hypertension, & normal cardiac output and index by thermodilution.

Title:

Anesthetic Management of an Elderly Patient with Severe Pulmonary Arterial Hypertension (PAH) and Scoliosis undergoing Left Hip Hemiarthroplasty using a combination of Suprainguinal Fascia Iliaca Compartment Block (FICB), Peri-Capsular Nerve Group (PENG) block, an Intrathecal Catheter and Isobaric Bupivacaine.

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Background:

Goals of anesthetic management for severe PAH include maintaining adequate systemic pressure, preventing increases in pulmonary arterial pressure, and maintaining coronary perfusion to the right ventricle. Due to hemodynamic fluctuations frequently encountered during general anesthesia and mechanical ventilation, incremental regional anesthesia is preferred in patients with severe PAH scheduled for hip surgery.

Case Description:

An 89yo 50kg female with multiple co-morbidities including scoliosis, 54 pack year COPD and suspected cor pulmonale with severe PAH (PASP >100mmHg and severe Tricuspid Regurgitation by echocardiography) was scheduled for a left hip hemiarthroplasty to repair a left femoral neck fracture. She was not on any anticoagulants/antiplatelet agents.

An awake arterial line was inserted for close hemodynamic monitoring. A combination of PENG and supra inguinal FICB blocks (using 5ml of 2% lidocaine & 10ml of 0.25% bupivacaine for each block) helped this patient comfortably tolerate sitting posture for the initially planned epidural placement as the primary anesthetic. But following accidental dural puncture at L3-4, a 19G PERIFIX epidural catheter was placed intrathecally through the 17G Tuohy needle and incremental dosing of 0.5% plain isobaric bupivacaine 1ml followed by 0.5ml 5 minutes later was used to facilitate slow rise of a reliable spinal anesthetic level to T10 via pinprick sensation.

Patient tolerated left hip hemiarthroplasty in right lateral decubitus position with spontaneous ventilation, hemodynamic stability and 100% SpO2 on a simple face mask. She received only minimal sedation for comfort through the operation.

Discussion:

This was a challenging case given patient's age and significant co-morbidities. Her severe PAH placed her at increased risk for complications under general anesthesia. So epidural anesthesia was considered as the primary anesthesia option to avoid general anesthesia and allow for a gradual slower anesthetic onset with minimal hemodynamic fluctuations. Also surgeon agreed to avoid cementing to reduce embolic load.

To improve chance for successful epidural placement, a combination of PENG block and suprainguinal FICB was done to help patient tolerate sitting position (as opposed to lateral position) with minimal intravenous sedatives/analgesics thus avoiding hypoventilation, hypercarbia and hypoxemia.

Epidural block was challenging due to patient's severe scoliosis. When an accidental dural puncture occurred, an alternate plan was improvised to manage the patient's PAH. So an intrathecal catheter was placed and a reliable T10 anesthetic level was gradually obtained with incremental doses of isobaric bupivacaine. In comparison to hyperbaric bupivacaine, intrathecal isobaric bupivacaine has a slower onset, delayed incidence of hypotension and more time to initiate blood pressure treatment.

Utilizing regional blockade to aid in positioning and an intrathecal catheter to obtain a gradual incremental spinal anesthetic level, we were able to avoid potentially catastrophic peri-operative hemodynamic disturbances.

Perioperative considerations for adults with repaired congenital heart disease

Sydney Hemphill, MD; Abhinav Gupta, MD; Kyle Harrison, MD; Erica Stary, MD

Background

Cardiac evaluation and appropriate optimization are important components of the preoperative evaluation, especially for adults with repaired congenital heart disease. There are currently no established guidelines for preoperative imaging for asymptomatic adults with repaired congenital heart disease receiving elective non-cardiac surgery. The purpose of this case study is to suggest increased vigilance and preoperative cardiac catheterization for patients with an anomalous coronary artery.

Case Presentation

A 55 year old male was scheduled for an elective total knee arthroplasty. He had a history of anomalous right coronary artery originating from his pulmonary artery which was incidentally discovered during his adulthood and repaired uneventfully a few years prior to his total knee arthroplasty. Since his repair, he remained asymptomatic and follow-up transthoracic echocardiograms were normal.

He was scheduled to receive an adductor canal catheter preoperatively. During the procedure, the patient experienced a vasovagal reaction with a heart rate in the 30's. Because of this event, the decision was made to avoid neuraxial anesthesia and proceed with a general anesthetic for the case. Induction and insertion of the supraglottic device was uneventful. The rest of the case proceeded uneventfully. Right before the supraglottic device was to be removed, the patient went into ventricular fibrillation. CPR was initiated and the patient was intubated. He received many rounds of defibrillation, chest compressions, and epinephrine with intermittent return of spontaneous circulation, but he would quickly revert back to pulseless ventricular fibrillation. Transesophageal echocardiography revealed depressed RV function with normal LV function. Quickly after intubation, ventilation and oxygenation became increasingly difficult and a CV code was called. Cardiac surgery cannulated for peripheral V-A ECMO through the femoral vein and artery. Hypoxemia and low flows on the ECMO circuit were noted so the patient was cannulated for V-A-V ECMO with an additional venous drainage limb through the right internal jugular vein. Cardiac catheterization and CTA revealed an occluded right coronary artery stump with extensive collateralization, suggesting chronic occlusion. The patient eventually deteriorated and was ultimately made comfort care and passed.

Discussion

This case study highlights the potential complications of anesthesia in adults with repaired congenital heart disease, especially those with an anomalous coronary artery. Anomalous coronary artery (left more common than right) is a rare congenital heart defect. Most often,

patients with left anomalous coronary artery are symptomatic (angina, dyspnea on exertion, CHF). Repair of normal coronary ostial circulation is recommended even in asymptomatic patients.

Although our patient was asymptomatic, this case underscores the utility of further preoperative cardiac testing, including cardiac catheterization. The presence of collateralization on CTA and cardiac catheterization post-arrest suggests our patient's RCA was chronically occluded; perhaps preoperative catheterization would have convinced us to cancel the elective total knee arthroplasty. More information about the risks of anesthesia to those with anomalous coronary arteries is needed to guide anesthesiologists during the perioperative period.

Video laryngoscopy Assisted Fiberoptic Intubation with McGill's Tracheal Clot Retrieval

Background: We present a difficult airway case of a patient who presented with a substantial posterior nasal bleed and subsequent aspiration requiring emergent intubation. In addition to profound airway bleeding this patient was 1-week status post C1 laminectomy without fusion and required strict cervical spine (C-spine) immobilization as well as other anatomical difficulties. Intubation required multiple attempts and the use of video laryngoscopy, bougie introducer, fiberoptic bronchoscope (FOB), direct laryngoscopy (DL), and McGill's forceps.

Case Description: A 78-year-old female one-week status post C1 laminectomy without spinal fusion for cervical osteomyelitis with abscess developed a massive posterior nasal bleed. Due to both a weak cough in this cachectic elderly female as well as an oversized cervical collar (C-collar) the patient was unable to protect her airway from bloody aspiration and the decision to perform rapid sequence intubation was made.

Aside from copious amounts of blood pouring into the pharynx, this patient had multiple other predisposing factors to a difficult airway. A full physical exam revealed the following: Thin elderly female of short stature (4'11"), thyromental distance 2 fingers, incisor opening 2-2.5 fingers, trachea midline, C-spine hard collar in place with an open surgical site and drain in place. Initial intubation plan included intravenous (IV) induction with 12 mg of etomidate and 60 mg of rocuronium followed by video laryngoscopy (VL) and suction for visualization. A back up plan included a bougie introducer and or video assisted fiberoptic bronchoscope.

After IV induction, a size 3 D VL was used for visualization of the glottis which was completely obstructed by active bleeding and clotted blood. A second physician assisted in suctioning the airway and was able to keep all active bleeding at bay, however, the suction catheter was unable to remove a large clot at the arytenoid cartilage; nonetheless a grade 2a view was obtained. We were unable to pass anteriorly to the clot and repeatedly were caught underneath the clot, unable to advance the tube above the arytenoids into the trachea. Subsequent attempts with both a VL guided bougie as well as FOB were similarly unsuccessful. A Macintosh 3 direct DL was then used and allowed better inspection of the posterior pharynx. McGill's forceps were then used to retrieve the clot which spanned from both tonsils to the larynx and upon extraction was noted to extend 3-4 cm into the trachea. With the obstruction now clear, VL showed a grade 2A view and intubation failed due to the hyper angulated anterior approach into the trachea but was successful with the assistance of FOB.

Discussion: VL can be a great airway device that gives a great view of the glottis, however, it can hide obstructive objects lurking behind the focal point of the camera. DL in this case was not used to visualize the glottis but to better see the posterior pharynx. The smaller profile of a DL blade also offered better workspace within the airway and facilitated clot retrieval.

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Institution: Los Robles Regional Medical Center – Anesthesiology Residency

Title: Continuing Professional Development: Blended-Learning Symposium on Sepsis & Septic Shock in Rwanda

Authors:

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Introduction: Sepsis is a syndromic response to infection and a final common pathway to death from many infectious diseases worldwide. The global burden of disease and mortality from sepsis and septic shock mostly occurs in the resource-constrained environments of low- and middle-income countries. In Rwanda, studies from two public referral hospitals found a 51% mortality for all septic hospitalized patients and up to 82% for those in septic shock.

Methods: A team of anesthesiologists from a long-term academic partnership between the University of Rwanda in Kigali and Stanford University developed a 1-day symposium covering the 2021 updates of the *Surviving Sepsis Campaign Guidelines*. The symposium utilized a blended-learning approach with in-person and virtual case-discussion as well as in-person simulation and skills stations. A 5-question multiple choice pre- and post-test was given to assess participant knowledge of sepsis management. An additional post-survey using a 5-point Likert scale was used to evaluate the symposium's design, relevance, and likelihood to change daily practice. Continuing Professional Development (CPD) credit was issued to participants and facilitators by the Central Hospital of Kigali.

Results: Twenty-seven healthcare providers attended the symposium in-person including physicians, resident trainees, nurses, and midwives; 93 participants joined virtually representing 24 different countries. The average pre-test score was 42% which improved to 91% following participation. The participants rated the case discussions and simulations as relevant and likely to impact daily practice.

Conclusions: Sepsis is a clinical challenge faced by all healthcare providers but is especially burdensome in resource-constrained areas. In Kigali, Rwanda, a blended-learning sepsis symposium was received favorably and significantly improved provider knowledge. Expansion of CPD training activities that review updated practice guidelines is important for advancing patient care.

Title: Using virtual reality as a substitute for pharmacologic anxiolysis during the administration of regional nerve blocks: barriers to use and limitations.

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Introduction:

VR has a potential for broad application in the healthcare system, having been successfully utilized to reduce perioperative anxiety in pediatric patients, reduce pain during wound care in burn patients, improve cancer-related symptoms during chemotherapy infusions, and decrease the use of analgesics and sedatives during adductor canal catheter placement all while also being associated with improvement in procedure-related pain². VR has been used intraoperatively during upper limb surgery under regional anesthesia with resultant increase in patient satisfaction and decrease in anxiety and intraoperative hemodynamic changes³. With an increasing body of evidence suggesting decreased pharmacologic intervention and improvement in patient satisfaction during medical interventions, it is the aim of this study to evaluate the feasibility of using VR in an ambulatory surgical center and to understand the limitations and barriers to its use.

Methods:

Virtual reality will be offered to a cohort of 45-50 healthy ASA I-II patients at the Redwood City Outpatient Surgery Center undergoing peripheral nerve block placement by an anesthesiologist prior to an ambulatory orthopedic surgery. We will survey these patients, along with 10-20 members of the healthcare team. We do not intend these to be randomized groups since in clinical practice the patients will be allowed to choose between sedation, VR and combination and benefit from the autonomy of choice. There is prior published data showing benefit of VR¹⁻³, this QI project is to understand the barriers to implementation of this device in clinical practice, and also to measure satisfaction/benefits/limitations in the VR experience for those patients who agree to utilize VR. This intentional distraction may cause patient movement or difficulty hearing the instructions of the provider, and thus resident and attending anesthesiologists and pre-operative nurses will also be surveyed to provide additional evaluation of the use of virtual reality as an adjunct/substitute to pharmacologic therapy for sedation during peripheral nerve block placement.

Results:

The data will be examined and codified from both patients and providers and perform a qualitative analysis of the responses to discover recurring themes in the responses that may identify barriers and limitations to the utilization of VR. In addition, a quantitative analysis of both patient and provider level of satisfaction with the VR experience will be performed.

Conclusions:

This study will help to provide a foundation for further research into the use of VR for regional nerve block, as well as identify areas for process improvement at our facility to further integrate this important intervention into standard medical care. Additionally, this study would guide the development of educational materials for patients and staff to encourage utilization of virtual reality in the perioperative setting for adult patients at Stanford and potentially be useful for other institutions implementing this safe and effective technology.

Unleashing the Potential of Epic's SlicerDicer for Self-Service Data Exploration

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Institution(s): Loma Linda University Medical Center

Introduction:

Electronic medical records house an abundance of data and the demand to extract clinically, and operationally significant metrics is increasing. Early exposure to data exploration is necessary to match the demand for near real time analytics. Epic's SlicerDicer is a self-service analytic tool that allows near real time, customizable analysis of data elements contained within the electronic medical record. SlicerDicer is a powerful data exploration tool that quickly sorts large quantities of data through filtering and drill down. Residents can use this tool to evaluate their practice trends and selected quality outcomes. SlicerDicer provides responsive, data-driven feedback. We believe SlicerDicer empowers residents to seize responsibility for their clinical maturation with meaningful and impactful feedback.

Objectives:

1. Detail our organization's rollout, customization, and resident usage of SlicerDicer.
2. Present opportunities for data usage to evaluate outcomes and identify areas for quality improvement.
3. Provide an overview of custom filter creation to review personalized efficiency data and compare with peer metrics.

Discussion:

Self-service data analytics allows any user to initiate explorative analysis without taxing IT resources. Access to near real time data presents the opportunity to provide individualized performance feedback proximal to observation. Furthermore, self-service analytics supports early and iterative analysis of quality improvement and operational efficiency projects. For example, at our institution residents can query compliance with perioperative glucose control protocols. Deficient cases are identified in the query and can be evaluated for patterns such as case length, diagnosis, location, or case type. Residents are also able to compare their performance on efficiency metrics such as on-time starts, turnover duration, and emergence duration.

Increased data accessibility is not without risk, data integrity and security must be preserved. Security risks can be largely mitigated through institutional profile settings that limit access to aggregate data across the organization, while only allowing line level data to cases in which the clinician was directly involved. Queries and chart access is stored and can be audited. The greatest risk, however, may be misinterpretation of data. Big data analysis is fraught with limitations and analytic quality is predicated on high-quality data. We encourage residents to explore self-service data analytics and seek mentorship from faculty proficient in SlicerDicer to understand the validity and potential pitfalls of self-service analytic reports.

Electronic Order Set Review and Maintenance: practical considerations from a multi-hospital system experience

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Abstract

Order sets are a widely implemented clinical decision support tool in the electronic health record. While a periodic review and revision of order sets are necessary, there is minimal guidance for institutions. We share an effective order set review process at a major academic medical center and success elements that may be replicated at other teaching hospitals. In particular, we highlight the involvement of the hospital housestaff as a critical source of user feedback and guidance in order set revisions.

Learning Objectives:

Participants of this session will learn the definition of EHR order sets, requirements for their maintenance, challenges for institutions to meet these requirements, and success elements that enabled an effective order set review process at a large academic medical center.

Background

With the wide adoption of electronic health records (EHRs) across hospitals nationally as incentivized by the 2009 Health Information Technology for Economic and Clinical Health Act (HITECH), order sets have become a widely implemented clinical decision support (CDS) tool.¹ An order set aggregates orders or steps relevant to a given condition, process, or clinical scenario in one location in an EHR with the intention of improving efficiency and effectiveness of the ordering provider.² While a periodic and regular review of order sets are necessary to ensure they are current with Joint Commission standards, evidence, and best practices, there is limited guidance for institutions to design and implement such review processes.

Methods

We first reviewed the current regulations and guidelines for electronic order set review and maintenance at U.S. healthcare systems at the federal, state, and institutional levels. We then describe the order set comprehensive review process at a major academic medical center in the U.S. and highlight key success elements that may be replicated at other teaching hospitals.

Results

The minimum cadence of the mandated order set reviews is every three years. Moreover, there are currently no regulations or best practice guidelines for active surveillance and optimization of order sets inside of this time period provided by the regulating agencies. We find similarities and differences in the comprehensive order set review processes across hospitals within the authors' health care system. All of the hospital systems conducted comprehensive order set reviews in accordance with regulatory requirements at a triennial cadence with an established committee and guiding principles. Not all of the hospitals however had a process for ongoing order set maintenance within the three year comprehensive review time frames. Stanford Health Care-TriValley (SHC-TV) stood out with a comprehensive scheduled review mechanism managed by the CDS committee based on data-driven and people-driven insights, from which we derive essential markers of order set performance and SHC-TV strategies to optimize each.

Conclusion

The following elements were critical to an effective and efficient order set review process at an academic medical center: a multidisciplinary order review committee coordinating and executing the review process logistics, governing principles defining goals, scope, and mechanisms of the process, and involvement of clinical end users. Future research and innovation are needed to make the order set maintenance process more responsive to current clinical needs and less resource-intensive for organizations.

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Case Report:**16 year old male with Hyperkalemia from Rhabdomyolysis during Posterior Spinal Fusion and Instrumentation in the Prone Position**

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Background:

Rhabdomyolysis is caused by muscle breakdown leading to the leakage of cell contents, and is characterized by dark urine, muscle pain, and weakness. It is more commonly seen in settings of multisystem trauma or intoxication leading to prolonged ischemia, or status epilepticus. However, there are reports of the prolonged prone position leading to a rhabdomyolysis clinical picture. We report a case of a pediatric patient undergoing posterior spinal fusion in the prone position who developed hyperkalemia, thought to be the result of rhabdomyolysis.

Case:

A 16-year-old, 132-kilogram male presented for posterior spinal fusion and instrumentation from T1 to L4 for progressive idiopathic scoliosis. His PMH was notable for BMI 35 (99th percentile) and OSA s/p T&A. He had an uneventful induction with easy intubation with direct laryngoscopy. After PIV and arterial line placement, he was turned prone at approximately 9 AM and positioned on Gel bolsters with a proneview head positioning cushion. Case proceeded uneventfully and general anesthesia was maintained with propofol (150 mcg/kg/min) and dexmedetomidine infusions. Routine arterial blood gas sent 4 hours after prone positioning was notable for potassium of 5.3 with Hgb of 14.8 (baseline K of 4.0 preop). Repeat ABG confirmed elevated K of 5.4. Patient was noted to have peaked T waves and was treated with 1 gm of Calcium Chloride. EBL was minimal and the patient had not received any blood products. Follow-up ABG noted K of 5.5 and a separate chemistry panel was sent and confirmed K of 5.9.

Hydration therapy was initiated at approximately 1 liter per hour. Albuterol therapy was initiated by administering 10 puffs every 15 minutes via MDI. Lasix therapy of 10 mg every hour for 3 doses was administered. Bicarb 50 MeEq was given every hour for 2 doses. Insulin infusion was begun at 0.05 units/kg/hr and D5 1/2NS was administered to maintain blood sugar between 100 and 160.

The patient responded to these treatments and potassium normalized to 3.8 at approximately 10 hours of prone positioning. The case lasted approximately 11 hours and the patient was then transferred intubated to the PICU for further hydration and monitoring of potassium and CK. CK was 2,343 intraoperatively and peaked at 8,648 on POD #1. There was a mild elevation of Cr which peaked at 1.3 during the case, and then returned to a baseline of 0.8 on POD #2. Lactate peaked at 3.5 at the conclusion of surgery. Patient was extubated on POD#1 and discharged home on POD#5.

Three months after T1-L4 PSF, the patient had a loosening of the L4 screw with resultant segmental kyphosis. He underwent L3-4 XLIF and revision of L2-4 PSF. Similar to his prior

surgery, he again developed significant hyperkalemia and peaked T waves intraoperatively, and was again treated with IV insulin, calcium, lasix, aggressive IV hydration, and temporary hyperventilation. K responded well to these interventions and was normal at the end of the case. Of note, CK was not elevated.

Discussion:

There are many potential etiologies of intraoperative hyperkalemia, including exogenous administration (blood products, medications), intracellular-extracellular shift (acidosis, beta blockade), increased productions (malignant hyperthermia, rhabdomyolysis, succinylcholine), decreased excretion (decreased cardiac output, renal insufficiency). During the first case, hyperkalemia was thought to be secondary to rhabdomyolysis from the duration of the case, positioning, and large body habitus. Spinal surgery may be a risk factor for rhabdomyolysis compared to other surgeries, as there may be direct muscle injury from surgical insult and retraction of spinal muscles to obtain adequate surgical exposure, particularly in obese patients. Regardless of the etiology, the prompt treatment of hyperkalemia is imperative to prevent cardiac dysrhythmias which can be lethal. Careful attention should be paid to positioning, particularly for obese individuals in the prone position for prolonged periods.

Given the suspicion for rhabdomyolysis, the differential for his clinical presentation also includes propofol infusion syndrome (PRIS) and mitochondrial disorder. PRIS is a rare, potentially fatal condition that affects patients receiving high-dose propofol treatment, and can lead to cardiac failure, rhabdomyolysis, metabolic acidosis, and renal failure. Although often associated with critical illness and prolonged propofol infusions >48hrs, this patient had several risk factors for PRIS including administration of propofol (high dose >5 mg/kg/h), steroid administration (dexamethasone given in second case), use of vasopressors, and young age. Due to concerns that the rhabdomyolysis may have been part of PRIS rather than solely due to prone position and habitus, it was recommended that this pediatric patient be referred to a metabolic clinic for a possible mitochondrial disorder workup, and to consider limiting all future anesthetics until diagnosis.

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A Pathway to Expedite Preoperative Evaluation of High-Risk Inpatients

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Background:

Preoperative identification of high-risk patients has historically been performed with metrics that either lack specificity at the patient level or require the time and effort of an experienced clinician to perform chart review. Collaborators at UCLA have previously developed a fully automated score to predict postoperative, in-hospital mortality using structured data available at the time of surgery. This score was created with the use of machine learning algorithms, specifically random forests. Subsequently, they showed that the score outperformed several other common modalities. Given its potential efficiency, we set out to identify high-risk inpatients who may benefit from preoperative intervention prior to non-cardiac, non-liver surgery or procedures requiring administration of anesthesia.

Methods:

Using the automated score, a daily list of inpatients scheduled for anesthesia and deemed high-risk for postoperative in-hospital mortality was created within the electronic medical record (EMR). The anesthesiology resident physician assigned to the “day team captain” role was asked to perform a chart review on these patients and to identify and obtain additional indicated workup or interventions before proceeding. To assess process outcomes, a survey was to be completed after each evaluation. The survey recorded whether or not a preoperative intervention was taken, and if so, what that intervention was. Both components represented new elements of the resident workflow.

Results:

Between April 1, 2022 and January 31, 2023 there were 59 survey responses over 206 eligible days; of these responses, 47 (79.7%) indicated that no additional preoperative interventions were undertaken. 12 (20.3%) responses indicated that an intervention was taken.

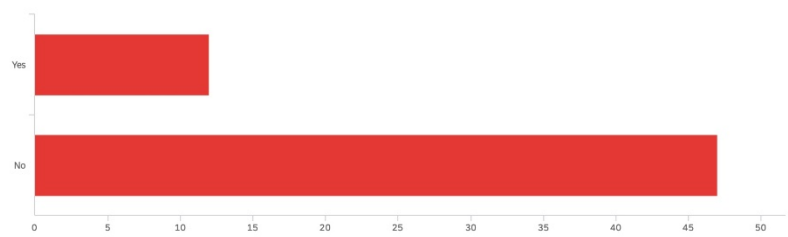
Conclusion:

Chart review by a clinician is time-consuming; our findings showed a high rate of intervention, and suggest that an automated scoring system has the potential to target detailed evaluations and improve efficiency in preoperative optimization. Unfortunately, due to low utilization, the current breadth of data is not sufficient to draw definitive conclusions, and may indicate missed opportunity. Additional study, including modification to physician workflow to improve consistency, could expand the dataset and allow for more detailed evaluation of the efficacy of this automated score on both process and clinical outcomes.

Q3 - This survey is intended for users of the high-risk perioperative mortality score only. If

this does not apply, please do not proceed. Were any preoperative interventions

undertaken for this patient?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	This survey is intended for users of the high-risk perioperative mortality score only. If this does not apply, please do not proceed. Were any preoperative interventions undertaken for this patient?	1.00	2.00	1.80	0.40	0.16	59

VV ECMO for Whole Lung Lavage for Pulmonary Alveolar Proteinosis

Kevin Huynh, MD, MS¹, Thanh-Giang Vu, MD¹, and Victor Ng, MD¹.

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Background:

Pulmonary Alveolar Proteinosis (PAP) is a rare disorder characterized by accumulation of lipoproteinaceous material in the lower respiratory tract. In adults this manifests as progressive dyspnea on exertion, weight loss and hypoxemia. Whole lung lavage (WLL) remains a mainstay of treatment in severe cases of PAP. WLL requires general anesthesia with a double-lumen tube and instillation of large volume saline, often with chest percussion, to remove proteinaceous material. Despite being a standard therapy for PAP, whole and partial lung lavages can be poorly tolerated, even in normal healthy lungs. This creates additional challenges as many patients with PAP present with significant hypoxia and do not tolerate even segmental lung lavages. Here we present a case in which venovenous extracorporeal membrane oxygenation (VV ECMO) was utilized in a patient with severe PAP and hypoxemia that was refractory to multiple lung lavages.

Case Description:

A 36-year-old woman with history of cigarette use presented with severe dyspnea and hypoxemia. Upon workup, which included diagnostic lung lavage and antibody testing, she was diagnosed with PAP. On her initial presentation she required up to 35L on high flow nasal cannula to maintain adequate oxygen saturation. She had difficulty tolerating lung lavage with a significant episode of desaturation to 60% and therefore could only undergo small volume segmental lobar lavage. Her oxygen requirement improved and was eventually discharged saturating 92% on 6L NC. However, over the subsequent five months, she continued to develop worsening hypoxemia requiring three additional segmental lobar lavages. After her fourth lavage, she returned to clinic with worsening symptoms with an oxygen saturation 81-83% on room air. Because of the severity of her hypoxemia and inability to tolerate WLL, the decision was made to proceed with whole lung lavage with VV ECMO support.

The patient presented on the day of the procedure requiring 15L on a non-rebreather mask to maintain saturation in the high 80s. She was brought to the OR and general anesthesia was induced. A left-sided double-lumen tube was inserted. The patient was then placed on VV ECMO via a dual lumen right internal jugular cannula. Shortly after initiation of ECMO, her oxygen saturation improved from to 99-100%. WLL was then performed with each individual lung receiving 18L of warm saline. After completion of WLL she was transferred to the ICU intubated where she was quickly weaned off both ventilator and ECMO support and extubated on post-op day (POD) 2. She was discharged on POD 3 saturating 100% on 6L NC. In clinic 3 weeks after discharge, she was noted to be doing very well and saturating 98% on 2L NC.

Discussion:

In this case, the patient had undergone multiple lung lavages that were limited by the severity of her disease. This limitation was bypassed with VV ECMO which enabled the use of aggressive high volume WLL and resulted in significant improvement in the patient's pulmonary status.

The use of VV ECMO may be more common in the future and providers should be aware of its use in expanding applications.

Title: Using the 55-word story method of reflection and writing about not Losing Hope in Humanity

Authors: Pearl Huynh MS, Ricardo Falcon MD, Tim Petersen PhD, Codruta Soneru MD

Creative writing with 55-word stories can encapsulate key experiences. It stimulates reflection and professional growth. Their brevity adds insight and impact.

Draft 1:

I have so many mixed feelings about everything going on in the world right now. There is so much disagreement on everything and to me it feels like we can never get everyone on the same page. Whether it be political things, health care, Roe v. Wade, world hunger, vaccines, violence, etc.. Being a first-year medical student, it can be easy to forget about everything going on in the world as you are so busy trying to study and stay afloat. I forget about everything going wrong for a while until I open a news article or Facebook and see another school shooting happening not too long from the last one that occurred. My hope in humanity had been continuing to decrease as I continued seeing all the bad news. As I continued forgetting away in my studies, I completely forgot that I needed to make an appointment for my dad to see his surgeon regarding a procedure he had awhile back on his arm -- I felt extremely guilty that I didn't find time to make it for him. A week later, I had dinner with him and asked how his doctor's appointment went (this was with his oncologist who knows nothing about his surgical procedure), he told me it went well and that the doctor went out of her way to ask about his arm and even asked to call and make his appointment for him. Him telling me this made me cry. It was so touching to me that his oncologist went out of her way to make his appointment for him when it had nothing to do with her care. Amid all this chaos, my dad, who does not speak English, received help. I thought to myself, maybe hope in humanity still exists.

First drafts have no length limit; editing distills key components and implicit ideas. The final version:

55 words:

Politics, healthcare, abortion, violence. The world will never be on the same page. My hope for humanity diminishes. One day, an oncologist made an appointment for my dad through his cellphone about his missed orthopedic appointment. My mind changed. She didn't need to do that. I thought to myself, maybe hope in humanity still exists.

Discussion:

Verbalizing strong feelings was hard. I adore my parents, who left wartime Vietnam seeking a better life and future. I feel guilty about spending little time with them, and not always helping my non-English-speaking dad with appointments. We live in stressful, conflicting times. My story helped pinpoint the essence; cutting to 55 words was cathartic. Reflecting on the good instead of focusing on the negative is okay.

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Treatment and Complications Associated with Thyroid Storm in the Pediatric Population

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Background

Grave's disease is an autoimmune disease resulting in hyperthyroidism with low TSH due to overproduction of thyroid hormones.¹ Thyroid storm (thyrotoxic crisis) is an acute life-threatening hypermetabolic state with excessive release of thyroid hormones that can be induced by anesthesia.⁵ Its massive catecholamine release causes hyperglycemia, fever, delirium, tachycardia, arrhythmias, heart failure, CNS irritability, seizures, delirium, and eventually coma, with 8-25% mortality.^{2,5}

Case Description

A 14 y/o female with uncontrolled Grave's disease and severe constipation (stool consisted of 10 cm pebbles) presented for colonoscopy. Endocrinology and Gastroenterology argued that a euthyroid state would worsen intestinal motility, halting stool passage completely, causing hyperthyroidism treatment to be withheld. Endocrinology recommended methylprednisolone to inhibit T4-T3 conversion) 1mg/kg bolus, followed by 1 mg/kg for one hour. An NG tube was placed to administer methimazole in case of a thyroid storm and an esmolol infusion was ready in case of tachycardia/hypertension. Only steroids were administered as she was stable throughout the case. She was transferred to ICU for close observation and discharged home without issues the next day.

Discussion

Patients with Graves requiring surgery are generally pretreated for 5-7d with beta-blockers, glucocorticoids, and iodine to achieve a euthyroid state. Thyroid suppression was inappropriate for our patient, so we managed risk with glucocorticoids and prepared for thyroid storm.

Children require specific thyroid storm prophylaxis. After supportive care for homeostasis, thyroid hormone synthesis is inhibited via methimazole (MMI) or propylthiouracil (PTU).⁴ PTU inhibits multiple pathways of T4 to T3 conversion centrally and peripherally, but is dangerous in children, with severe hepatotoxicity and ANCA vasculitis.^{1,4,5} Thyroid hormone release is inhibited via potassium iodide (SKKI) or corticosteroids.^{1,4,5} Beta-blockers (eg esmolol) treat cardiovascular symptoms.⁴ A euthyroid state usually follows in 1-7d.^{4,5} Radioactive iodine should be avoided in pediatrics due to thyroid cancer risk.⁵

Differential diagnosis of thyroid storm during anesthesia include anaphylaxis, malignant hyperthermia, brain insult, pheochromocytoma, neuroleptic malignant syndrome (NMS), and uncontrolled hypertension.³

Thyroid storm risk is elevated in poorly treated Grave's disease.^{6,7} We hope to increase awareness of thyroid storm in pediatrics.

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Title: Complications of Mechanical Circulatory Devices in a Patient with Cardiogenic Shock: Impella-induced Hemolysis and Intra-aortic Balloon Pump Malposition

Authors/Institutions:

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¹Mayo Clinic Alix School of Medicine, Mayo Clinic, Jacksonville, FL; ²Department of Critical Care Medicine, Mayo Clinic, Jacksonville, Florida

Background: Mechanical circulatory devices, such as Impella and intra-aortic balloon pump (IABP), have been widely used to provide hemodynamic support and to bridge heart transplant in patients with cardiogenic shock.¹ These interventions often present complications: Impella-related massive hemolysis is primarily linked to the shearing force from the mechanical device, clot formation, or device malposition;^{2,3,4} IABP malposition is often related to a percutaneous approach placement via the axillary artery.^{5,6,7} In this report, we present a case of Impella-induced hemolysis leading to progressive decompensation and malposition of IABP in a patient with cardiogenic shock.

Case Description: A 68-year-old woman was admitted due to increasing inotrope and vasopressor needs. Past medical history included breast cancer, anthracycline-induced dilated cardiomyopathy, and biventricular automated implantable cardioverter defibrillator (AICD) placement complicated by pericardial tamponade. Her ejection fraction was 29%, and left ventricular thrombus was also noted on the echocardiogram, which resolved with IV heparin. Despite the increasing doses of Dobutamine and Bumetanide, rising lactate and a dropping SvO₂ necessitated a transfer to the ICU and placement of Impella 5.5 via the right axillary artery.

Several complications were encountered. On day 12 post-op, the patient reported pain in the Impella site. On day 14, she experienced an episode of ventricular tachycardia, and on day 19, liver dysfunction associated with a rising LDH (298-> 314 -> 410-> 1298) and complicated by polymorphic ventricular tachycardia. A multidisciplinary decision was taken to remove the Impella due to the suspicion of significant hemolysis, and a clot was noted at the pigtail end of the explanted Impella (Figure 1). Veno-arterial extracorporeal membrane oxygenation (VA-ECMO) was initiated via the femoral route, and IABP was inserted via the right axillary artery. Follow-up chest X-ray (Figure 2) showed a malpositioned IABP, found to be located in the superior mesenteric artery by ultrasound (Figure 3). It was retracted to the ideal position. The patient received an orthotopic heart transplant after 5 days of ECMO, IABP, and vasopressor support and is recovering well on diuretics, vasopressors, post-transplant immunosuppressants, and prophylactic antimicrobials.



Figure 1: Clot at tip of pigtail end of Impella 5.5 (post explant)



Figure 2. Chest X-Ray showing right axillary IABP with proximal marker approximately 5 cm distal to aortic isthmus and distal marker in upper abdominal aorta.

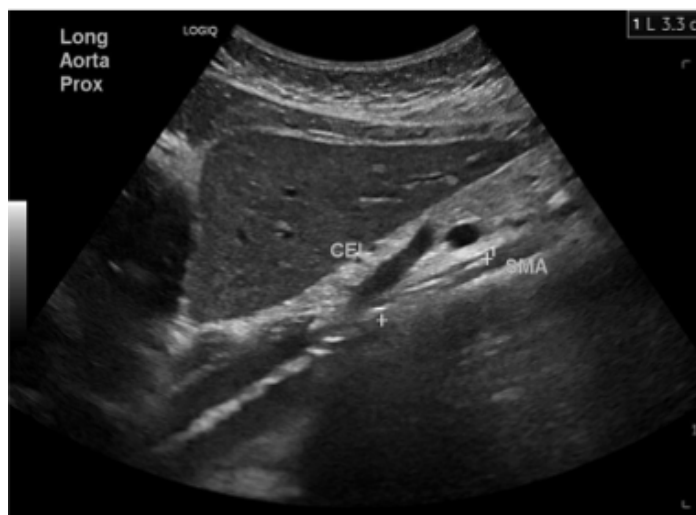


Figure 3. Mesenteric ultrasound showing IABP tip within proximal superior mesenteric artery.

Discussion: Massive hemolysis and balloon mispositioning are the two most common complications associated with Impella and IABP placement, respectively, in patients with cardiogenic shock. Early diagnosis and timely intervention can prevent devastating outcomes associated with these complications. Elevated liver enzymes may suggest Impella-related hemolysis and indicate device removal. When placing an IABP, although the percutaneous approach via the axillary artery may better facilitate mobilization, it frequently results in malposition. Subsequent X-ray confirming proper placement is essential.

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1st Annual Waste to Art Exhibition
Jai Eun Huh, Teal Jenkins, Seema Gandhi, Kaiyi Wang
University of California San Francisco

Introduction

The healthcare industry is the second-largest waste generator in the US after the food industry, producing more than 5 million tons of waste each year. Among them, 85% of the waste is non-infectious and ends up in landfills with only a small fraction being recycled and repurposed. As a global leader in healthcare sustainability, the University of California has pledged to produce net-zero greenhouse gas emissions by 2025, becoming the first major university to commit to this goal. As part of this Carbon Neutrality Initiative, the Waste to Art competition was developed with two goals: to gather support and active participation from diverse graduate communities and health campuses, and to encourage people to reflect on the waste in our lives and think about ways we can transition to a more sustainable future.

Methods

To foster campus wide engagement and participation, leaders put out physical and electronic announcements to advertise the competition. Through this multimodal approach, flyers were placed around the UCSF campuses and hospitals, emails were disseminated through listservs, and announcements were made in the UCSF Sustainability Newsletter. Local stakeholders in environmentalism and art were invited to judge the artwork. For easy of accessibility, the artwork was showcased with an in-person event and virtually via a website.

Results

For the first upcycled medical waste competition, 30 proof of concept entries were received from various departments, ranging from sculptures to photography in medium. A total of 16 pieces of art were received by the exhibition deadline. Judging of the artwork was completed in two parts by public popularity voting (50%) (receiving over 200 votes) and by a panel of local stakeholders (50%). Projects were received with widespread support and will be permanently displayed across UCSF campuses for patients and visitors to admire.

Conclusions

The Waste to Art Exhibition was a success in elucidating the amount of waste the healthcare industry generates, specifically highlighting single use items that can be repurposed and upcycled. The largest limitation of the exhibition was difficulty showcasing fine details of physical artwork virtually via the website and you-tube channel. Similar exhibitions can be implemented at institutions across the country as single use plastics, textiles, and various material waste are generated at every healthcare organization. By showcasing medical waste, we can help to bring attention to sustainability and the environmental impact of our careers.

Title: Treatment of Chronic Pain in Patients with Cancer, a Retrospective Chart Review

Authors: Tyson Jergensen, MD, Zachary Jergensen, MD, Matthew Seely, MD, Shane Brogan, MD

Institution: University of Utah, Division of Pain Medicine

Abstract:

Introduction

In the U.S. there were an estimated 1.9 million new cancer cases diagnosed in 2022. Improvements in cancer treatments have increased survival rates in these patients with over 18 million cancer survivors in the same year. Although cancer survival rates have improved, the prevalence of cancer-related pain remains high. A meta-analysis revealed that pain was reported in 59% of patients undergoing cancer treatment, in 64% of patients with advanced disease, and in 33% of patients after curative treatment. Despite guidelines and the availability of various interventions and medications, undertreatment is common. The purpose of this study was to review a population of cancer patients and observe the interventions used to treat pain in this population.

Methods

We performed a retrospective chart review of 102 patients at a tertiary cancer hospital and analyzed the pain treatments they received.

Results

In our population of 102 cancer patients, we observed a wide range of pain etiologies and treatments. In addition to their cancer pain, 27.5% of patients had pre-existing pain and 25.5% suffered from non-cancer related pain. As seen in the general population, the most common non-cancer pain source was back pain (12.7%). Patients were treated with various interventions including neuraxial (11.8%), sympathetic block (7.8%), joint injections (4.9%), and neuromodulation (3.9%). Unique to the cancer population, kyphoplasty was performed in one patient and IT pump placed in 19.6% of patients. Opioid management, a mainstay of cancer pain management, was observed in 75% of this population.

Conclusion

Despite improvements in cancer treatments and survival rates, prevalence of chronic pain in cancer patients remains high. Many pain providers are hesitant to treat these patients because cancer pain management has historically been synonymous with opioid medication management. This retrospective chart review shows that although opioids remain a mainstay of cancer pain treatment, very often these patients suffer from various other sources of pain and benefit from many of the same interventions performed for chronic pain patients without cancer.

A Case Report of Unanticipated Difficult Intubation Due to Posterior Tracheal Angulation.

Authors

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Introduction

Tracheal deviation mostly occurs from mechanical compression of the trachea and can be caused by a variety of clinical conditions. Anterior- posterior (A-P) tracheal deviation has rarely been reported. We would like to report a case of difficult endotracheal tube advancement secondary to acute posterior tracheal deviation encountered during cardiopulmonary resuscitation (CPR).

Case Description

A 50-year-old male with a history of chronic cerebral venous sinus thrombosis presented to the emergency department for recurrent headaches. He suffered a sudden cardiac arrest and CPR was immediately initiated. Using a video laryngoscope, the trachea was intubated. After 40 minutes of CPR, a persistent air leak was observed and the ETT tip was found to be at the level of the first rib on portable A-P chest X-ray (CXR). This prompted blind advancement of the ETT against resistance. Subsequent chest computed tomographic scan (CT) (Figure 1A), revealed the

ETT termination 8.2 cm above the carina in addition to a significant posterior deviation of the mid and lower trachea. No masses or lesions contributing to the tracheal angulation could be identified. Perplexingly, on CT imaging from two months prior, the trachea was noted to be of normal caliber and ordinarily aligned with the vertebral column (Figure 1B).

Flexible fiberoptic bronchoscopy was then performed. 90-degree tracheal angulation was encountered and navigated to visualize the carina and the ETT was then advanced. A subsequent CXR confirmed appropriate ETT position.

Discussion

Tracheal deviation in the A-P dimension resulting in difficult tracheal intubation has rarely been reported. Previous reports have described anatomical lesions contributing to similar tracheal deviation. In our case, there was no interval history of neck trauma or tracheal obstruction suggestive of a likely cause. This change in the patient's anatomy was only discovered after CPR had been performed. Iatrogenic injuries are known to occur during CPR, such as laryngeal cartilage damage from intubation¹, but there have been no previous reports of tracheal displacement following CPR.

Our case of tracheal deviation is unlikely to be related to patient positioning as the A-P deviation persisted in three separate head and neck alignments. On magnetic resonance imaging, tracheal deviation has not been observed with changes in head and neck alignment². In situations similar to ours, where A-P tracheal deviation has been encountered, other authors have reported the necessity of alternative techniques to establish a patent airway, including the use of a laryngeal mask airway³, and a cuffless ETT with saline-soaked gauze packing⁴. In one reported

case, awake fiber-optic intubation was performed when difficult tracheal intubation was anticipated due to known A-P tracheal deviation⁵.

Failure of ETT advancement can be due to obstruction from the arytenoids and vocal cords⁶. When the ETT has traversed the vocal cords, tracheal A-P deviation should be considered as a cause of difficult ETT advancement. If an endotracheal airway cannot be established, prompt consideration should be given to placement of a supraglottic airway. Early fiberoptic bronchoscopy should be used to establish a diagnosis and assist with proper ETT positioning.

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Figure Legends:

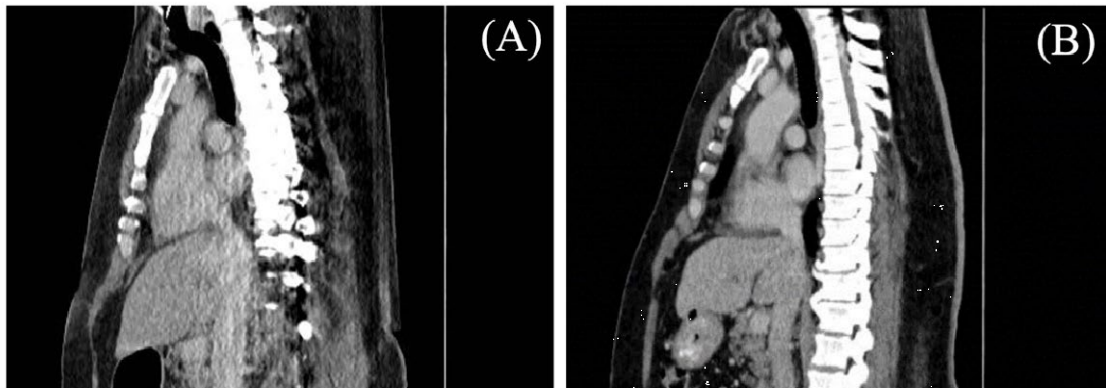


Figure 1. (A) Sagittal CT following intubation with significant posterior deviation of the mid to lower trachea. (B) Comparison CT from 2 months prior to this case presentation demonstrates normal tracheal alignment without A-P deviation.

Title: “Peripheral Nerve Stimulation of the Lesser Occipital and Greater Auricular Nerve for Post Herpetic Neuralgia in a Case of Ramsay Hunt Syndrome”

Authors: Brooks W. Johnson M.D.¹, Stephen M. Covington D.O.², Mostafa M. Maita D.O.², Natalie H. Strand M.D.²

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Background

Post-herpetic neuralgia (PHN) is a chronic neuropathic pain condition following an outbreak of herpes zoster. Recommended treatment for PHN includes neuropathic agents, antidepressants and topical creams and patches [1]. When these treatments fail to control chronic pain, neuromodulation may provide an additional option for patients with chronic PHN. When PHN affects the scalp and periauricular region, this poses a complex and unique clinical scenario. Peripheral nerve stimulation (PNS) has been used to treat a variety of facial and cranial neuralgias [2]. We present a case of successful PNS to the lesser occipital and greater auricular nerves for PHN.

Case Description

An 81-year-old male presented with three years of right sided posterior scalp and periauricular pain after herpes zoster infection presenting as Ramsay Hunt Syndrome. The patient trialed oral and topical medications as well as botulinum toxin injections without relief. Pain was rated between 6-10 and averaging a 9 on a scale of 10. Neuromodulation using the SPR 60-day peripheral nerve stimulator system was offered to the patient in the distribution of the right lesser occipital and right greater auricular nerves.

Ultrasound guidance was used to visualize the right lesser occipital and right greater auricular nerve which helped identify an optimal needle path. A total of two linear array electrodes were advanced under ultrasound guidance near the right lesser occipital and right greater auricular nerves. Stimulation of the lesser occipital nerve was successful in stimulating the posterior auricular area. The greater auricular nerve branch of C2/C3 was stimulated at the posterior border of the upper one third of the sternocleidomastoid muscle resulting in successful stimulation of the whole ear. Patient reported reduction of pain to 1-2 out of 10 directly after stimulation and implantation. Patient consent was obtained to use photographs for purposes of medical education.

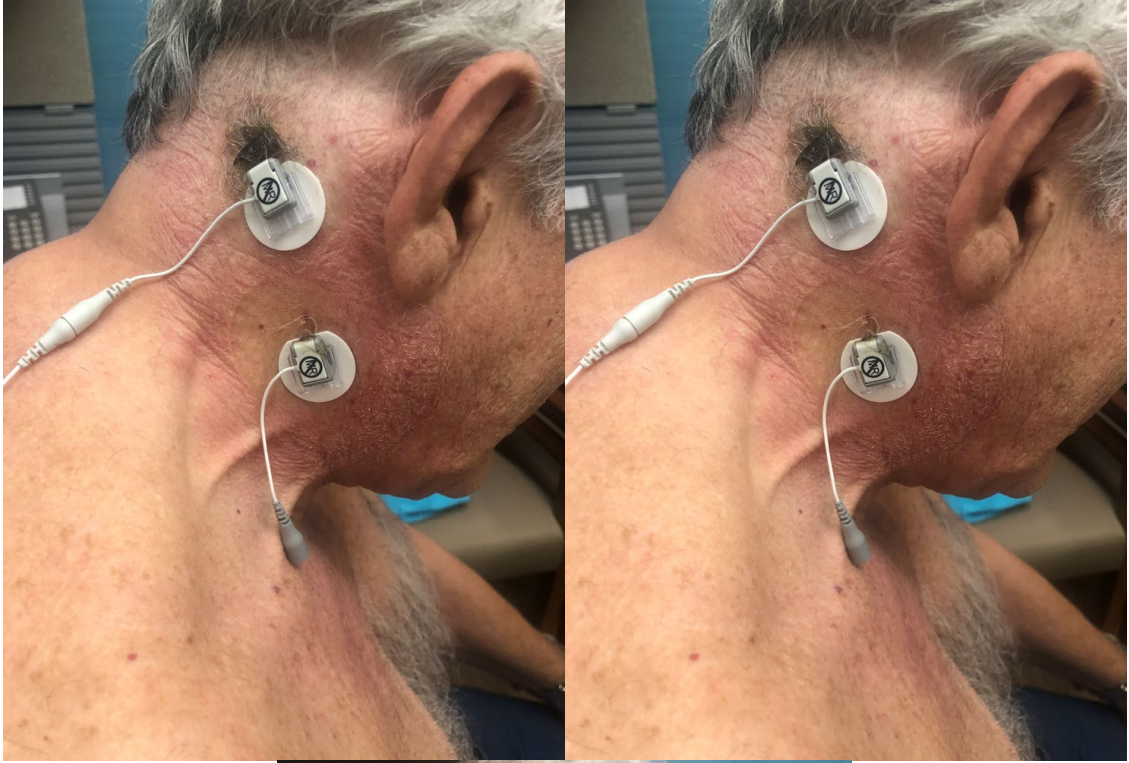
The patient returned for lead removal on post-procedural day 65. He reported continuous 90% improvement of his symptoms with pain averaging a 0 out of 10. The patient reported no side effects or complications since the time of his procedure. Leads were removed without complication.

Discussion

We present a case of severe pain from PHN of the periauricular region refractory to several prior medical interventions that responded to PNS with immediate and continuous resolution of symptoms. In complex cases of PHN of the scalp and periauricular area, PNS of the lesser occipital and greater auricular nerves may be a treatment option for pain relief.

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Title: Augmenting the Algorithm: Managing Post-Operative Cardiac Arrest in a Patient with Sick Sinus Syndrome and Severe Aortic Stenosis

Authors: LT Kelly Joyce, DO (CA-1), Sean Birmingham, MD (Staff Cardiothoracic Anesthesiologist) and CDR J. M. Ismawan (Program Director); Department of Anesthesiology, Naval Medical Center San Diego.

Background: Sick sinus syndrome and severe aortic stenosis pose numerous challenges for the anesthesiologist, specifically requiring understanding of nuanced emergency interventions.

Case Description: A 75-year-old gentleman underwent occiput to C2 fusion for an unstable lytic lesion at C1. His medical history included atrial fibrillation status post pacemaker placement and later sick sinus syndrome, severe aortic stenosis, coronary artery disease status post NSTEMI and stenting, heart failure with reduced ejection fraction, hypertension, type 2 diabetes mellitus, chronic obstructive pulmonary disease, obstructive sleep apnea, two strokes with residual right-sided deficits, stage IV non-small cell lung cancer, gastroesophageal reflux, and depression. Transthoracic echocardiogram revealed a 34% ejection fraction, severe left ventricular hypertrophy, and likely severe low-flow low-gradient aortic stenosis. His pacemaker was re-programmed from DDDR to DOO at 80 BPM the night before surgery. Of note, the patient had an active do-not-resuscitate order.

The anesthesia team discussed the risks of anesthesia and proposed anesthetic plan with the patient and his wife. He affirmed understanding of the elevated risk for severe complications and consented to undergo anesthesia. Additionally, he consented to undergo chest compressions, electric shock, and administration of emergency medications in the event of intraoperative cardiovascular collapse. The patient had two working intravenous lines on arrival to the operating room. In addition to a pre-induction arterial line, the anesthesia team placed defibrillation pads prior to induction.

Following an uneventful anesthetic and extubation in the operating room, the patient was hemodynamically stable and following commands during transfer. Immediately after turnover to the intensive care unit and prior to post-operative goals-of-care discussion, the patient developed pulseless ventricular fibrillation. The team initiated advanced cardiac life support, administering chest compressions, four defibrillating shocks, two rounds of epinephrine 1mg, one round of amiodarone 300mg, and re-intubation with return of spontaneous circulation after 10 minutes. Pacemaker interrogation revealed atrial fibrillation and was reprogrammed to DDDR with 60/130 upper/lower rate limits. 50 ml of 25% albumin was rapidly administered to augment preload, a norepinephrine infusion was titrated to maintain normotension, and an amiodarone infusion was initiated to convert the patient's atrial fibrillation. The patient became pulseless again with return of spontaneous circulation after 30 seconds of chest compressions and epinephrine 1mg. Afterwards, the patient was following commands. Discussion with the patient's family resulted in return to do-not-resuscitate status.

Discussion: Chest compressions in patients with aortic stenosis do not generate adequate stroke volume. And so, early electrical conversion, maintenance of preload, and restoration of sustainable rhythm are essential. Since aortic stenosis portends poor outcomes in patients who suffer cardiac arrest, anesthesiologists should discuss patient wishes for intervention should arrest occur. Additionally, as sick sinus syndrome includes a variety of rhythms, early identification of intrinsic rhythm facilitates prompt intervention to ensure ongoing stability.

Intraoperative diagnosis of tracheal stenosis during intubation

Kelly Kaneshiro DO, Harbor-UCLA Medical Center; Maulik Rajyaguru DO, Harbor-UCLA Medical Center

Background:

50-year-old male who sustained a mechanical fall one year ago with subarachnoid hemorrhage and subdural hemorrhage status post emergent craniotomy and craniectomy, presented for cranioplasty and was diagnosed intraoperatively with subglottic stenosis. The patient was intubated for one month in the surgical intensive care unit for 2.5 weeks during his prolonged hospitalization one year ago. The patient was evaluated by speech/language pathology, physical therapy and occupational therapy before discharge and no major issues were documented.

Case Description:

The patient was evaluated in our preoperative anesthesia clinic where no respiratory issues were endorsed by the patient or found on physical exam. Following induction, a grade III view was obtained with direct laryngoscopy (DL). Upon second attempt, a grade I view was obtained using a Glidescope, but a 7.0 endotracheal tube (ETT) was unable to pass through the cords. A 6.0 ETT was unable to pass and a 5.0 microlaryngeal tube (MLT) was unable to pass beyond 20cm. No leak was observed with the 5.0 MLT cuff uninflated, and we could adequately ventilate and oxygenate the patient. ENT was consulted and upon DL, the patient was found to have 70% tracheal stenosis 1cm in length, located 2.5cm below the cords. Anesthesia, neurosurgical and ENT teams concluded that it was safer to extubate the patient and cancel the case. Three weeks later, the patient underwent DL with dilation and CO2 laser. At the end of the case, a 5.0 ETT passed easily. ENT recommended the patient be intubated with a 6.0 ETT with a 5.0 MLT as backup for future cases.

Discussion:

Tracheal stenosis is one of the worst complications following prolonged intubation (Farzanegan et al., 2017). Post-intubation tracheal stenosis has an incidence rate of 6-22% among intubated patients (Farghaly et al., 2020). One study cited 12% incidence of laryngeal stenosis in patients with tracheal intubation for 11 days or longer, 5% incidence with 6-10 days of intubation, and 2% incidence with less than 6 days of intubation (Whited, 1979). Diagnosis of tracheal stenosis is often delayed due to rapid transition from acute inpatient care to outpatient rehabilitation facilities, with possibly 10% of patients going undiagnosed for more than ten years or being misdiagnosed with asthma (Farzanegan et al., 2017). Tracheal stenosis is most often diagnosed through outpatient specialty evaluation versus in the operating room by the anesthesiologist. This case offers perspective on how to manage intubation of a patient with undiagnosed tracheal stenosis. It is important to avoid forcing ETT placement if the tube does not pass easily as this may cause further damage to the airway. Utilizing a Glidescope is a sufficient technique to gain better visualization of the airway and assess for possible obstruction or explanations for difficulty passing the ETT. Downsizing the ETT and eventually using an MLT are viable options. Finally, an ENT consultation can offer a definitive diagnosis and expedite treatment of the patient's tracheal stenosis.

Resection of Renal Cell Carcinoma with Tumor Thrombus Extension into the Right Atrium
Christopher Karasch, Fourth year Clinical Anesthesiology Resident, University of Arizona

A 51-year-old female with a past medical history of methamphetamine use, diabetes mellitus, and hypertension presented with right flank pain and was found to have a large 11x12x11 centimeter right renal mass. The mass extended into the right renal vein, up the inferior vena cava, and into the right atrium of the heart. This posed a formidable challenge from a surgical standpoint requiring urology, vascular, and cardiac surgery involvement. Additionally, anesthetic concerns included hemodynamic instability on induction due to lack of preload, thrombus embolization during central line placement, and possible need for deep hypothermic cardiac arrest.

A preoperative arterial line was placed, and general endotracheal anesthesia was induced with slow propofol titration. She remained hemodynamically stable throughout induction. A transesophageal echocardiogram was then performed with identification of the tumor thrombus with near total occlusion of the IVC. The hepatic veins were free of tumor and there was extremely limited flow from the IVC into the right atrium. Two right internal jugular central lines were placed under TEE guidance to avoid disrupting the tumor in the IVC and right atrium. A laparotomy was then performed and the renal mass and IVC were isolated. Cardiac surgery then performed sternotomy. The patient was heparinized for cardiopulmonary bypass, and an aortic cannula was placed in the ascending aorta. A venous cannula was placed in the IVC, just inferior to the tumor thrombus via the femoral vein. Partial cardiopulmonary bypass was initiated and a right atriotomy was performed with subsequent direct SVC cannulation, full bypass was then initiated. The patient was cooled to 29 degrees Celsius. Fortunately, deep hypothermic cardiac arrest was not required as the cardiac index on the bypass circuit was able to be maintained at 2.0 or greater.

After clamping the IVC distal to the tumor, vascular surgery performed a venotomy and identified the tumor thrombus. With one finger in the right atrium on the thrombus, the surgeon was able to push the tumor inferiorly to the intrahepatic IVC where it was able to be removed. After resection of the tumor and the renal vein, the IVC was repaired primarily. TEE was used to confirm complete removal of the tumor thrombus from the right atrium and intrahepatic IVC. The patient was then rewarmed and weaned from cardiopulmonary bypass without the need for inotropic support. She was then brought to the ICU where she was extubated on post operative day one. She was discharged from the hospital on post operative day six. In this case, surgical resection was curative.

Successful Use of Regional Anesthesia in a Patient with Charcot-Marie-Tooth Disease who demonstrated aberrant anatomy

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Background

The most common inherited neuropathies are collectively referred to as Charcot-Marie-Tooth (CMT) disease affecting approximately 1-in-2500 people. Typical signs and symptoms include extreme lower extremity motor weakness and muscle wasting, gait abnormalities, and lower extremity neuropathy (1). We describe a case report using regional anesthesia for lower extremity surgery as a primary surgical anesthetic in a patient with CMT with preexisting lower extremity nerve injury.

Case Description

A 56-year-old female with CMT complicated by bilateral foot drop presented to the outpatient surgery center for arthrodesis and internal fixation of the left first metatarsal phalangeal joint. Focused exam demonstrated 2/5 strength in LLE dorsiflexion. The patient preferred a regional anesthetic. After applying standard monitors, performing a procedure timeout, and administering mild sedation, the sciatic nerve was identified near the popliteal fossa using ultrasound which revealed an abnormal presentation with a large common peroneal nerve (CPN) that appeared to split with multiple large fascicles (Figure 1). Approximately 20mL of bupivacaine 0.5% was administered that targeted both the CPN and tibial nerve. The saphenous nerve was then identified in the adductor canal and 10mL of bupivacaine 0.5% was administered. The patient tolerated the procedure and surgery well and was discharged without issues.

Discussion

We describe a case report of utilizing regional anesthesia as the primary anesthetic in a patient with CMT for lower extremity surgery. CMT frequently results in a progressive distal-to-proximal weakness with atrophy in the feet and legs. Anesthetic challenges to consider in patients with CMT include increased sensitivity to muscle relaxants and possible autonomic dysfunction. Given the underlying neuropathy, there is a concern for worsening nerve injury with regional anesthesia as well. This is related to the “double crush” phenomenon, where a second minor insult to an already compromised nerve can lead to permanent injury (2).

Determining the best anesthetic plan for this patient was challenging. We wanted to avoid general anesthesia given a history of asthma and uncontrolled hypertension. Thus, the decision was made to proceed with regional anesthesia under a primary surgical block. An exhaustive literature search did not reveal a single case documenting any adverse outcome following peripheral nerve block in CMT patients.

Lastly, we did observe what we think was an abnormal presentation of the sciatic nerve. As shown in Figure 1, the CPN appears to split at the level of the popliteal fossa with large, hypertrophied fascicles. We hypothesized that given her pre-existing CPN dysfunction, the hypertrophied appearance may be a compensatory mechanism. Several authors conducted US assessments of patients with CMT and found consistent enlargement of fascicles in both upper and lower extremity nerves (3).

In conclusion, there are no clear recommendations regarding the role of regional anesthesia in patients with preexisting neuropathy. A multidisciplinary discussion with the surgical team, anesthesiology team and patient is encouraged. If a regional technique is pursued, strongly consider the use of ultrasound to help minimize potential nerve trauma that could result from landmark and/or stimulation techniques.

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Figure 1: The sciatic nerve at the popliteal fossa. The common peroneal nerve appears to split with large, hypertrophied fascicles

Title:

Case Report of an Asymptomatic Patient with Recurrent Pleural Effusions Undergoing Basilio Vein Transposition Complicated by an Intraoperative Code

Authors:

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Background:

Pleural effusions are diagnosed in about 1.5 million individuals in the US annually. Pleural effusions have a wide variety of etiologies, including pleural infections, heart failure, renal failure, and malignancies, and are associated with significant morbidity and mortality. Currently, there are no established guidelines to facilitate the management of nonmalignant pleural effusions (NMPE) and most strategies are dependent on expert's specific experience and information derived from patients with malignant pleural effusions. We present a case of an asymptomatic patient with recurrent nonmalignant pleural effusions who coded intraoperatively due to acute respiratory distress.

Case Description

A 57-year-old female with hypertension, insulin dependent diabetes, end stage renal disease on hemodialysis, hyperparathyroidism, recurrent left sided loculated pleural effusion, persistent pericardial effusion, and status post stage 1 basilio vein transposition (BVT) 4 months prior (complicated by intraoperative conversion from MAC to general anesthesia due to oxygen desaturation) presenting for stage 2 BVT. Preoperatively, patient was clinically stable and saturating appropriately on room air with no obvious symptoms of respiratory distress. After receiving supraclavicular and intercostobrachial blocks, patient incrementally received a 100mg of propofol while spontaneously ventilating the entire time. Nasal airway was inserted, which was shortly switched out for an oral airway after epistaxis and coughing were noted. Prior to incision, case was complicated by sudden respiratory obstruction, hypotension, bradycardia, and eventually an intraoperative code. Immediate intubation was performed due to acute respiratory decompensation and case was aborted.

Discussion

For persistent or recurrent symptomatic NMPEs, repeat therapeutic thoracentesis under ultrasound guidance is generally the first-line option. Repeat thoracentesis are best suited for patients who experienced relief from drainage on presentation, patients with NMPE that reaccumulate slowly (eg. once every 4 weeks or more), and patients with grim prognosis (eg, <2 weeks). However, when patients present clinically stable and asymptomatic, repeated drainage is generally avoided due to theoretical risk of introducing infection and inducing thickened visceral pleura or unexpandable lung.

Evaluating perioperative pulmonary risk can be comprehensively done with an overall medical condition, initial clinical presentation, and other clinical factors. Risk calculators can be utilized as well, such as the ARISCAT Risk Index. Overall incidence of postoperative pulmonary complications can be evaluated by assigning a weighted point score to 7 independent risk factors (advanced age, preoperative O2 saturation, respiratory infection within past month, preoperative anemia (Hgb < 10), upper abdominal or thoracic surgery, surgery > 2hrs, or emergent surgery). Score can be stratified to low (1.6%), intermediate (13.3%), or high (42.2%) risk.

The present case highlights the importance of preoperative evaluation of patients with history of recurrent pleural effusions who present asymptotically with no strong clinical indication for preoperative intervention. In our patient, thoracentesis was not indicated perioperatively because she was asymptomatic, even though patient desaturated and coded intraoperatively due to acute respiratory distress.

Title: Prediction of occult hypoxemia using Deep Neural Networks in Multi-center Intensive Care Unit dataset

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Background and Aims:

Invasive blood sampling to measure arterial oxygen saturation (SaO₂) is required to identify patients with occult hypoxemia. The aim of this study is to develop Deep Neural Networks (DNN) to detect patients with occult hypoxemia without arterial oxygen saturation (SaO₂) measurement among patients admitted to intensive care units across the United States.

Methods:

We developed a DNN algorithm to detect patients with occult hypoxemia using a multi-center intensive care unit database (eCIU dataset) at 208 hospitals located throughout the U.S. A total of 200,859 patient unit encounters of 139,367 unique patients admitted between 2014 and 2015 were included in this study. We defined occult hypoxemia if an arterial oxygen saturation (SaO₂) was <88% despite an oxygen saturation of >92% on pulse oximetry (SpO₂) (Fig 1). The purpose of our DNN algorithm is to detect patients with occult hypoxemia in the absence of SaO₂ reading. The aim of the DNN was to assign a binary class for occult hypoxemia (False vs True). The input of the DNN was composed of periodic features (values of SpO₂, arterial blood pressure, mean arterial pressure, and heart rate) and static features (age, gender, self-reported ethnicity, and body mass index). The output of the DNN was the probability of occult hypoxemia. The configuration of the DNN was composed of sequential three layers of 64x64x1 weights with dropout ratio of 0.5, and loss function of binary entropy. The performance of the DNN was evaluated by mean and 95% confidence intervals (CI) of the Area Under the Receiver Operating characteristic Curve (AUROC). The overall scheme is depicted in Fig 2.

Results:

We included 13,063 patient unit encounters and identified 225 cases of occult hypoxemia. In each unit encounter, we selected the first measurement of SaO₂ and then selected periodic features in the closest time with selected SaO₂. The timing difference of measurement between SaO₂ and periodic features was within 5 minutes in 91% of observations. Dataset was split into (1) training and validation set (n=9144) and (2) test set (n=3919). The DNN was trained only on training and validation set. The performance of The DNN was evaluated on the test set. The DNN achieved AUROC of 0.81 (95% CI 0.75-0.87) in detecting patients with occult hypoxemia (Fig 2).

Conclusions:

The DNN achieved fair performance of AUROC in detecting patients with occult hypoxemia without measuring arterial oxygen saturation in intensive care unit. Our approach may be considered as a screening algorithm for detecting patients with a high probability of occult hypoxemia without invasive blood sampling.

Figure and Tables:

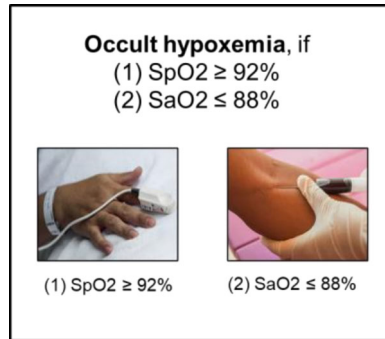


Fig. 1 Definition of occult hypoxemia

		all	normal	occult hypoxemia
n		13361	13130	231
SaO ₂ , mean (SD)		97.1 (3.0)	97.3 (2.5)	84.4 (4.2)
SpO ₂ , mean (SD)		98.4 (2.1)	98.5 (2.1)	95.2 (2.8)
gender, n (%)	Female	5031 (37.7)	4941 (37.6)	90 (39.0)
	Male	8330 (62.3)	8189 (62.4)	141 (61.0)
age_group, n (%)	<50	1693 (12.7)	1656 (12.6)	37 (16.0)
	50<=&<60	2419 (18.1)	2362 (18.0)	57 (24.7)
	60<=&<70	3587 (26.8)	3527 (26.9)	60 (26.0)
	70<=&<80	3523 (26.4)	3473 (26.5)	50 (21.6)
	80<=	2139 (16.0)	2112 (16.1)	27 (11.7)
ethnicity, n (%)	African American	1148 (8.6)	1123 (8.6)	25 (10.8)
	Asian	241 (1.8)	240 (1.8)	1 (0.4)
	Caucasian	10614 (79.4)	10430 (79.4)	184 (79.7)
	Hispanic	489 (3.7)	476 (3.6)	13 (5.6)
	Native American	98 (0.7)	97 (0.7)	1 (0.4)
	Other/Unknown	771 (5.8)	764 (5.8)	7 (3.0)
BMI, mean (SD)		29.2 (6.5)	29.2 (6.5)	30.3 (7.6)

Table 1 Baseline characteristics All patient's SpO₂ ≥ 92%

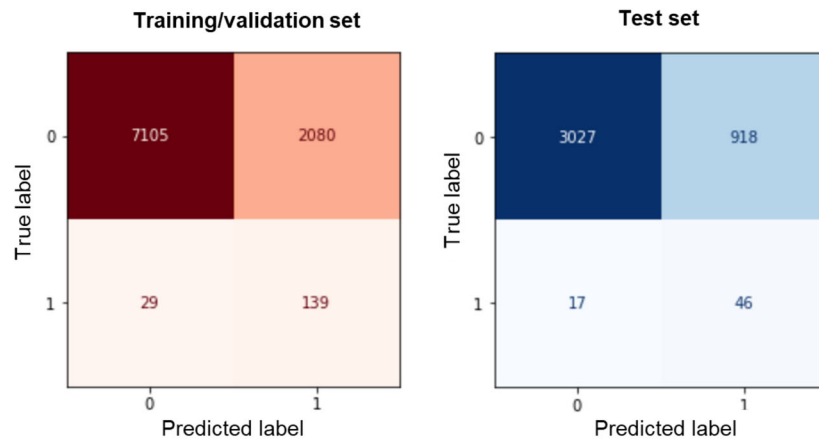


Fig 2 Confusion matrices Label 1 indicates Occult hypoxemia. Our algorithm detects 82% of occult hypoxemia (139 out of 168) in training/validation set (n=9353) and 73% of occult hypoxemia (46 out of 63) in test set (n=4008).

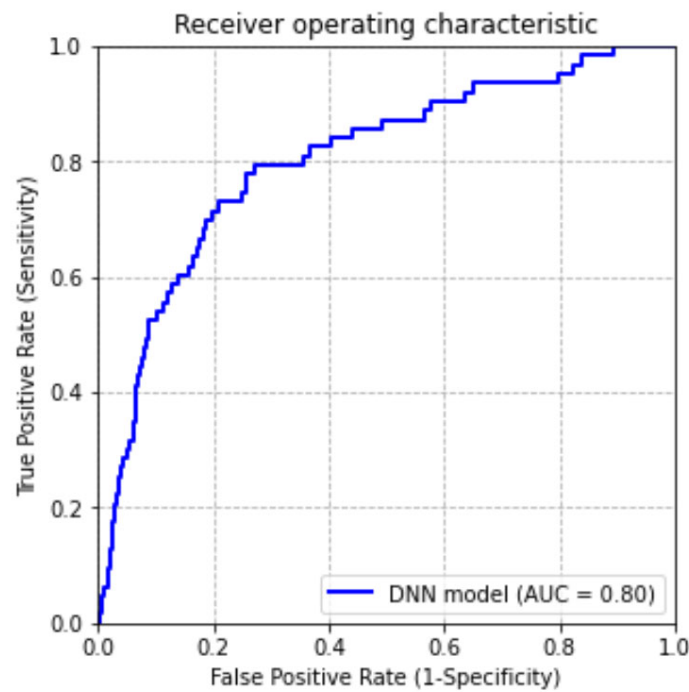


Fig. 3 Area Under the Receiver Operating characteristic Curve Predicting Normal (False) vs occult hypoxemia (True) in patient with $SpO_2 \geq 88\%$

Acknowledgements:

This research is supported by NIH research funding (R01HL144692; Machine Learning of Physiological Waveforms and Electronic Health Record Data to Predict, Diagnose, and Treat Hemodynamic Instability in Surgical Patients) and by UCLA Anesthesiology & Perioperative Medicine Seed grant (441006-2X-75014; Application of Deep Learning for real-time non-invasive continuous monitoring for enhanced peripheral oxygen saturation)

Resection of a Wilm's Tumor in an Atypical Patient

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Background

Wilm's tumor is the fourth most common pediatric cancer overall and is the most encountered solid abdominal malignancy in children (1). Each year, about 500 – 600 Wilm's tumors are diagnosed in the United States (2). Classically, the tumor presents between ages 3-4, and is more common in girls and patients of African American or East-Asian descent (1,2). While no exact cause has been elucidated, about 1/3 of patients possess genetic alterations which can be associated with syndromic conditions (3). Treatment options include surgery, chemotherapy, radiation, or a combination based on presenting factors. Survival rates after treatment depend on staging and tumor histology and range from 30-100% at 4 years (2).

Case Description

6-year-old white male with reactive airway disease presenting with a 2-month history of unexplained hematuria. MRI showed a heterogeneously enhancing 8 x 8 x 11 cm right renal soft tissue mass with retroperitoneal lymph node enlargement and severe compression of the IVC and ureter causing hydronephrosis. He underwent abdominal mass excision, right total nephrectomy, retroperitoneal dissection, and portacath insertion. Anxiolytic premedication was provided prior to careful induction of inhaled sevoflurane and propofol. A post-intubation radial arterial line was placed under ultrasonic guidance in addition to a large bore secondary IV. Anesthesia was maintained with a combination of propofol and volatile anesthetic. Estimated blood loss was less than 100 mL which did not require transfusion. Excellent post-operative analgesia was achieved with a T 10-11 thoracic epidural infusion of 0.125% bupivacaine with 0.5 mcg/mL clonidine infusing at 6mL/hr.

Discussion

The most pertinent factor in this case was tumor compression of the IVC for which we elected to place IV access in the upper extremities, an arterial line, and crossmatch blood products. Fortunately, we did not encounter major bleeding or significant hemodynamic instability which allowed us to place an epidural post-operatively for analgesia. Aside from reactive airway disease, our patient was without comorbidities. Communication with him and his family was straightforward, as was airway placement. However, these aspects may not always be uncomplicated, especially for patients with accompanying genetic syndromes like Beckwith-Wiedemann or WAGR. Histology was overall favorable and surgical pathology showed clean margins with no evidence of lymph node metastasis. Currently he is scheduled to undergo EE4A therapy with Dactinomycin and Vincristine every 4 weeks. Overall, this presentation differs from the classic Wilm's tumor patients given his age > 6, male sex, white ethnicity, lack of family malignancy history, and completely normal phenotype. Regardless of presentation, anesthetic considerations for resection of a Wilm's tumor should focus on the patient's comorbid conditions, surgical plan for resection, and ensuring adequate postoperative analgesia.

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Submitter: Taylor Kinsey

Novel regional anesthetic techniques have been adapted to target upper abdominal incisional pain, as the commonly performed transversus abdominis plane (TAP) and quadratus lumborum (QL) blocks do not reliably extend analgesia above the umbilicus. Both the subcostal TAP and rectus sheath blocks provide analgesia to the upper abdominal midline, but anterolateral incisions present an issue. The external oblique intercostal (EOI) plane block presents a potential solution to obtaining upper midline and lateral abdominal wall analgesia through targeting of both the anterior and lateral cutaneous branches of the T6-T10 intercostal nerves. We present a successful case of analgesia achieved for a Mercedes-type incision in a young female patient after reopening of her prior liver transplant incision for biliary revision. An initial block was performed intraoperatively, pre-emergence, providing analgesia until POD1, at which time the patient requested re-block due to difficult to control pain. A second block provided an additional ten hours of analgesia, and superb patient satisfaction.

A New Intraoperative Neuromonitoring Program in Mbale, Uganda: A Pediatric Case Report

Tessa Klumpp, MD, Julio Montejano, MD, Colby Simmons, DO; University of Colorado

Background

The public health and medical communities have explicitly stated the goal of improving access to safe and cost-effective medical care in low-income and lower-middle-income countries (LMICs)¹. One area of opportunity is in the neurosurgical field. Although there is a wealth of evidence to support the use of intraoperative neuromonitoring (IONM) during pediatric and adult operations that may place sensitive neural structures at risk, such as during a tethered cord release, access to these services is very limited². The safest and most effective way to monitor the integrity of spinal cord and central nervous system (CNS) structures while maintaining general anesthesia is with IONM. Here we describe the first pediatric tethered cord release performed utilizing IONM at CURE Uganda, a pediatric neurosurgical center of excellence in Mbale, Uganda.

Case Description

At birth, the patient was found to have a nontender, cystic swelling over his lumbosacral region with normal skin overlying the lesion without focal deficits. At five days of age, he was diagnosed with a suspected lumbo-sacral lipomyelomeningocele which was further evaluated with MRI at 11 months of age and found to have an accompanying tethered cord. Despite these findings, surgical intervention was deferred until IONM was available to give this child the best chance at a normal life. At two years of age the patient was scheduled for an L4/5 laminectomy, lipoma resection, and cord release with IONM.

The patient was monitored intraoperatively with continuous upper and lower somatosensory evoked potentials, (SSEPs), intermittent motor evoked potentials (MEPs), spontaneous electromyography (EMG), and triggered EMG. Intraoperative neuromonitoring tests were notable for unchanged MEPs and upper extremity SSEPs, however the amplitude of lower extremity SSEPs was variable throughout surgery. Triggered EMG activity was seen on monitored muscles during appropriate stimulation. The surgical time was 6 hours, notable for a significant CSF leak requiring a dural patch repair, and an estimated blood loss of 150 cc ultimately requiring a blood transfusion of 10cc/kg of packaged red blood cells. Post-operatively the patient had intact motor function and was discharged on post-operative day five.

Discussion

Over the past two decades, intraoperative neurosurgical teams in high income countries have recognized the increasingly vital role of IONM. Neurosurgical procedures manipulating at-risk spinal cord and CNS structures without continuous monitoring may result in rare, unrecognized, preventable neurological damage. Other forms of monitoring, such as intraoperative wake-up tests, may not be feasible and even dangerous in pediatric patients³. The potential economic costs lower middle-income countries may experience without IONM could be incalculable, given they carry a disproportionately large burden of neurosurgical need compounded with the morbidity associated with potential intraoperative neurological damage, especially when considering pediatric patients. This health access disparity may limit nations, such as Uganda, in achieving their economic growth and development goals^{4,5}. We hope that our established collaborative IONM program at CURE Uganda will remain efficacious in furthering their goal of providing safe and quality care to their patients.

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Title:

Anesthesia for Esophageal Dilation in a Patient with Recessive Dystrophic Epidermolysis Bullosa

Author(s)/Institution(s):

David Kneiber¹, MD; Jimmy Ly, MD¹; Tigran Sukiasyan¹, MD

¹University of Southern California, Department of Anesthesiology

Background:

Recessive Dystrophic Epidermolysis Bullosa (RDEB) is a rare, inherited disorder that results in the formation of blisters and erosions on the skin and mucous membranes due to even minor traumas or shearing forces. RDEB is a debilitating condition that often necessitates frequent surgical interventions. Herein we describe the management of an adult patient with RDEB who underwent esophagogastroduodenoscopy with dilation under general anesthesia. The purpose of this report is to discuss the unique challenges posed by RDEB in the perioperative period and highlight the peculiarities of anesthetic care for these patients.

Case Description:

A 23-year-old female with recessive dystrophic epidermolysis bullosa was scheduled for dilation of an esophageal stricture caused by her RDEB. The patient's medical history was notable for anemia, gastrostomy tube placement, prior esophageal dilations, and frequent wound infections. To minimize the risk of intraoperative airway manipulation which could lead to skin breakdown or exacerbate pharyngolaryngeal scarring, General Endotracheal Anesthesia was administered using an awake fiberoptic intubation technique and a microlaryngeal tube. This method was preferred over Monitored Anesthesia Care to avoid jaw thrusts, mask ventilation, and possible difficult intubation related to prior scarring.

The patient in this case had survived to adulthood and was highly knowledgeable about her condition. She actively participated in her own care, especially with regards to monitor placement, IV access, and positioning for the procedure. Despite a longer than expected intraoperative course, the proximal esophageal stricture was successfully dilated. The patient tolerated the procedure well, was discharged the same day, and fortunately there were no complications related to the patient's RDEB.

Discussion:

Caring for a patient with Recessive Dystrophic Epidermolysis Bullosa in the perioperative period presents unique challenges, such as skin breakdown, bleeding, and potential difficult intubation due to pharyngolaryngeal scarring. The involvement of pediatric anesthesiologists, who may have greater experience in treating patients with RDEB, should be considered when such patients are treated in adult hospitals. The input and cooperation of adult patients, who have a high level of understanding about their condition, should be valued and incorporated into perioperative care.

Title

Perioperative Management of a Redo Bioprosthetic Mitral Valve Replacement Due to an Unsuspected Iatrogenically Retained Tricentrix Valve Holder: A Cardiothoracic Anesthesia Case Report.

Authors/Institutions:

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Background

Valve repair and replacement are first line treatments for valvular heart disease which is increasingly prevalent. Many adverse events have been reported after valve replacement surgeries, but no reports thus far have described a major piece of equipment mistakenly retained in a replaced valve. This report reviews a case of a patient undergoing a redo mitral valve replacement (MVR) for what seemed to be early onset postoperative mitral stenosis but was found to be due to a retained valve holder, causing significant multiorgan sequelae.

Case Description

A 56-year-old male who had a past medical history of heart failure with reduced ejection fraction, atrial fibrillation, pulmonary hypertension, former intravenous drug use, and prior bioprosthetic MVR for mitral regurgitation presented for a redo MVR for mitral stenosis.

His symptoms persisted after surgery, and his postoperative course was complicated by onset of worsening heart failure as well as diagnosis of MSSA bacteremia. He subsequently suffered an occipital intracerebral hemorrhage. Echocardiography at that time showed a moderately reduced ejection fraction, moderate pulmonary hypertension with severe tricuspid regurgitation, and a stenotic bioprosthetic valve in the mitral position with the presence of concerning echodensities.

Three weeks after his stroke, he underwent general anesthesia for redo MVR and tricuspid ring annuloplasty. Intraoperative TEE was notable for the presence of a regular-appearing echodensity associated with the bioprosthetic mitral valve, initially thought to be severe commissural and leaflet calcification due to his endocarditis. Upon performance of cardiectomy and visualization of the valve in the operative field, it was found that the Tricentrix holder for the bioprosthetic valve had been retained, causing significant impairment of valvular function. The valve holder was removed from the valve which was found to have misshapen leaflets due to the long attachment to the holder. The valve was resected and replaced, and the remainder of the surgery proceeded in an uncomplicated manner. He was transferred to the ICU and discharged home two weeks later.

Discussion

This case serves to demonstrate the potential complications that may be associated with a frequently used medical device, as well as the need to maintain a broad differential in the setting of such sequelae. Stenosis of an implanted bioprosthetic valve is a known potential complication of said implantation, particularly in the setting of prosthetic valve endocarditis. This is typically the result of calcification of the valve resulting in restricted leaflet opening; however, in this particular case there was a highly unusual cause - the retention of a piece of equipment intended for removal. In hindsight, the “calcification” on initial TEE was unusually regular-appearing and symmetric. This case highlights the importance of careful echocardiographic interrogation as well as the need to maintain a broad differential for diagnostic etiologies, including sometimes uncommon causes.

Cognitive impairment negatively impacts orthopedic perioperative outcomes: Can an interprofessional care pathway that targets patients at highest risk reduce the outcome disparity?

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Introduction

Perioperative neurocognitive disorder (PNCD) is the most common postoperative complication affecting older adults. Cognitive impairment predicts those at increased risk of PNCD, complications, longer length of stay (LOS), and discharge to place other than home. Our perioperative brain health initiative has implemented routine preoperative cognitive screening to identify those at highest risk and an interprofessional perioperative care pathway to mitigate risk.

Method

We conducted a retrospective chart review of elective joint replacement patients age ≥ 65 between January 2020 to June 2022. Patients underwent cognitive screening before surgery. We noted postoperative LOS, complications, delirium events, place of discharge and readmissions among patients. Those with cognitive impairment were referred for a geriatric assessment and care pathway.

Results

This study included 185 patients with 22% incidence of preoperative cognitive impairment. Impaired patients had longer LOS (2.5 days vs 1.8 days, $p = 0.07$), increased complications (21.9% vs 9.7%, $p = 0.03$), increased delirium (22% vs 4.2%, $p = 0.05$), higher likelihood of not being discharged home (17.1% vs 2.1%, $p = 0.001$) and increased readmission (7.3% vs 0.7%, $p = 0.03$).

Conclusions

Preoperative cognitive impairment predicted worse perioperative outcomes after joint replacement. Implementing an interprofessional care pathway for those at high risk helped decrease the above events.

Anesthetic Management of a Patient with a Chronic Bronchopleural Fistula
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Introduction

Bronchopleural fistula (BPF) is a rare clinical presentation for anesthetic management. BPF can present acutely or chronically, both offering significant challenges in management of anesthesia. We present the anesthetic decision making and management of a patient with a chronic bronchopleural fistula.

Case Description

A 64-year-old male with a past medical history of chronic, left-sided bronchopleural fistula (BPF), nephrolithiasis, obesity (BMI 35), hypertension, type II diabetes mellitus, OSA not on CPAP, coronary artery disease status post coronary artery stent, presented for an elective ureteroscopy, laser lithotripsy, and ureteral stent placement for a 7mm kidney stone in the right kidney. The BPF originated from a penetrating wound approximately 24 years ago. The patient has had consistent follow up with a pulmonologist and has good exercise tolerance. Chest X-ray on the day of surgery showed small left pleural effusion and small left-sided, persistent pneumothorax, consistent with computed tomography completed three months prior. Historical referral to a thoracic surgeon recommended no surgical intervention. He has not had general anesthesia (GA) since his chest injury.

The original anesthetic plan was GA with a laryngeal mask airway, as this is the preference of the surgeons at our institution. Due to the BPF, we completed the procedure under a spinal anesthetic (SA) with sedation and spontaneous ventilation. Spinal anesthetic was placed at the L3-L4 spinal level with 2cc bupivacaine 0.75%-dextrose 8.25%. Sedation was initiated with propofol, ketamine, glycopyrrolate, and ephedrine. Sedation was maintained with a propofol infusion for the duration of the procedure with maintenance of spontaneous ventilation. The patient tolerated the procedure well and the postoperative course was uneventful.

Discussion

Significant risks can be associated with positive pressure ventilation in a patient with BPF including air-leaks, incomplete lung expansion, loss of effective tidal volume or positive end expiratory pressure, CO₂ retention, and tension pneumothorax^{1,2}. At our institution, lithotripsy for renal stones is usually done under GA due to surgeon preference. Several alternative anesthetic plans were considered prior to definitive management with SA and sedation, including GA with isolation of the left lung with a double lumen endotracheal tube (ETT), an ETT with a bronchial blocker, or intentionally placing an ETT into the right mainstem bronchus.

Anesthetic management of BPF centers on decreasing ventilatory support as much as possible³. Spinal anesthesia is an appropriate alternative choice for anesthetic management in medically complex patients for some urologic surgeries. SA is advantageous over GA for postoperative pain⁴, better postoperative outcomes⁵; with no difference or even shorter operative time, intraoperative complications, length of hospital stay⁵⁻⁷. SA can result in longer post-anesthesia care unit stay compared to GA, but this challenge can be modified by considering alternative, short-acting intrathecal agents such as chloroprocaine and prilocaine⁸. Spinal anesthesia with or without sedation can be more widely considered for ambulatory surgical procedures in medically complex patients⁸.

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ABSTRACT

Title: Patient Discharge Opioid Over- and Under-prescription after Otolaryngology, Head and Neck Surgery

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Introduction: There are no clear opioid prescribing guidelines at discharge for patients undergoing Otolaryngology, Head and Neck (OHN) surgery. Previous studies have shown that patients can be over-prescribed opioids at discharge, with many tablets left unused at home^{1,2,3}.

Objective: To determine the discrepancy between discharge opioid prescription and inpatient opioid usage

Methods: Retrospective, observational cohort study at an academic tertiary medical center 2012-2019. All opioid-naïve patients ≥18 years-old who underwent OHN surgery with post-operative stays greater than 24 hours were included in the study. Exclusion criteria included patients that received peripheral nerve blocks, were transferred out to other hospitals, and were discharged to hospice or acute rehab facilities.

Main outcome measures: The primary outcome was the discrepancy between individual patients' prescribed daily oral morphine milligram equivalent (MME) at discharge and the same patient's inpatient daily MME 24 hours before discharge. Chi-square, Mann-Whitney, Wilcoxon and Kruskal-Wallis tests and multivariable logistic regression analyses were applied.

Results: 1,075 patients were included in the analysis. 64.3% of patients were opioid over-prescribed (the daily opioid prescription was at least 5 MME more than inpatient daily opioid consumption) in comparison to 19.2% of patients that were opioid under-prescribed (daily dose at least 5 MME less than inpatient consumption) at discharge. Of the opioid over-prescribed patients, the median [IQR] daily prescribed opioid dose at discharge (60.0 [40.0 to 90.0] MME) was 400% of the median inpatient daily opioid consumption 24 hours before discharge (15.0 [0.0 to 37.5] MME; $p < 0.0001$). In opioid under-prescribed patients, the median [IQR] of the daily prescribed opioid dose at discharge (30.0 [10.0 to 45.0] MME) was 48% of the median inpatient daily opioid consumption before discharge (62.5 [44.5 to 90.0] MME; $p < 0.0001$).

The rates of opioid under-prescription increased dose-dependently with inpatient daily MME; 65.3% of patients who had high inpatient daily opioid requirements > 90 MME were opioid under-prescribed. Among patients of opioid under-prescription, 24.8% needed inpatient opioid the day before discharge but were discharged without any opioid prescription.

The rate of opioid refill within 30 days after discharge in opioid under-prescribed patients was 30.3%, or 45.7% higher than the 20.8% rate of refill in patients without opioid under-prescription ($p < 0.001$).

Multivariable logistic regression analysis revealed that increased risk of opioid over-prescription was associated with the time length in the operating room (adjusted odds ratio aOR [95% CI] of 1.001 [1.001-1.002]) and male sex (aOR [95% CI] 1.373 [1.091-1.729]).

Conclusions: Substantial mismatch exists between inpatient opioid requirements and opioid prescription at discharge for patients undergoing OHN surgeries at this single medical center. Opioid

under-prescription was linked with greater prescription refills, and more attention is needed to determine the risk factors for opioid prescription mismatch.

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Title:

Tunneled Fascia Iliaca Catheter Placement for Chronic Pain from Advanced Lower Extremity Osteosarcoma

Authors/Institution:

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Background:

The fascia iliaca compartment block (FICB) is a regional anesthetic technique for hip and femoral surgery that blocks the femoral, obturator, and lateral femoral cutaneous nerves. The FICB was first described by Dalens et al. in 1989 with a high degree of sensory blockade of the lumbar plexus nerves supplying the thigh. The FICB has been well described as an anesthetic technique in case reports for hip and femoral surgeries. However, the use of the FICB as a primary anesthetic technique for the control of chronic lower extremity cancer pain has been poorly described in current literature.

Case Description:

A middle-aged female patient with a past medical history of end stage renal disease on hemodialysis presented with advanced osteosarcoma of the left proximal femur. Acute pain service was consulted for excruciating left lower extremity pain refractory to near maximal opioid medication regimen as prescribed by palliative care service. Her pain was described as constant, sharp, stabbing, radiating down the left lower extremity, worsened with movement and relieved with rest. Pain scores immediately prior to consult ranged from zero to ten at maximum, with an average of approximately seven. A regional nerve block was planned for her unremitting left lower extremity pain. However, a traditional femoral nerve block was unable to be performed due to significant tissue compression from the large size of the tumor (8.5 cm in maximal diameter). As an alternative nerve block, a single shot FICB was performed with 20 mL of 0.5% ropivacaine mixed with 4 mg of dexamethasone without complications. Following this block, the patient reported significant pain relief and did not require PRN opioids for nearly 40 hours postoperatively. Due to the success of this prognostic block, a tunneled FICB catheter was placed under sterile conditions in the operating room under monitored anesthesia care, with a catheter maintenance goal duration of three weeks. The nerve block was maintained with an On-Q pump infusing 0.25% bupivacaine at a rate of 8 mL per hour. Following this tunneled catheter placement, the patient reported near total pain relief with no opioid PRN medications required for over four days, when her On-Q pump ball required replacement.

Discussion:

This case demonstrates two unique situations in the treatment of chronic extremity pain caused by an advanced orthopedic tumor: 1) Difficult anatomy secondary to a compressive tumor precluding traditional peripheral nerve blocks such as the femoral nerve block. 2) Use of a tunneled FICB catheter placed under sterile conditions for long term pain relief. Our case demonstrates that with strict aseptic technique and placement in a sterile operating room environment, a peripheral nerve block catheter may be maintained for more than 48 hours without a greater risk of infection.

Title: The association between hypotension and the risk of occult hypoxemia in the intensive care setting in the United States

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Background and Aims:

There have been limited number of previous studies reporting the risk of inaccuracy of pulse oximetry depending on the level of hypotension based on large multi-center data, although the evidence for reduced accuracy of pulse oximetry in patients with severe hypotension has been reported. We investigated the association between hypotension and risk of occult hypoxemia among patients admitted to intensive care unit across the United States.

Methods:

We evaluated the association between hypotension and occult hypoxemia by analysis of a multi-center intensive care unit database, the eICU Collaborative Research Database, at 208 hospitals located throughout the U.S. A total of 200,859 patient unit encounters for 139,367 unique patients admitted between 2014 and 2015 were included in this study. We defined occult hypoxemia as an arterial oxygen saturation (SaO₂) <88% despite an oxygen saturation >92% on pulse oximetry (SpO₂). Occult hypoxemia was used as a primary outcome to represent inaccuracy of pulse oximetry. We used mean arterial pressure (MAP) based on invasive blood pressure measurement. We used univariable and multivariable-adjusted Logistic regression models to measure odds ratios (ORs) for occult hypoxemia and 95% confidence intervals (CI) adjusting for age, sex, race, body mass index, and heart rate.

Results:

We included 14,229 patient unit encounters which have SaO₂, SpO₂, and invasive blood pressure values. In each unit encounter, we selected the first measurement of SaO₂ and then selected SpO₂ which was measured in the closest time with selected SaO₂ to calculate occult hypoxemia. Timing difference of measurement between SaO₂ and SpO₂ was within 5 minutes in 91% of observations. MAP was measured with SpO₂ at the same time. In univariable model, compared to MAP 70 to 90 mmHg, the univariable ORs for occult hypoxemia were 1.95 (95% CI 1.34-2.84) for MAP <60 mmHg, 1.52 (95% CI 1.11-2.08) for MAP 60 to 70 mmHg, 1.15 (95% CI 0.82-1.61) for MAP >90 mmHg. After adjusting for potential confounders, ORs appeared to be minimally changed. Compared to MAP 70 to 90 mmHg, the multivariable-adjusted ORs for occult hypoxemia were 1.98 (95% CI 1.35-2.89) for MAP <60 mmHg, 1.54 (95% CI 1.13-2.13) for MAP 60 to 70 mmHg, 1.08 (95% CI 0.77-1.53) for MAP >90 mmHg.

Conclusions:

Compared to MAP 70 to 90 mmHg, hypotension of MAP <60 mmHg was associated with 98% increased odds of occult hypoxemia, and hypotension of MAP 60 to 70 mmHg was associated with 54% increased odds of occult hypoxemia. Our finding suggests oxygen saturation on pulse oximetry should be used with caution among patients with severe hypotension.

Title: The hidden headache: Intracranial subdural hematoma due to accidental dural puncture following neuraxial anesthesia in a parturient with preeclampsia

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
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Background:

Neuraxial anesthesia is commonly employed in obstetrical patients for labor analgesia and is broadly categorized into spinal, epidural, and spinal-epidural anesthesia. Accidental dural puncture (ADP) is a known complication of neuraxial anesthesia and can lead to post-dural puncture headache (PDPH) (Sprigge 2007). PDPH shares symptoms with intracranial subdural hematoma (SDH), a life-threatening complication. We describe a case of intracranial SDH as a complication of ADP in a parturient with postpartum preeclampsia.

Case description:

A 27-year-old G1P0 female with gestational hypertension was admitted to labor & delivery for active labor and requested epidural anesthesia for pain control. Two attempts at epidural placement were made; there was suspicion of an ADP noted after the first attempt, followed by a second successful attempt. The patient continued to labor and had a successful nonspontaneous vaginal delivery one day after epidural anesthesia. Five days postpartum, the patient was admitted for evaluation of a persistent bilateral frontal headache. She reported a positional headache that worsened when sitting upright and improved in the supine position, symptoms consistent with PDPH. She denied any significant neurological symptoms and was also found to be hypertensive. It was determined that she was experiencing postpartum onset preeclampsia in addition to a PDPH; she was started on intravenous magnesium sulfate and elected to undergo an epidural blood patch (EBP). The patient reported symptomatic relief following administration of 15ml of autologous blood. She was discharged home two days later following treatment for preeclampsia.

Nine days after placement of the epidural catheter and 48-hours after her most recent discharge, the patient returned with new onset diplopia and gait instability. A CT head showed no acute changes, but given the index of suspicion for neurological pathology, an MRI brain was ordered. MRI revealed a trace SDH; the patient was started on labetalol, nicardipine, and levetiracetam infusions. Over the course of three days, the patient reported an improvement in headache and was discharged successfully. She had a full recovery without any lasting neurological cits.

Discussion:

SDH following ADP in neuraxial anesthesia administration is a rare complication. The presentation of SDH can overlap with PDPH in symptoms; therefore, this complication may go unrecognized as well as underreported. In the postpartum period, preeclampsia is another common culprit of headaches and may further delay diagnostics. Parturients may be at elevated

risk for SDH given physiologic changes in pregnancy including increased dural elasticity. Diagnostic algorithms for the workup of postpartum headache have been proposed (Cuypers 2016) and may aid clinicians in clinical decision making.

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Anesthetic Considerations for a Patient with Moebius Syndrome

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Background: Moebius syndrome is a rare disease characterized by either unilateral or bilateral facial palsy involving cranial nerves VI and VII. Other main features of the syndrome include anomalies in the upper and lower extremities, facial structures, and thorax.

Case description: We report on a 39-year-old female with Moebius syndrome who presented for MRI due to agitation, deemed an American Society of Anesthesiologists classification III. The patient had a history of severe developmental delay, aphasia, and visual disturbance, all of which have been attributed to the syndrome. She had received general anesthesia in the past for gastrostomy tube placement. On physical exam, the patient also appeared to have syndromic facies with observed hypersalivation. A comprehensive airway examination was unable to be completed due to her inability to follow commands. Special attention was paid to patient's ventilation and aspiration risk due to her facial anomalies and unknown oropharynx structure. The 1-hour MRI brain scan proceeded uneventfully, and the patient was later transferred to the post-anesthesia care unit and discharged home shortly after.

Discussion: Patients with Moebius syndrome have a wide range of anatomic and functional deformities that create unique anesthetic challenges that affect each perioperative stage. Skeletal deformities are common and may create challenges in patient positioning. Patients may also benefit from a cardiology work-up due to a higher incidence of reported congenital heart diseases. Orofacial deformities may create challenges in mask ventilation and intubation, potentially calling for alternatives to standard direct laryngoscopy. There is a higher risk of aspiration due to the orofacial anomalies, cranial nerve deficits, and hypotonia, and patients may benefit from prophylactic medications. A number of these patients may also be taking anticonvulsant medications, which may decrease the efficacy of non-depolarizing neuromuscular blockers (NDNMB) administered intraoperatively; thus, special consideration should be made towards its dosage, and providers are recommended to consider the risk of NDNMBs further depressing the patient's poor respiratory function. Hypoplasia of respiratory centers in the pons and medulla calls for extra monitoring of hypoventilation upon extubation. Due to the many anatomic deformities and functional changes possible in patients with Moebius syndrome, we need to

consider potential anesthetic challenges and implement prophylactic measures in all perioperative stages.

Title: Tranexamic Acid Disuse in a Marfan Syndrome Patient with a Mechanical Aortic Valve Receiving Scoliosis Repair

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Background:

Marfan Syndrome (MFS) is a connective tissue disorder with the primary gene defect located on the fibrillin-1 gene (FBN1) of chromosome 15q21.1. Clinical features of MFS include exaggerated long bone growth associated with scoliosis, increased joint laxity, ectopia lentis, and cardiovascular disease. Importantly, cardiovascular disease is the primary determinant of lifespan in MFS patients, with aortic aneurysm and dissection being life-threatening conditions.

Tranexamic Acid (TXA), a synthetic lysine-analogue antifibrinolytic that competitively inhibits the activation of plasminogen to plasmin, is used to minimize perioperative bleeding and transfusion requirements. However, due to the risk of thromboembolism in this patient, TXA was omitted after considering risks and benefits.

Case Description:

A 37-year-old female with a history of MFS with mechanical aortic valve and kyphoscoliosis presented for elective scoliosis repair. Lovenox and warfarin were discontinued appropriately prior to surgery. Preoperative laboratory tests revealed hemoglobin of 9.7, hematocrit of 30.2, MCV of 73, and RDW of 20.1.

An ASA score of 3 and Mallampati score of 2 were assigned. Given the large volume of blood loss anticipated in the absence of TXA, blood products were prepared. General anesthesia was induced with 100 mg of propofol, 20 mg of methadone, 100 mg of lidocaine, 10 mg of rocuronium, and 65 mg of succinylcholine. Oral tracheal intubation was performed successfully. Intraoperatively, anesthesia was maintained with propofol, ketamine, dexmedetomidine and sevoflurane. Seven units of packed red blood cells, six units of fresh frozen plasma and one unit of platelet were used. Additionally, five liters of crystalloid fluids and one liter of 5% albumin were used, with an estimated blood loss of 3L and urine output of 850 mL.

Patient was discharged on postoperative day 8 after complications of left pneumothorax and difficult pain management. There were no indications of thromboembolic events and lovenox was restarted and bridged to home warfarin following hemoglobin trends.

Discussion:

Given the risk of cardiac complications that predispose to bleeding in MFS patients, TXA can be beneficial. TXA has been shown to reduce perioperative bleeding and transfusion requirements in both cardiac and non-cardiac surgeries. Furthermore, a study showed an association between TXA use and reduced blood loss during surgical treatment of MFS-associated scoliosis. However, TXA in a MFS patient with a mechanical valve poses risks.

Patients with mechanical prostheses are at risk for prosthetic valve thrombosis (PVT), among other thromboembolic episodes. PVT is a serious condition with an associated 10% mortality rate. In hospitalized MFS patients specifically, there is an increased prevalence of stroke and cerebral aneurysms. TXA has been associated with postoperative stroke in patients undergoing cardiac surgery. While patients with MFS may show benefit with TXA, in situations in which cerebrovascular risk is high and sufficient blood products are available, the risks of TXA use may outweigh the benefits.

Title:

Anesthetic Considerations of Patient with Pulmonary Angiosarcoma, Severe Pulmonary Hypertension, and Pneumonectomy Undergoing Elective Orthopedic Surgery

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Background:

Pulmonary artery intimal sarcoma (PAIS) is a rare disease with prevalence being 0.001% to 0.03%¹. The mainstay of treatment is surgery^{1,2}. Overall, the prognosis is poor, as median survival time varies from months-years^{2,3,4}.

Anesthetic considerations of thoracic masses center around airway management. Loss of spontaneous ventilation, chest wall tone, and normal transpleural pressure gradient during general anesthesia reduces support of a narrowed airway and can lead to acute respiratory compromise⁵.

In our case, we discuss a 55-year-old female with left PAIS and multiple pulmonary and oncologic complications, presenting with a debilitating femur fracture that needed open reduction internal fixation (ORIF).

Case Description:

Her original presentation was cough and dyspnea. Imaging revealed right upper lobe (RUL) and left pulmonary artery (PA) masses. She had the RUL mass irradiated and PA mass excised, which turned out to be high-grade sarcoma. She eventually underwent left pneumonectomy. She later developed right lung metastasis with formation of a 7.7cm x 7.6cm apical mass.

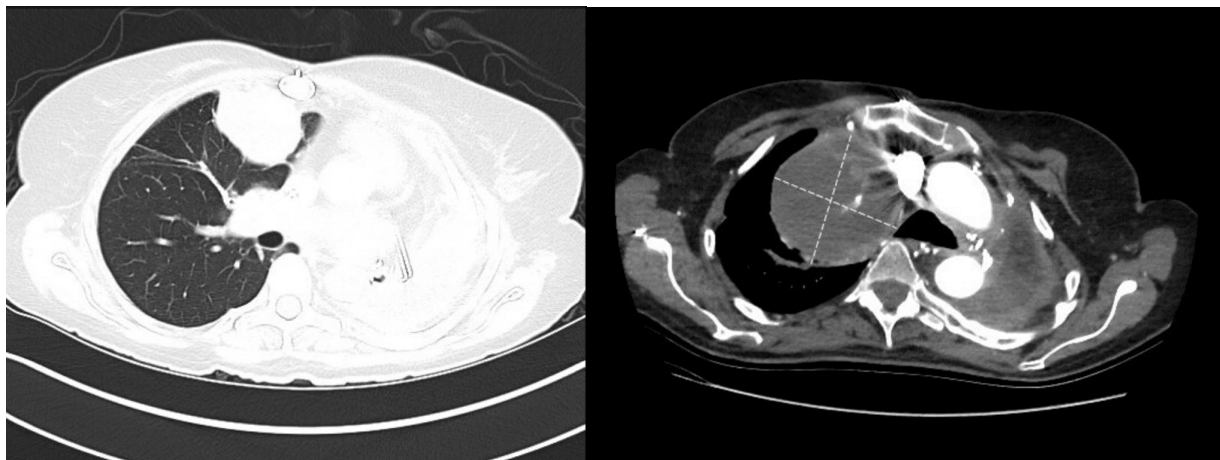


Figure 1. Images of chest CT demonstrating the right apical lung mass abutting the trachea.

She developed severe, debilitating left hip pain and had a nondisplaced femoral neck fracture. She was insistent on intervention to improve her quality of life (QOL). The orthopedic surgeon recommended prophylactic fixation to prevent displacement.

During a telephone consult with the Anesthesia Preoperative Evaluation Clinic, the patient reported productive cough and limited exercise tolerance and denied difficulty breathing while supine. Her INR was elevated to 1.8, and she was on rivaroxaban for PT gene mutation, so neuraxial was contraindicated. After extensive discussion of the anesthesia risks with the patient, a multidisciplinary discussion between the surgeon, anesthesiologist, and oncologist led to the decision to proceed with surgery due to a limited appropriateness of surgical timing and QOL.

Preoperative vitals were within normal limits, and oxygen saturation was 100% on room air. She underwent a left fascia iliaca block. She was induced with 1.5mg of midazolam, 50mcg of fentanyl, and a propofol infusion at 150 mcg/kg/min. A left radial arterial line was placed for continuous cardiac monitoring. Her airway was managed with a supraglottic airway (SGA). She was maintained on pressure support during the case, with oxygen saturation 98-100%. She had her SGA removed uneventfully and was transported to the recovery room in stable condition.

Discussion:

The patient's complex pulmonary and oncology history placed her at high risk of complications with general anesthesia or deep sedation. With compression of her right mainstem, there was concern for airway collapse with any sedation. As discussed above, neuraxial anesthesia was contraindicated. Awake fiberoptic intubation was considered, though not without risk of pulmonary complications and postoperative ventilation. Ultimately, the patient underwent general anesthesia with an SGA and continued spontaneous ventilation and an uncomplicated surgery.

This medically challenging case demonstrates the importance of preoperative evaluation in patients with complex pathologies and anatomy. In this case, a multidisciplinary discussion allowed the team to devise the safest plan and have contingency plans for any perioperative complications.

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Pain and Disability after an Uneventful Achilles Tendon Repair: Double Crush Syndrome?

Authors: Man Kuan Lei, MD, Dillon Sooknanan, MD, Mark Schumacher, MD, PhD / UCSF

Background:

A 37-year-old man presented with disabling lower extremity pain and weakness after an Achilles Tendon repair. Initial imaging and surgical exploration failed to explain his symptoms. Further investigation eventually revealed lumbar stenosis. The concomitant findings were concerning for double crush syndrome (DCS).

Case Description:

After an uneventful Achilles Tendon repair, a 37-year-old patient developed severe pain that had led to escalating analgesic requirements, inability to bear weight, and anxiety of long-term disability. On POD4, he demonstrated numbness, coolness, and decreased strength in his lateral lower extremity which he described as “distant, cold, and electric shocks”, most significant in his ankle, toes, and sole. MRI showed tarsal tunnel edema and a suture near the posterior tibial nerve. However, surgical exploration did not reveal any nerve involvement.

Given the hyperalgesia, temperature asymmetry, edema, and weakness, there were concerns for early CRPS. Therefore, in addition to his multimodal pain regimen, duloxetine and ketamine were initiated for neuropathic pain. Due to confusion, ketamine was discontinued. Levorphanol was started given its NMDA antagonism, oral availability, and potential to decrease other opioid requirements.

Meanwhile, MR neurogram again only showed tarsal tunnel edema. As the team continued to search for additional etiologies, MR spine eventually revealed disc bulge causing right foraminal narrowing contacting the L5 nerve root which, along with the previous findings, indicated DCS. Around POD10, his pain started to subside. Upon discharge, his oxycodone requirement was minimal. Due to outpatient unavailability, levorphanol was switched to methadone. He was referred to PT and neurosurgery for further rehabilitation and evaluation.

Discussion:

DCS was first described in 1973. The theory postulated that a proximal nerve lesion predisposes that nerve to a second lesion distally. DCS was investigated mostly in the upper extremity. While cases involving the lumbar spine and lower extremity had been reported, these patients had chronic symptoms [a, b].

The disabling symptoms in an otherwise healthy patient were concerning. Foot paresthesia and neuralgia were consistent with nerve irritation from post-surgical edema in the tarsal tunnel. However, given the acuity, weakness should not be expected. Furthermore, imaging only showed mild edema, which was inconsistent with the severity.

A careful examination was essential in identifying a problem that was not only isolated around the surgical site, especially when symptoms were also present in his leg. Further studies were needed to search for additional etiology. The finding of L5 stenosis was consistent with the distribution in the lateral lower extremity. The diagnosis was challenging as he never had any signs of lumbar radiculopathy. The non-focal symptoms were likely caused by coexisting lesions that had acted synergistically on each characteristic symptom.

This case illustrated the vigilance of our multidisciplinary team and the prompt initiation of multimodal pain management involving neuromodulating agents.

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The Impact of Chronic THC Exposure on Propofol Sensitivity in Pregnant Rhesus Macaques Undergoing Magnetic Resonance Imaging: A Prospective Interventional Controlled Pilot Study

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Disclosures: None.

Introduction. The prevalence of cannabis use in United States adult surgical patients has increased; an estimated 17.9% of Americans used cannabis last year.¹ Studies suggest an association between cannabis use and anesthetic requirement,^{2,3} but this relationship remains poorly understood. Human clinical studies have been unable to control for mode of cannabis delivery, composition, and frequency of use, and preclinical rodent models lack the complexity of the human neurologic system. Accordingly, we conducted a study in a translational nonhuman primate (NHP) model to investigate the effect of stable dose delta-9-tetrahydrocannabinol (THC, the main active component of cannabis) ingestion on propofol sensitivity. We hypothesized that propofol MAC-BAR would be higher in THC exposed NHPs compared to naïve control.

Methods. This study was nested within a larger prospective cohort study to determine the impact of chronic THC use on reproductive health in female NHPs. Female Rhesus macaques were divided into a naïve control (n=7) and THC-exposed group (2.5mg/7kg/day edible THC; n=4). General anesthesia was induced with intramuscular ketamine (10 mg/kg) and maintained with isoflurane 0.4 vol% and propofol infusion to facilitate magnetic resonance imaging at gestational day 110 (G110) and G155 (term is ~168 days, Figure 1). Propofol was titrated to maintain heart rate (HR) and blood pressure (BP) within 10% of baseline during a 5 second hemostat pinch between thumb and index finger. If HR or BP increased > 10% despite 3 dose adjustments, rescue occurred with isoflurane 1-2 vol%. Final propofol dose was considered representative of MAC-BAR. Propofol MAC-BAR was summarized as median, minimum-maximum values. We tested for treatment differences of continuous characteristics using the Mann-Whitney test and categorical characteristics using Fisher’s exact test. Hypothesis testing was two-sided, p-value < 0.05 was considered statistically significant.

Results. Propofol MAC-BAR did not differ at G110 [THC-exposed (330, 230-430 mcg/kg/min) vs. control (230, 230-280 mcg/kg/min); p=0.70] or G155 [THC-exposed (330, 280-380 mcg/kg/min) vs. control (280, 230-330 mcg/kg/min; p=0.30; Figure 1]. At G155, isoflurane rescue occurred in 67% (2/3) THC-exposed vs. 0% (0/6) control subjects, p=0.083. The incidence of isoflurane rescue did not differ between groups at G110.

Conclusions. In this pilot study, we observed a trend towards higher propofol MAC-BAR in THC-exposed NHPs. This study is limited by incomplete data collection. Subjects did not undergo toe pinch if general anesthesia was shorter than 60 minutes or if HR or BP increased >10% without a stimulus. Larger studies are needed to clarify the effect of chronic

THC exposure on propofol MAC-BAR.

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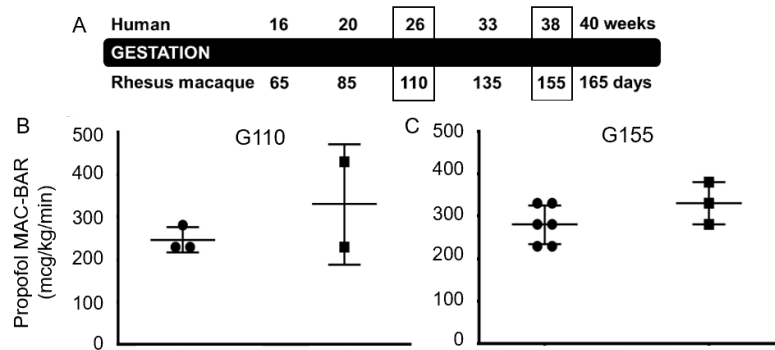


Figure 1. G110 and G155 in NHPs correlates to gestational weeks 26 and 38 in humans (A). Propofol MAC-BAR not differ between groups at either G110 (B) or G155 (C).

Midazolam for anesthetic premedication in children: friend or foe?

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Preoperative anxiety in children is associated with several adverse postoperative outcomes including increased pain, sleep disturbances, and negative behavioral outcomes.¹ There are roughly 4 million pediatric surgeries performed yearly in the United States, and most of these patients report anxiety.² While a variety of preoperative pharmacologic and nonpharmacologic anxiolytic treatments exist, oral midazolam has long been a favorite choice with its ease of administration, short duration of action, favorable side effect profile, and low cost. Its use has recently been questioned due to emerging evidence suggesting neurotoxic effects on the developing brain and weak evidence of long-term benefit.³

Midazolam premedication reduces separation anxiety in both patients and parents, decreases the incidence of negative preoperative behaviors including crying, and increases mask acceptance at induction.⁴ Its effectiveness at reducing the incidence and severity of negative postoperative behavioral outcomes and emergence delirium is less clear. Some studies show a reduction in both incidence and severity, some a reduction in severity only, and some show no benefit.⁵

In 2017 the FDA issued a new warning regarding the use midazolam in children stating that exposure for lengthy periods of time or over multiple surgeries or procedures may negatively affect brain development in children younger than 3 years. Since then, several animal model studies and one on cumulative NICU midazolam dose have shown links between midazolam exposure and changes in neonatal brain development,⁶ though this evidence is still only suggestive and in need of further investigation.

Overall, midazolam is an excellent anxiolytic, preferred by many pediatric anesthesiologists. There is no literature suggesting that a single premedication dose would cause persistent deficits in developing brains. Since the risks remain unclear, it may be prudent to consider the whole clinical picture- e.g. each child's anxiety level, preexisting neurological deficits, future surgeries, and concerns for specific postop complications. We hope to raise awareness of the pros and cons of midazolam premedication and its alternatives in pediatric surgery.

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Title:

Endovascular repair of a pulmonary artery pseudoaneurysm on VA ECMO in a patient with massive pulmonary embolism

Author(s)/Institution:

[Chris Lewis, MD](#); University of Arizona
Kristen Swenson, DO; University of Arizona

Background:

Acute, massive pulmonary embolism is associated with high mortality worldwide. Pulmonary artery pseudoaneurysm is a rare, typically iatrogenic condition which also carries a high mortality. Here we describe the use of VA ECMO to facilitate repair of a left pulmonary artery pseudoaneurysm in a patient with massive PE with associated TEE findings.

Case Description:

A 75 year old woman with massive pulmonary embolism underwent an attempted percutaneous thrombectomy at an outside hospital which was complicated by left pulmonary artery pseudoaneurysm, hemoptysis, and code arrest. She was stabilized and brought to our center intubated on pressor and inotropic support. The decision was made to proceed with endovascular pseudoaneurysm repair and mechanical thrombectomy after initiation of VA ECMO.

She was brought to a hybrid operating room in critical condition. Intraoperative TEE demonstrated severe right heart dysfunction with clot present in the IVC and right atrium. VA ECMO was initiated via fem-fem cannulation. The IVC clot was determined to originate from a right groin sheath that had been left in place from her prior attempted thrombectomy and it was successfully aspirated after ECMO initiation. The pseudoaneurysm was coiled and mechanical thrombectomy was performed with aspiration of additional clot from both pulmonary arteries. ECMO was weaned in the OR with inotropic support and she was successfully decannulated. Reevaluation of the right ventricle on TEE demonstrated improved right heart function with absence of clot in the IVC and right atrium.

She returned to the CTICU where hemodynamic support was weaned. She was extubated on post-operative day 2 and transferred to the cardiology floor service on day 3.

Discussion:

This case posed challenges to both the ICU and cardiac anesthesia teams. The patient presented to us in right heart failure as assessed clinically and by TEE. She was not a candidate for systemic thrombolysis due to her pulmonary arterial pseudoaneurysm, nor was she deemed a good candidate for surgical thrombectomy by the CT surgery team. Endovascular repair and thrombectomy was deemed the safest option with planned VA ECMO support during the procedure. IVC and right atrial clot was clearly visible on TEE which allowed confirmation of successful aspiration. TEE also allowed for assessment of right heart function to guide pharmacologic management during intraoperative weaning from ECMO and decannulation.

Title: Laryngospasm in the Setting of COVID-19 and Suspected Laryngopharyngeal Reflux Disease

Authors/Institution: Scott Lewis, MD; Evan Shawler, MD; Claire Soria, MD; UC San Diego

Background: Laryngospasm is an uncommon life-threatening anesthetic emergency that can also occur outside the perioperative environment. Airway obstruction from sudden, involuntary closure of the false and true vocal cords can lead to stridor, low-pitched crowing, dyspnea, and difficulty speaking¹. Etiologies include gastroesophageal reflux (GERD), laryngopharyngeal reflux (LPR), reactive airway disease, neurodegenerative diseases, infection, and inhalation of noxious fumes. LPR is a complication of GERD where refluxate enters the larynx or pharynx, and can cause hoarseness, difficulty swallowing, chronic cough, choking episodes, heartburn, and paroxysmal laryngospasm^{2,3,4}. Common findings involve mucosal injury resulting in edema, posterior commissure hypertrophy, and subglottic stenosis^{5,6}. A retrospective study of 35 patients reported that 100% of patients with frequent paroxysmal laryngospasm and 87% of patients with occasional laryngospasm received the diagnosis of GERD; however, only 29% of the study population reported symptoms⁷. Some studies reported only 36-43% of GERD patients experience typical heartburn and regurgitation^{2,8}, suggesting subclinical disease may contribute to paroxysmal laryngospasm.

Case Description: We present a case of a 30-year-old female with a history of anxiety, hypothyroidism, microprolactinoma, and remote admission for acute dyspnea from laryngitis. She arrived at the emergency department (ED) at 1:00 AM after awakening suddenly with acute dyspnea in the setting of a sore throat and negative home COVID-19 test. In triage she was noted to be dyspneic and stridorous, prompting urgent evaluation. The patient was started on a racemic epinephrine nebulizer, supplemental oxygen, and methylprednisolone. Neck soft tissue radiographs demonstrated glottic and subglottic airway narrowing. Otolaryngology and anesthesia were consulted for an emergent airway. Upon initial examination by the anesthesiologist, the patient was sitting upright in acute distress with tracheal tugging, loud audible stridor, and increased work of breathing. Her oxygen saturation was 97%, blood pressure was 123/74 mmHg, respiratory rate was 24 breaths per minute and heart rate was 84 beats per minute. She had no visible urticaria, face swelling, or evidence of arrhythmias on cardiac monitoring. A multidisciplinary decision was made to bring the patient to the OR for possible awake fiberoptic intubation or awake tracheostomy. Her ED COVID-19 test returned positive during transition to the OR. Approximately 25 minutes after the initiation of racemic epinephrine, the patient's symptoms improved and she demonstrated a substantial decrease in work of breathing, less anxiety, less respiratory distress, less tracheal tugging, and resolved stridor. Given her improvement, a nasal fiber optic was performed in the OR showing mild subglottic narrowing and mild arytenoid edema bilaterally. Intubation was deferred in favor of admission for observation. She was discharged the following day with resolved symptoms.

Discussion: Given the presentation of an anxious patient awoken from sleep with acute dyspnea and stridor, no history of reflux symptoms, and glottic structure edema, this patient's clinical course is consistent with paroxysmal laryngospasm. We suspect microaspiration with concomitant laryngeal reactivity from COVID-19 and baseline anxiety resulted in a known complication of LPR. Fortunately, with judicious application of invasive management this patient was able to avoid intubation through medical management and observation.

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The Role of Peripheral Nerve Stimulation in Treating Chronic Neuropathic Pain: An International Focused Survey of Pain Medicine Experts

Alice Li

Interventional pain management (IPM) options for refractory neuropathic pain (NP) have recently increased with availability of peripheral nerve stimulation (PNS) equipment and expertise. Given a lack of high-quality evidence and guidelines on this topic, we sought to understand the perception of physicians with expertise in treating NP regarding IPM and the role of PNS. We emailed a survey in March 2022 to international NP experts including Pain Medicine physicians, researchers, and leaders of eleven professional pain societies. No representatives from vendors of PNS systems were included in the design of the survey nor as respondents. Among 24 respondents (67% of those contacted), the distal common peroneal, tibial, and sural nerves were most frequently targeted (60%) with PNS. Persistent post-surgical pain of more than 3 months was the most common indication for PNS (84%). The aggregate NP treatment algorithm in order of median rank was non-opioid medications as first line, IPM including epidural/perineural steroid injections tied with TENS as second line, pulsed RF tied with RF ablation/denervation as third line, temporary then permanent PNS as fourth line, followed by SCS, opioids, cryoablation, botulinum, PNfS, intrathecal targeted drug delivery, and others. Before offering PNS, twelve respondents (50%) indicated their preference for trialing non-neuromodulation treatments for 1-3 months. Twenty-two respondents (92%) agreed PNS should be offered early in the treatment of neuropathic pain. The most common barriers to PNS use were cost, lack of high-quality evidence in support of its use, lack of exposure to PNS in training programs, and lack of familiarity with the use of ultrasound-guidance. PNS appears to have an increasing role in the treatment of NP but more research is needed on the outcomes of PNS to elucidate its role.

Title

Undetected foreign body causing airway obstruction following extubation, necessitating emergent tracheostomy

Author(s)/Institution(s)

- Sophia Liang
- Christian Agatep
- Michael Langevin
- Ellie Fratt
- Taizoon Dhoon, MD

Background

Foreign bodies (FB) can cause airway obstruction and progress into a life-threatening emergency. We present a case in which an undetected FB was dislodged during extubation, necessitating emergent tracheostomy.

Case Description

A 69-year-old man with history of alcohol use disorder, depression, obesity, and atrial fibrillation presented to an outside hospital following loss of consciousness and respiratory distress. The patient was stabilized and transferred to our facility and arrived intubated with propofol sedation. An initial chest x-ray (CXR) from the outside facility was read as “clear, without infiltrate”, and a second CXR at our facility reported nonspecific “focal airspace opacity” in the lower left lung region.

Over the next two days, the patient was administered CPAP and weaned off propofol sedation. Four CXRs performed during this time reported no significant changes compared to prior imaging, which led to a decision to extubate the patient.

Following extubation, the patient’s breathing became stridorous and began to decompensate. Intubation was attempted by the primary team, who noted a blue-colored foreign body obstructing the airway. Bag valve mask was used to ventilate the patient in the interim. The anesthesiology and otolaryngology teams were paged.

Video laryngoscopy revealed a blue colored object obstructing the entirety of the glottis; only the epiglottis was visible. Anesthesia and ENT attempted removal with McGill clamps but were unable to achieve an adequate grasp given the smooth, spherical surface of the object. Attempts to intubate via direct laryngoscopy, video laryngoscopy, and fiberoptic bronchoscope over the foreign body were unsuccessful. The foreign body would dislodge slightly from the glottis as the patient exhaled, but every inhalation would pull the obstructing object back into the glottis. Ultimately, an emergent bedside tracheostomy was performed by otolaryngology.

The tracheostomy was complicated by the patient’s body habitus and short neck morphology. The initial attempt to place a size 6.0 tracheostomy tube created a false passage, thus additional dissection was performed to facilitate palpation of the lower aspect of the cricoid and upper tracheal rings. A vertical incision was created, and the trachea was dilated prior to another attempt to place a size 6.0 endotracheal tube. Successful cannulation was finally achieved through placement of a size 6.0 endotracheal tube, with placement verified via fiberoptic scope. Securing the airway facilitated removal of the foreign body with forceps; which was determined to be a blue-colored, ping pong-sized metallic ball. The patient was transported to the OR for tracheostomy revision.

Discussion

While 75% of FB aspiration cases occur in young children (Blanco), adults can also present emergently with FB obstruction. Factors that can increase the risk of adult aspiration include drug use, psychiatric illness, and poor dentition

(Tseng). Symptoms include coughing, wheezing, or dyspnea, so timely extraction of FBs is crucial to prevent progression into respiratory failure (Sehgal). In this case, the ball was missed on radiographic imaging; the foreign body was likely thought to be outside the body and/or an artifact (Figure 1). Our case highlights the importance of 1) remaining vigilant despite available radiographic interpretation and 2) maintaining awareness of possible foreign body aspiration or ingestion in settings of alcohol intoxication.

Figures

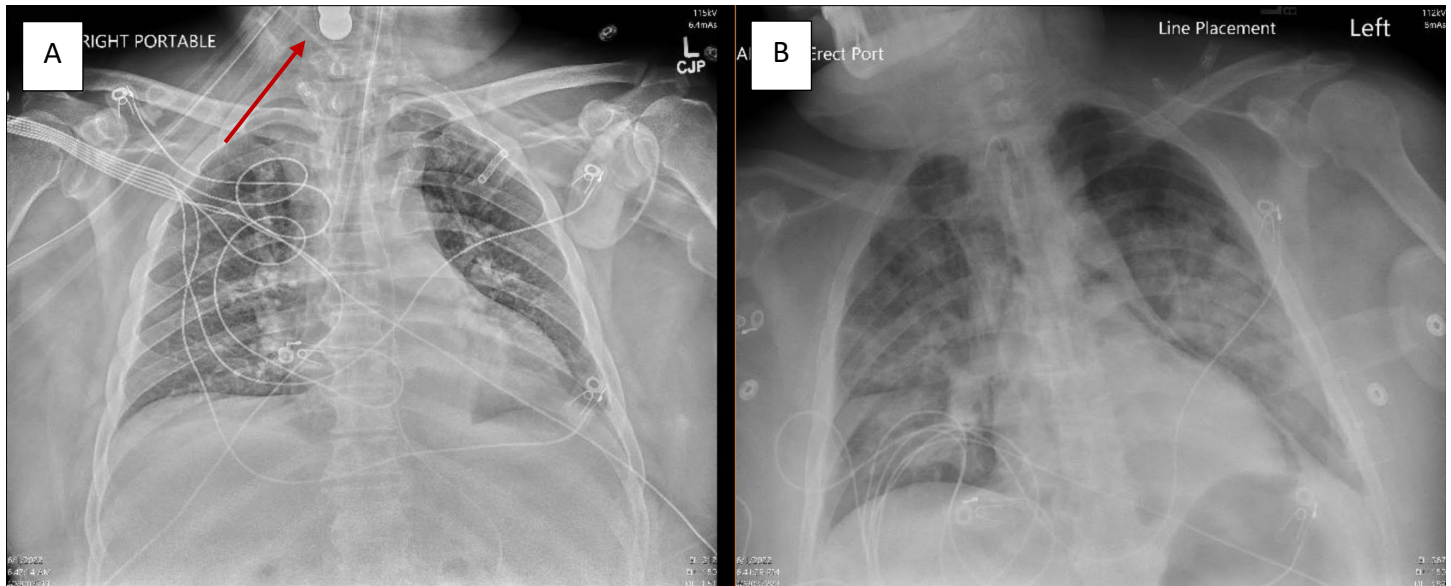


Figure 1: CXRs pre- and post-extubation attempt. (A) Daily CXR collected prior to extubation with red arrow denoting foreign object. Radiology findings include endotracheal and nasogastric tubes, mild cardiac silhouette enlargement, and previously identified opacities in the right and left lower lungs. (B) Post-extubation CXR showing new tracheostomy tube and no foreign object. Radiology findings include interval tracheostomy tube, right IJ central line, and an increase in bilateral airspace opacities with no pneumothorax.

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Title: SussPulseOx: Suspicious Pulse Oximetry in the Context of Isosulfan Blue

Authors/Institutions: Caleb Liberman, MD; Tyler Chernin, MD (University of California San Francisco)

Background: Pulse oximetry is the mainstay of non-invasive monitoring of oxygen saturation. By determining the ratio of absorbance of two different wavelengths (660nm and 940nm), calibrated against direct measurements of arterial oxygen saturation known as fractional oximetry (SaO₂), this method can approximate oxygen saturation via functional oximetry (SpO₂). However, pulse oximetry has limitations, and various conditions including dyshemoglobinemias (carboxyhemoglobin, methemoglobin), poor perfusion, anemia, variations in tissue pigmentation, and the use of injectable dyes can cause spurious SpO₂ readings.

Sentinel lymph node (SLN) biopsy is the standard of care for the management and staging of early breast cancer. SLN mapping is accomplished using both radioisotopes and blue dyes like methylene and isosulfan blue. Both dyes result in comparable SNL identification, and each have their own known interactions and adverse effects. Notably, methylene blue is often preferred to isosulfan blue due to its lower cost, rates of anaphylactic reactions, and incidence of interference with pulse oximetry.

Case Description: Here we describe an otherwise healthy 59 year-old female presenting for scheduled partial mastectomy with SNL biopsy for known carcinoma of the left breast. Following induction of general anesthesia, bilateral pectoralis 2 (PECS2) plane blocks were performed under ultrasound guidance with a total of 60cc 0.2% ropivacaine. Approximately 25 minutes following these blocks a desaturation was noted with a decrease in SpO₂ from 98% to 93% over the course of the next 10 minutes. This desaturation was not improved with multiple interventions including an increase in FiO₂ from 60% to 100% and recruitment maneuvers. The patient remained hemodynamically stable throughout. Given the instrumentation of the anterior chest wall during the PECS2 blocks a chest x-ray and bedside ultrasound were done to assess for evidence of pneumothorax (PTX) which was not present. The operative case was cancelled and a CTPE was obtained to rule out pulmonary embolism (PE) as a cause of this hypoxia. An arterial line was established, and a blood gas was sent which demonstrated a PaO₂ of 228mmHg. Notably, the surgical team injected isosulfan blue dye into the areolar tissues approximately 15 minutes prior to the desaturation episode.

Discussion: The differential diagnosis for perioperative hypoxia is extensive and includes low inspired oxygen, hypoventilation, diffusion impairment, shunt, and V/Q mismatch. In this patient with recent instrumentation of the anterior chest and known hypercoagulable state (carcinoma), pneumothorax (PTX) and pulmonary embolism (PE) both needed to be ruled out. However, these diagnoses would both result in a decrease in SaO₂ and SpO₂. Despite being aware of the more common and transient nature of spurious SpO₂ readings with methylene blue injection, neither the surgical nor anesthesia teams considered the possibility of such a delayed and prolonged effect on the SpO₂ reading with isosulfan blue. Thus, the case was canceled before the arterial sample had been obtained due to the need to rule out the more serious possibility of PE or PTX. This demonstrates the value of establishing arterial access to definitively assess adequate patient oxygenation in the setting of questionable SpO₂ readings.

Management of interstitial lung disease requiring HFNC during cesarean delivery: a case report
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Background:

Interstitial lung disease (ILD) is a rare disease occurring in an estimated 0.22% of women with increasing incidence in young women.¹ Patients with ILD can develop pulmonary arterial hypertension, which is frequently a contraindication to pregnancy due to mortality rates of 5-36% in the peripartum period.^{2,3} We present a case of a 30-year-old G1P0 at 31 weeks who underwent cesarean delivery due to rapid progression of autoimmune ILD requiring heated HFNC at 80-100% FiO₂ with flows of 50-60 L/min to maintain SpO₂ >88% at rest. Prior to her hospitalization at 29 weeks, her O₂ need was 10-12L via NC.

Case Description:

Patient was 91 kg, 165 cm, and Mallampati I. Recent TTE at ~26 weeks showed EF 60-65%, PASP 32-37 mmHg, and normal valvular and biventricular function. Given her history of prolonged mechanical ventilation, maximal oxygen requirements on HFNC, acute on chronic respiratory failure, and TTE results, we planned a slow titration of neuraxial anesthesia, escalating, if needed, to GA with additional monitors/lines, nitric oxide, ECMO, and cardiac anesthesiology support.

Before surgery in MICU, bedside TTE was grossly unchanged with mild RV dysfunction. She was transported to the OR with a nonrebreather mask since HFNCs require a wall source of oxygen and electrical power. HFNC was resumed upon arrival to OR. A CSE was placed with 20 mcg fentanyl. The epidural was dosed with 2% lidocaine and epinephrine in 3-4 mL increments every 5-7 min. Infusion with 0.4 mcg/kg/min phenylephrine was started immediately after the spinal dose. The baby was delivered with APGAR scores of 7 and 8.

At delivery she was hemodynamically labile requiring addition of vasopressin infusion and boluses. MAPs decreased precipitously from 70-80 to 45-55 mmHg with HR decreasing from 130 to 80bpm. Within ten minutes we established a new baseline with MAPs > 65 and HR 90. She remained asymptomatic and maintained SpO₂ >92%. Oxytocin infusion of 5 units/hr was started. Case finished uneventfully.

Discussion:

Preparing for this case, we discussed anticipated maternal and fetal needs with an interdisciplinary team. Literature search showed patients with PAH receiving GA were 4x more likely to die compared to neuraxial anesthesia.⁴ Therefore, we carefully titrated our neuraxial analgesia and avoided spinal bupivacaine to prevent sudden sympathetic blockade and hypotension. We optimized positioning with an inclined ramp and left uterine displacement to avoid decreasing FRC and alleviate aortocaval compression. We continued the HFNC to maintain FiO₂, decrease work of breathing, decrease dead space, generate PEEP, and increase patient comfort.⁵ In the OR we were cognizant to limit fluids and gave furosemide to prevent volume overload. We selected vasopressin to support SVR and cardiac output without increasing PVR.⁶ Our patient had a complicated postop course requiring two ICU readmissions for respiratory distress and intubation; however, she was discharged after a month on 10-12L O₂ via NC.

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Title: Anesthetic Considerations of Awake Craniotomy

Author: Edwin C. Lin, Joseph Szokol

Institution: Keck School of Medicine of USC, Keck Hospital of USC.

Background:

Awake craniotomy is required for real time brain mapping with intent to map or extract brain tissue with intent of sparing speech, sensory, or motor functions. Awake craniotomy requires unique anesthetic considerations.

Case Description:

31F with past medical history of anxiety, cervical radiculopathy, and nephrolithiasis presents with worsening headaches, found to have 25 mm x 27 mm x 28 mass in posterolateral frontal lobe near the motor strip and Broca's area. In addition to headaches, she was also experiencing episodes of right leg/thigh numbness and right arm numbness. She did not have any confusion or difficulty with speech. Patient was scheduled for a left frontal awake craniotomy for speech and motor mapping with mass resection. Patient was given 2 mg midazolam in pre-op and started on a dexmedetomidine infusion at 1.0 mcg/kg/hr and propofol at 40 mcg/kg/min. Nasal cannulae administered at 4 LPM. Once the patient was adequately relaxed, a frontal scalp ring block was performed with 20cc 0.25% bupivacaine with 1:200,000 epinephrine. Neurosurgery team subsequently provided additional local infiltration with 1% lidocaine at three pin sites, including two pins on the forehead and one on the right lateral occiput. Patient was subsequently pinned in a Mayfield skull clamp. Patient complained of pain at the occiput at time of pinning, requiring IV bolus of 40 mcg dexmedetomidine and 50 mcg fentanyl. Shortly after pinning, patient required placement of a 32Fr nasopharyngeal airway to relieve obstruction. Multiple additional doses of 50 mcg fentanyl was administered to tolerate dural incision. After dural opening, dexmedetomidine was decreased to 0.2 mcg/kg/hr with propofol infusion turned off. Patient regained consciousness and was able to participate in conversation as well as respond to commands. Patient was provided with lemon oral swabs for comfort, complaining of dehydration. 30 minutes later, patient complained of nausea, 4 mg ondansetron and 12.5mg diphenhydramine was administered with relief of nausea. However, 90 minutes after first episode of nausea, patient complained of nausea once again refractory to another 4 mg ondansetron, with subsequent emesis into a kidney basin of approximately 50 mL in volume. Patient was protecting her airway and did not experience desaturation, and tolerated the rest of surgery and closure. Postoperatively, the patient required around the clock metoclopramide and ondansetron for nausea management.

Discussion:

In an awake craniotomy, several factors are imperative to success including patient cooperation, regional anesthesia of the skull, maintaining a patent airway and ventilatory drive, rapid emergence from anesthesia, and prophylaxis against nausea and vomiting. Although the patient tolerated surgery without major complications, she did experience inadequate scalp anesthesia as well as an episode of intraoperative emesis. Scalp anesthesia may be achieved with a ring block or specific blockade of the supraorbital, supratrochlear, zygomaticotemporal, auriculotemporal, greater occipital, and lesser occipital nerves. Intraoperative and postoperative nausea should be addressed with multimodal antiemetics starting from pre-operative medication administration.

Title: Massive vomiting during induction in a patient with incarcerated ventral hernia

Authors: Remy Link BS¹, Priyanka Jain BS¹, Jake Rothfork MD¹, Ricardo Falcon MD¹, Tim Petersen PhD¹⁻³, Codruta Soneru MD¹

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Ventral hernia is a protrusion of the intestine/other tissue through an anterior abdominal wall weakness. An incarcerated hernia leads to strangulation of blood flow to the intestinal area entrapped and development of necrotic bowel. These patients are at risk of aspiration. Aspiration of gastric contents leads to significant morbidity and mortality. (1)

Nasogastric/orogastric (NG/OG) tube placement and suction are helpful but not completely effective in emptying the stomach. (2)

A 61yo M with obesity, prediabetes, presented with small bowel obstruction (SBO) from known ventral hernia that had become incarcerated, confirmed on CT. There were ischemic changes of the small bowel within the hernia sac including pneumatosis, mesenteric gas, and variable wall thinning and thickening. Additionally, dependent airspace opacities were visualized which may represent aspiration bronchiolitis and/or atelectasis given esophageal distention.

Patient endorsed nausea but no vomiting. Intubation was performed with RN providing cricoid pressure. Patient vomited copiously upon intubation. Intubation was quickly completed and suction applied; no vomit was suctioned via ETT. A total of 3.5L were suctioned via NGT at the beginning of the procedure, 500mL throughout the case, and another 1200mL at the end of the case after the NGT clogged and was replaced. Patient was taken to ICU with open abdomen to return 2 days later for closure. He was successfully extubated 2 days later.

Gastric contents shape anesthesia plans during induction, maintenance, and emergence. Fasting status alone is insufficient for safety; SBO, other GI pathology, acute pain, distress/anxiety, pregnancy, increased intracranial pressure, ulcer/gastritis, and opioids. Children and elderly patients are most likely to aspirate, and risks also increase with emergency surgery, difficulties with the airway, upper abdominal surgery, nasogastric tube and pregnancy (3). Aspiration can lead to complications including chemical pneumonitis, bacterial pneumonia, adult respiratory distress syndrome, and prolonged mechanical ventilation. Several strategies have been identified to help mitigate it, e.g. reducing gastric volume via NG aspiration and preoperative fasting, avoidance of general anesthesia if possible, reducing pH of gastric content, airway protection, cricoid pressure and rapid sequence intubation, and extubation in the lateral position after return of airway reflexes. Ultrasound imaging of the gastric antrum can help to screen for high volume of gastric contents (4).

Given the high prevalence and serious complications associated with aspiration identification of risk factors for early detection and rapid action on mitigation strategies is necessary for more informed and effective patient care. We used rapid sequence intubation with cricoid pressure because of our patient's aspiration risk. We hope to increase awareness of aspiration in anesthesia. Despite vomiting on induction, there was no evidence of it in our patient.

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When There is More Blood Loss than Expected

Flora Liu, MD and Emilee Borgmiere, MD; University of Utah

Background

Managing unexpected intraoperative hemorrhage and performing massive transfusion resuscitation is an integral part of hemodynamic management in anesthetic care. Blood transfusion has inherent risks, and the clinical sequelae can range from mild to fatal. Signs and symptoms of transfusion reaction can be masked by general anesthesia or delayed by days. Therefore, understanding the basics of blood transfusion as well as institutional blood bank operation is essential to patient safety.

Case Description

A 69-year-old male with recurrent hemophagocytic lymphohistiocytosis from presumed lymphoma and chronic pancytopenia presented for emergent splenectomy. He was one day status post spleen biopsy complicated by hemorrhage refractory to IR embolization. He presented to the operating room hemodynamically stable. Intraoperatively, the significantly enlarged spleen was removed with multiple capsular tears from subcapsular hematoma and active extravasation. With ongoing bleeding, the patient converted into SVT with rate up to 200s requiring adenosine. Further resuscitation was mandatory.

The patient was B- and receiving irradiated blood given presumed lymphoma. The requested STAT RBCs arrived within 30 minutes, which was slow in the setting of acute high-volume bleed. Upon cross checking the units, the team realized that B+ non-irradiated blood had been sent. In the setting of active hemorrhage with subsequent hemodynamic instability and lack of bleeding source control, the decision was made to transfuse. Total EBL was five liters. At the end of the case, 6 RBCs, 4 FFPs, 2 platelet, 20 cryoprecipitate, and 3.5 L of crystalloids were administered. Patient's hemoglobin started at 7.7, dropped to 5.7 intraoperatively, and ended at 7.7 postoperatively. Patient was transported to SICU hemodynamically stable.

Discussion

Massive or unexpected hemorrhage intraoperatively is a situation anesthesiologists encounter. When blood products are urgently needed, knowing the time frame from ordering to administration is imperative. Massive transfusion protocol is frequently used when six units of RBCs is expected to be transfused within less than two hours to allow more balanced transfusion. Emergency release is an alternative to customize the number of each product. Both MTP and emergency release allow uncrossmatched blood to be delivered within 10 minutes².

Patient was Rh negative but was receiving Rh positive blood. Under non-massive hemorrhage situation, the blood bank will provide Rh negative blood to avoid formation of anti-D antibodies. Rh negative blood is limited and often reserved for women of reproductive age to avoid hemolytic disease of the newborn. When a patient requires more than six units of RBCs, the standard is to switch to Rh positive if patient does not have anti-D antibodies. This practice is frequently done with MTP in trauma patients safely³.

This patient was receiving irradiated blood due to presumed lymphoma to avoid transfusion associated graft vs. host disease, which has 100% mortality, although rare, with only about 350 cases reported in the literature³. In the setting of massive hemorrhage use of non-irradiated blood product would be reasonable, as exsanguination would cause more immediate mortality. In summary, under active hemorrhage situation knowing how to efficiently to obtain safe blood products for patients is essential to anesthesiologists.

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TITLE: Spinal subdural hematoma and its anesthetic considerations

AUTHORS: [Lauren Locke, MD](#); Matthias Braehler, MD, PhD

AFFILIATED INSTITUTION: University of California, San Francisco

BACKGROUND: Spinal subdural hematomas are a rare cause of spinal cord injury and typically fall into one of three categories: posttraumatic, iatrogenic, or spontaneous. They frequently occur in the thoracic region and presenting symptoms are due to spinal cord compression. The majority are associated with motor symptoms, although sensory deficits and pain are also common.¹ Emergent surgical decompression is the mainstay of treatment.

CASE DESCRIPTION:

A 79-year-old female with a history of atrial fibrillation, mechanical aortic valve replacement on warfarin, and heart failure presented to an outside hospital after a mechanical ground level fall. On admission, her INR was 5.8, but she otherwise had no significant exam or imaging findings. She was admitted and treated for a urinary tract infection. Three days later, she developed lower extremity weakness, back pain, and urinary retention. MRI revealed extensive spinal cord edema at T1-T9 levels with intradural extramedullary hematoma. Her INR was reversed with prothrombin complex concentrate (PCC) and she was transferred to our institution.

Upon arrival, the patient had 0/5 strength in the right lower extremity (RLE) and 2/5 strength in the left lower extremity (LLE) with normal sensation. Her INR had corrected to 1.2. Following an otherwise unremarkable pre-operative evaluation, the patient was taken emergently for a laminectomy.

Induction of general anesthesia and endotracheal intubation were achieved uneventfully. A radial arterial line was inserted, and the patient was placed in a prone position. General anesthesia was maintained with sevoflurane and propofol. A mean arterial pressure (MAP) greater than 85 mmHg was achieved via a phenylephrine infusion. Notable surgical events included evacuation of large subdural hematoma.

Immediately post-operatively, her neurological exam mildly improved with LLE strength 3/5 and RLE strength 1/5. She was transferred back to the outside hospital where she underwent an uncomplicated recovery. Four months post-operatively, she had significant improvement in lower extremity strength although experienced a residual right-sided foot drop.

DISCUSSION:

Spinal subdural hematoma is an important consideration in anticoagulated patients presenting with acutely worsening symptoms of spinal cord compression. For both diagnosis and follow-up, MRI is the imaging modality of choice.² In patients experiencing acute neurological deterioration, spinal cord decompression should be performed immediately. If receiving vitamin K antagonists, reversal with PCC can facilitate emergency surgery.³ Although no specific guidelines exist for anesthetic management of spinal subdural hematoma, guidelines for other types of spinal cord injury can be extrapolated. As systemic hypotension can lead to secondary ischemic injury, care must be taken to maintain spinal cord perfusion pressure, estimated by the

difference in mean arterial pressure and cerebrospinal fluid pressure. Arterial catheterization is important for continuous blood pressure monitoring, particularly with thoracic injury that may lead to worsening sympathectomy or compromise of the cardiac accelerator fibers. The American Association of Neurological Surgeons guidelines recommend blood pressure augmentation to reach a goal mean arterial pressure of 85–90 mmHg.⁴ However, above all, expedited surgical intervention is of utmost importance, as surgical decompression within 24 hours is associated with a greater than two times increased likelihood of improved neurological outcome.⁴

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Title:

A case of refractory hypotension in the setting of obstetric hemorrhage and methamphetamine use

Author(s)/Institution(s):

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Background:

Methamphetamine, an increasingly common recreational drug, acts on the nervous system by increasing the release of the endogenous neurotransmitters dopamine, norepinephrine, and serotonin. Perioperative methamphetamine use poses a particular challenge in hemodynamic management during general and obstetric anesthesia as patients can present with hypertensive emergencies as well as cardiovascular collapse.

Case Description:

A 29 year old female G1P0 at 36 weeks 5 days presented for medical induction for preeclampsia with severe features and worsening renal function. Medical history was significant for methamphetamine use disorder and asthma, with last methamphetamine use one day prior to admission. After induction of labor, an epidural was placed and preeclampsia was managed with magnesium and labetalol. Ultimately the patient experienced arrest of descent leading to cesarean section. Her epidural was bolused with 3% chloroprocaine and T4 surgical level was achieved. Phenylephrine infusion was initiated for prevention of hypotension. After hysterotomy, the patient's blood pressures began to fall from mean arterial pressures (MAPs) greater than 90 to less than 60, with a nadir of 42. Bilateral uterine artery transections and uterine atony were identified, and emergent blood product release was initiated. While waiting for blood, a total of 1000 mcg of phenylephrine, 7 units of vasopressin, 80 mcg of epinephrine, 1.2 L of crystalloid, and 1.25 L of 5% albumin were given over 20 minutes with poor response in MAPs. Epinephrine infusion was started and arterial line was placed. Two units of PRBC and 2 units of FFP were administered, resulting in rapid improvement of blood pressure and epinephrine infusion was stopped shortly thereafter. Uterine atony was treated with Oxytocin and Methergine, and tranexamic acid was administered. The patient was awake, oriented, ventilating via face mask with oxygen saturation 99% during the hypotensive episode. Once abdominal discomfort was reported, general anesthesia was induced and patient was intubated. Estimated blood loss was 2200 mL. Transthoracic echocardiogram performed during hypotension revealed hyperdynamic left ventricular function without other abnormalities. The patient was taken to the ICU she was discharged from the hospital post operative day four.

Discussion:

This patient's refractory shock was likely a combination of abrupt blood loss and catecholamine depletion from chronic methamphetamine use in the setting of preeclampsia. This combination resulted in shock that was only corrected once intravascular volume was restored and direct adrenergic vasopressors were infused. Quick communication between anesthesia and surgical teams identified surgical bleeding resulting in early initiation of emergent blood products.

Comprehensive diagnostic evaluation and aggressive treatment of underlying hemodynamic abnormality resulted in a prompt diagnosis, quick resolution of hemorrhagic shock and favorable outcome. This case illustrates the need for the close communication of multidisciplinary team. It also underscores the importance of detailed social history at a time of a nationwide substance use disorder epidemic.

Title: Perioperative Planning for a Combative Adolescent with Super Morbid Obesity and Autism

Authors/Institution: Lu, Michelle DO; Htun, Hnin MD; Sterni, Lynne MD; Naval Medical Center San Diego

Background: Anesthetic management for an adolescent male with non-verbal autism spectrum disorder, super morbid obesity (BMI 53), obstructive sleep apnea (OSA), intellectual disability, violent behavior, epilepsy, and ketamine allergy.

Case Description: A 14-year-old, 184 kg male (BMI 53) with untreated OSA, epilepsy, non-verbal autism, and violent behavior is scheduled for routine dental, ophthalmologic and otologic exams under general anesthesia. The patient is 187 cm, had a large face with marked facial adiposity and a thick neck. He takes risperidone and lorazepam for aggression and oxcarbazepine, topiramate, and olanzapine for seizures. The patient was given 10 mg oral diazepam upon arrival with the anesthesia team waiting for transport. Once calm, a portable pulse oximeter was placed and he was transported to a separate preoperative area with emergency airway equipment and medications on standby. 10 mg of intranasal midazolam was attempted, but only 5 mg was administered due to agitation. He was then transported to the OR with the father. A ramp was placed under the patient and basic monitoring was established. Inhalational induction was performed with nitrous oxide, oxygen, and sevoflurane. Peripheral IV was successful with ultrasound. Further induction was performed with 3 mg/kg propofol. Two providers were able to attempt successful mask ventilation with a 110 mm oropharyngeal airway (OPA). 0.5 mg/kg succinylcholine was administered and a Glidescope 4 provided a 2b view of the vocal cords. The patient was intubated with a 7.5 endotracheal tube and maintained with 150 mcg/kg/min intravenous propofol, 0.5 mcg/kg/hr dexmedetomidine, and 0.5 MAC of sevoflurane. The intraoperative course was unremarkable. Thirty minutes prior to the end, sevoflurane and propofol were stopped. Once spontaneously breathing with adequate tidal volumes, the dexmedetomidine infusion was stopped, and the patient was extubated to an OPA. As the patient emerged from sedation, he was then weaned from a face mask to room air and discharged home.

Discussion: This case is unique given the patient's medical comorbidities and aggression. Although diazepam has a low propensity to cause respiratory depression, pre-sedating a super morbidly obese autistic patient with OSA could have led to adverse outcomes. We ensured appropriate personnel and equipment were available in case of respiratory compromise. Inhalation induction was not ideal due to risks of aspiration, laryngospasm, and presumed difficult airway, however, establishing preoperative IV access was impossible due to agitation. We also recognized that emergence would be a challenge and planned for incremental cessation of anesthetics until appropriate extubate criteria was met. The patient was recovered in the operating room to keep him isolated, minimize risks associated with transport, and also have resources readily available in case of complications from emergence. His father was present to console him as he awoke. This case describes challenges of safely administering preoperative medication and general anesthesia in an autistic combative patient whose medical comorbidities increased his risk of adverse anesthetic events.

Title: Incidence of Covid and Long Covid Symptoms in Healthcare Workers, An Anonymous Survey

Authors: Calvin Johnson MD; Jose Lujano MD

Introduction: In the US, about 15% of US adults with a prior positive COVID test have been noted to develop long covid syndrome, which is defined as symptoms beyond 2 months of initial infection. In this survey we assessed the incidence of long covid symptoms in healthcare workers, which included but were not limited to fatigue, cough, joint pain, memory or sleep problems, and loss of smell or taste.

Method: An anonymous survey was distributed to healthcare workers, and included questions regarding their vaccination status, covid infection history, and long covid symptoms if any. Additionally other demographics such as their race, specialty, and stance on mask use were collected.

Results/Conclusion: Incidence of long covid symptoms was determined among healthcare workers, and rates of infection and long-term symptomatology were compared across multiple healthcare fields.

Symptomatic Bradycardia Secondary to Trigeminal Neuralgia Spells Associated with Cerebellopontine Angle Epidermoid Cyst

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Background:

Reflex mediated bradycardia involving the trigeminal nerve has been described in the perioperative setting. This rare phenomenon is referred to as the trigeminocardiac reflex and can occur during surgical manipulation along the afferent fibers of the trigeminal nerve, causing bradyarrhythmias and sometimes hypotension and asystole. Here we describe a case of a patient with recurrent episodes of unstable bradycardia during trigeminal neuralgia attacks associated with a cerebellopontine angle (CPA) epidermoid cyst.

Case Description:

A 63-year-old female with a history of hypertension and trigeminal neuralgia presented to the emergency room for intractable left-sided headaches that were worse than her baseline and associated with dizziness and shortness of breath. She was diagnosed with a CPA epidermoid cyst two years prior, but her trigeminal neuralgia predated this diagnosis. Her vital signs were within normal limits and physical exam was unremarkable. She had recurrent, witnessed trigeminal neuralgia attacks in bed, associated with intermittent periods of bradycardia with a rate of 20 bpm. These were concomitant with P-P prolongation, followed by 10 second sinus pauses and AV block. Atropine was given without significant improvement. Electrocardiogram showed no conduction disease and troponin was negative. Transthoracic echocardiogram demonstrated no structural or functional abnormalities. Brain MRI redemonstrated the lesion with lateral displacement of the cisternal left trigeminal nerve, which was hypothesized as the culprit for her trigeminal neuralgia. She was evaluated by neurosurgery and was scheduled for urgent craniotomy for tumor resection. Given her severe bradycardia during pain episodes, she was admitted to the ICU with transcutaneous pacer pads for close monitoring perioperatively. We continued her home carbamazepine and administered opioids as needed to manage her pain. Additional medications initiated were dexamethasone to decrease possible inflammation, scopolamine patch, and a dopamine drip to prevent bradycardia. Despite medical management, the patient still had bradycardic episodes during pain spells that were associated with severe hypotension. Given the severity and frequency of the bradycardia, the decision was made to insert a transvenous pacemaker (TVP) for perioperative management. TVP was programmed to VVI mode with a backup rate of 60 bpm and the dopamine drip was continued intraoperatively. The TVP paced several times throughout the operation, but the intraoperative course was otherwise uneventful. Postoperatively, the patient did not have any further neuralgia spells or associated bradycardia. The TVP was removed on postoperative day 1 after successful resection of the lesion. The patient reported resolution of her facial pain 1 month later and tapered off carbamazepine.

Discussion:

Trigeminal neuralgia associated with a CPA lesion is a rare cause of excessive vagal tone and unstable bradycardia. It was unknown whether resection would halt neuralgia spells. It was also plausible that surgical stimulation would trigger the trigeminocardiac reflex and exacerbate bradycardia, which was already refractory to medical treatment in the ICU. Placement of a TVP was therefore deemed the safest course of action to prevent potential hemodynamic instability intraoperatively. Given this successful case, we suggest perioperative placement of TVP in patients who have unstable bradycardia associated with CPA lesion trigeminal neuralgia that is refractory to medical management.

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Title

Successful Neuroprotection After Cardiac Arrest for Emergent Aortic Valve Replacement

Author(s)/Institution(s)

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Background

Therapeutic hypothermia has been shown to improve neurological outcomes in patients experiencing cardiac arrest, with a goal temperature of approximately 32-34°C, although there is also recent literature recommending targeted temperature management to a goal of 36°C. Cerebral metabolic rate decreases by about 6% to 7% for every 1°C drop in body temperature, in turn reducing oxygen demand, preserving energy stores, preventing lactate production and acidosis, as well as decreasing inflammation. However, the application of therapeutic hypothermia can also lead to adverse effects on physiologic systems. Here we describe a case where therapeutic hypothermia was applied intraoperatively for neuroprotection shortly after cardiac arrest and severe hemodynamic collapse, resulting in a successful outcome given the patient's critical presentation.

Case Description

The patient is a 40-year-old female with a past medical history of hypertension, obesity, paroxysmal atrial fibrillation, and postpartum dilated cardiomyopathy status post mechanical aortic valve replacement due to endocarditis in 2014, on warfarin therapy. She presented with chest pain and acute on chronic systolic and diastolic heart failure. TEE demonstrated an EF of 60-65% with severe aortic stenosis and regurgitation secondary to thrombus of the mechanical aortic valve. She was intubated in the ICU for respiratory failure and pulmonary edema. During the preoperative evaluation, the patient decompensated in the ICU with cardiac arrest and was taken emergently to the operating room for repeat aortic valve replacement. She required intermittent CPR and multiple epinephrine boluses throughout transport and on arrival to the OR, with extreme hemodynamic instability. Intraoperatively, she was cooled to 32-33°C for the duration of the surgery. Upon weaning from cardiopulmonary bypass, TEE demonstrated an estimated ejection fraction of 15% and global ventricular hypokinesis, and thus she was placed on central VA ECMO. Her early ICU course included maximum vasopressor and ventilator therapy, placement of an Impella device, and CRRT. Over the course of three weeks, she was decannulated, weaned from the ventilator, and eventually ambulating with recovery of renal function. She exhibited significant neurological recovery and was discharged from the hospital with a walker.

Discussion

Targeted temperature management, or therapeutic hypothermia, confers many neuroprotective benefits after cardiac arrest. Arguments can be made regarding the choice for a temperature goal of 32-34°C for patients with greater risk of neurological damage such as with prolonged CPR, or alternatively a more conservative temperature goal of 36°C in patients with coagulopathy or severe hemodynamic instability. In this example, our patient had excellent postoperative recovery after a challenging ICU and perioperative course using a temperature goal of 32-34°C shortly after severe hemodynamic collapse. These neuroprotective benefits warrant the continued research and advancement in the application of hypothermia and other protective mechanisms during perioperative cardiac arrest.

A Stab In The Chest - But No Blood?

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Background

This medically challenging case report describes the anesthetic management of a dramatic stab injury in the chest. The learning objective is to discuss the perioperative assessment and management of penetrating thoracic trauma.

Case Description

A 26-year-old young lady was brought to the emergency department in an apparent suicide attempt where she had stabbed herself with a serrated knife in the left side of her chest.

Emergency Medical Technicians (EMT) found her awake and alert with no air entry in the left chest and performed an emergency needle thoracotomy with a 14-gauge needle on site. In the emergency department she was awake, calm and with normal vital parameters. Physical exam was obvious for a knife handle sticking out of the left side of her chest along the mid axillary and above the nipple line.

A left side chest tube was placed in the 5th intercostal place with no drainage of blood. She underwent a CT angiogram of the chest which demonstrated a knife passing through the left upper lobe of lung, inseparable from the left heart border and without definite intracardiac extension.

In the operating room, she was connected to ASA monitors and a pre-induction arterial line secured. She was pre-oxygenated, premedicated with fentanyl induced with propofol and paralyzed with succinylcholine. Her trachea was intubated with a 6.5mm cuffed endotracheal tube (ETT) using a videolaryngoscope. A fiberoptic bronchoscope was used to guide the ETT into her right mainstem bronchus and the cuff inflated before the take off the right upper lobe bronchus. Ultimately a quadruple lumen central venous catheter was fastidiously secured in the right internal jugular vein and the patient handed over to the surgeons.

The surgical course was short and included a left sided video assisted thoracoscopy and removal of the knife under vision. Surgical hemostasis was ensured, injury to vital structures checked for and the stab wound sutured close. After a brief uneventful hospital stay, she was discharged to a psychiatry facility and has recovered to baseline physical wellbeing.

Discussion

Approximately 15 – 30% of penetrating chest trauma require surgical intervention. Consequences can be devastating but most often non-life threatening. Injuries can involve the chest wall, lung parenchyma, tracheo-bronchial tree, heart, major vessels, esophagus and diaphragm.

In the presence of tracheo-bronchial injury advanced airway techniques like awake fiber-optic intubation, lung isolation using double lumen tubes (DLT) or bronchial blockers might be needed.

Advanced hemodynamic monitoring is usually required like multiple arterial lines, central venous access, pulmonary artery catheter and transesophageal echocardiography.

Massive blood transfusion may be needed and venous access like large peripheral IVs, rapid infusion catheters and central venous introducer sheaths might be needed.

Ultimately outcomes of thoracic trauma depend on severity of injuries, availability of resources like a level 1 trauma center near location of injury, and a coordinated team care approach as multiple interventions are required simultaneously.

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Case Report: Awake Craniotomy in A Pediatric Patient: Opportunities and Challenges.

Lovemore P. Makusha M.D.; Nigel Wilkinson-Maitlan M.D.; Michael Chen M.D.

Background and objectives:

Awake craniotomy with direct cortical stimulation and mapping is the gold standard for resection of lesions near eloquent brain areas; this is primarily because it maximizes the extent of tumor resection while minimizing the risk of neurologic damage. To that end, cortical mapping has demonstrated a wide variability in the location of areas controlling speech, memory, motor and sensory function. Because these regions of the cortex, often referred to as eloquent cortex, can be near areas of epileptic foci or pathologic lesions, surgical resection can be challenging. Thus, optimal assessment of eloquent cortex function during a craniotomy often requires an awake and cooperative patient, which can be challenging in pediatric patients. Contrarily in the adult population, only small series of awake craniotomies have been reported for pediatric patients.

Case Report:

Herein, we present a case of a 16-year-old male with history of migraine headaches, multiple concussions, left temporal stroke, and left frontal astrocytoma who underwent an awake left-sided craniotomy for tumor resection with language mapping. The patient had been transferred to our hospital from an outside facility following an episode of “freezing” concerning for epileptic seizure activity, and an abnormal CT Head imaging. On admission, an MRI Brain showed an atypical lesion concerning for a glioma; thereafter, the patient underwent a brain biopsy, which showed an infiltrating astrocytoma with ill-defined margins. Video Electroencephalogram demonstrated several subclinical seizures. Furthermore, he underwent an awake craniotomy with subtotal tumor resection, with pathology revealing an astrocytoma, IDH1-mutant, WHO Grade 4.

Intraoperatively, patient was managed with nasal oxygen airway, and infusions of propofol and remifentanyl for maintenance of loss of consciousness and analgesia. Additionally, single-shot left suprazygomatic maxillary scalp blocks with ropivacaine were performed for additional analgesia. The infusions of propofol and remifentanyl were administered to maintain a Ramsay score of 2-3. Mayfield head fixation was installed, and drapes adjusted to maintain access to the airway and eyes for mapping with electrical stimulation and tumor excision. The surgical course was uneventful with maintenance of adequate hemodynamics, ventilation and oxygenation support. The patient was taken to the post-anesthesia recovery unit and was discharged on post operative day 7 without any complications from the surgical procedure, with plans to follow up for additional chemotherapy and radiation after wound healing.

Conclusions:

Surgical resection of brain tumors located near the eloquent cortex has the potential to cause significant neurologic deficits. Therefore, in the appropriate patient population, performance of an awake craniotomy can allow for intraoperative risk mitigation, while allowing for optimal tumor resection. While awake craniotomy anesthesia was a challenge in this pediatric patient, who at baseline had some neurologic deficits, the balanced anesthetic with propofol and remifentanyl infusions, coupled with scalp blocks, provided adequate loss consciousness, analgesia, and patient comfort.

Anesthetic Considerations for Minimally Invasive Median Arcuate Ligament Syndrome (MALS) Release Surgery

Hayk Manuk-Hakobyan MD, Henry Chou, MD

Introduction:

Median arcuate ligament syndrome (MALS) is characterized by recurrent chronic abdominal pain secondary to compression of celiac artery by the median arcuate ligament. The standard treatment for symptomatic patients involves laparoscopic release of the median arcuate ligament to allow celiac artery decompression. While the growing trend of minimally invasive approach provides for improved relief of symptoms, there remains a potential increased risk for vascular injury compared to other laparoscopic procedures.

Case Description:

Patient is a 49-year-old female with history of MALS status post previous laparoscopic MALS release two years prior, who presented for persistent chronic epigastric abdominal pain. She reported worsening postprandial abdominal that was associated with unintentional weight loss and nausea. A celiac plexus block only marginally improved her symptoms. Patient had a CT angiogram done which demonstrated persistent severe narrowing at the celiac axis with adequate collateral flow to the main branching arteries. Given these findings, she was scheduled for re-do robotic MALS release and celiac ganglion nerve plexus resection.

During the operation, the patient was found to have significant amount of inflammation and scarring within the region of the celiac axis. Dissection within this area resulted in an injury to the celiac artery, which led to conversion to an open operation. During this time, the surgical team held pressure to tamponade the bleeding while the anesthesiologist placed an emergent arterial line and central line for access. A massive transfusion protocol was initiated, and the patient required six units of packed red blood cells, three units of fresh frozen plasma, and two units of platelets. Vascular surgery was consulted to the operating room who achieved hemostasis of the avulsed celiac artery. The patient was ultimately admitted to the intensive care unit for continued ventilatory management and hemodynamic monitoring.

Discussion:

The overall reported rate of vascular injury in laparoscopic surgery is less than 1%, and most commonly occurs during initial abdominal access for insufflation.³ A systematic review of 20 observational studies that included 121 patients undergoing laparoscopic treatment for MALS found 9.1% rate of open conversion secondary to bleeding.¹ The high rate of conversion may be attributed to the learning curve associated with this relatively new approach for MAL release.¹ Vascular injury is particularly more prone for above downward technique (e.g., identifying the aorta and tracing to the celiac origin) compared to below upward (e.g., dissection of the common hepatic artery or left gastric artery to trace its origin up to the celiac trunk).¹ Patients with previous MAL release surgery may be at risk given the potential for inflammation or scarring near the celiac axis. Further, the operation includes ganglionectomy of the celiac plexus, which

provides for opportunity of vessel injury given it is located immediately over the anterolateral surface of the aorta.

While the typical demographic for MALS is in middle-aged females with a thin body habitus, given the surgical risk for vascular injury, type and cross-matched blood, invasive hemodynamic monitoring with an arterial catheter, and large bore intravenous access should be considered in part of the anesthesiologist.^{1,2}



A. Pre-operative CT angiogram showing narrowing at the celiac axis

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Project Title:

Prevention of Postoperative Nausea and Vomiting: A Resident-Led Quality Improvement Project

Author List:

Marcus, Sivan Goldenberg. Soriano, Laura. Chiu, Joshua. Suazo Gladwin, Lucas. Han, Mary. Zagunis, Daniel. Ramos, Joshua. Gillis, Stephanie. Measer, Jacqueline. Curtis, Michael. Robinowitz, David . Masters, Dylan. Michael. Liu, Linda. Braehler, Matthias.

Background:

Postoperative Nausea and Vomiting (PONV) is a common and harmful side effect of anesthesia, and decreases patient satisfaction with their perioperative care^{1,2}. Several risk stratification and management algorithms^{3,4} have been established over the past 30 years. Most recently, updated consensus guidelines for the management of PONV were established in 2020, which have been shown to reduce the incidence of PONV⁵. We implemented a resident quality improvement initiative to increase compliance with evidence-based PONV prophylaxis guidelines in adult patients undergoing general anesthesia.

Methods:

Adult patients who received general anesthesia during the intervention period of July 2022-June 2023 (study ongoing) were compared to patients from the year prior (control group). Exclusion criteria included patients who were recovered in the ICU, ASA 5-6 patients, and several non-operative procedures such as bronchoscopy, endoscopy, TEE/cardioversion, ECT, and MRI (as determined via MPOG PONV concept⁶). The intervention includes a combination of educational resources (regular departmental presentations, laminated guideline cards in the OR), EHR-based best practice advisories, introduction of new prophylactic agents, and regular feedback on individual and department performance. The primary outcome of the study was overall compliance with 2020 consensus guidelines for PONV prophylaxis (≥ 2 agents for low risk patients, ≥ 3 for high risk patients (3 or more risk factors present), as measured via MPOG. Secondary outcomes included PONV rate, cost of overall perioperative antiemetic use and prophylaxis rates for specific subpopulations including different race/ethnicities, procedural services, and perioperative locations. Data on successes and failures were collected on a monthly basis and shared with the department.

Results:

27,033 subjects have been included in the intervention group to date, with 54,706 subjects in the control group. In the control group, 52% of patients received appropriate PONV prophylaxis. After implementation of the QI intervention, compliance with prophylaxis guidelines continuously increased to a cumulative compliance since project start of 70%, with December 2022 performance of 79%. Significant racial/ethnic disparities were observed in the control group, with patients who identify as black receiving less prophylaxis compared to other ethnicities. Specific provider populations (residents as compared to CRNAs/Attendings), procedural services (CT Surgery, Vascular Surgery, Urology), and perioperative locations (NORA) were also noted to have significantly lower levels of compliance prior to the intervention. These disparities in PONV prophylaxis were all observed to be mitigated by the intervention.

Conclusions:

PONV is an unpleasant and potentially dangerous complication for surgical patients, including prolonged PACU stays, unanticipated admission/readmission, dehydration, aspiration, and wound dehiscence. Our goal was to increase the proper prophylaxis of PONV. Through our interventions, we exceeded the aim of our QI initiative and improved cumulative compliance from 52% to 70%. Further work is indicated to test the limits and sustainability of the intervention.

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Delayed Emergence and Prolonged Amnesia in the Setting of Perioperative Multimodal Antiemetic Administration: A Case Report

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Background: Post-operative nausea and vomiting (PONV) is a frequent concern by anesthesia providers in the perioperative setting and multimodal approaches, including total intravenous anesthetic (TIVA), are often utilized for mitigation. Delayed emergence, while also not uncommon within the specialty, presents a unique challenge for anesthesiologists in both diagnosis and treatment given its potential for multifactorial triggers. Here we present a unique case of delayed emergence from anesthesia resulting in prolonged amnesia in a healthy patient after administration of multimodal anesthetic medications in an effort to reduce pain and PONV.

Case Description: Patient X is a 61yo male, BMI 19, who presented for a robotic radical cystectomy with neobladder creation for high-grade papillary urothelial carcinoma. The patient was otherwise healthy and active but reported PONV with recent tumor resection utilizing sevoflurane as a maintenance anesthetic. Preoperatively, the patient received multimodal therapy including oral Acetaminophen, Ibuprofen, Pregabalin, Aprepitant, and a transdermal Scopolamine patch. Anesthesia was induced with midazolam, fentanyl, lidocaine, propofol and rocuronium, and subsequently maintained intraoperatively utilizing TIVA with combined, single-syringe, Propofol (average 85 mcg/kg/min) and Remifentanyl (average 0.17 mcg/kg/min) while continuously monitoring processed electroencephalography. Surgical course was unremarkable (~5hrs), and the patient tolerated the procedure well with stable hemodynamics. Following completion of the procedure, his neuromuscular blockade was adequately reversed utilizing Sugammadex, demonstrating a quantitative train of four ratio >90%. Patient regained ability to breathe spontaneously on the ventilator, however he failed to regain consciousness or follow commands 45 minutes following cessation of TIVA and paralytic reversal. He was subsequently treated with nalbuphine, naloxone, and flumazenil to reverse opioids and benzodiazepines, and his scopolamine patch was removed. Physostigmine was unavailable in our hospital for reversal due to a nationwide shortage. He remained hemo/thermodynamically stable throughout, and additional workup including arterial blood gas and point of care blood glucose was unremarkable. Approximately 2 hours after cessation of TIVA, the patient remained somnolent, but was intermittently following commands with stable respiratory drive and was therefore extubated. He was transferred to the intensive care unit (ICU) for continued monitoring and subsequent computed tomography (CT) brain without contrast was unremarkable. Patient regained ability to fully follow commands and communicate approximately 6 hours following surgery, although he reports no recall of events until ~18-24 hours following admission to ICU. Recovery was otherwise uneventful, and patient was discharged home 8 days following surgery.

Discussion: Differential diagnosis for this patient's delayed emergence includes a prolonged effect of scopolamine administration, abnormal redistribution of Propofol, and potentiating polypharmacy effects from multimodal analgesia, especially those that were irreversible. All potential intervenable causes were assessed and addressed including hydroelectric alterations, hemodynamic instability, hypoglycemia, acid/base disorders, temperature, neurologic injury, and reversible medications. Furthermore, despite improving cognitive function (~6hrs following cessation of anesthetic), patient exhibited prolonged amnesia, atypical from previously reported cases of delayed emergence. Although a specific cause was not clearly elucidated, this case demonstrates a unique correlation between multimodal antiemetic anesthesia and resulting delayed emergence with prolonged post-operative amnesia in order to guide future primary prevention and appropriate intervention.

Title: Flash Pulmonary Edema, Hypoxemia, and Cardiogenic Shock Following Routine Methylergonovine Administration During Cesarean Section

Authors: Lucas Meuchel, MD PhD. Lisa Corbett, MD CPE. Oregon Health and Science University, Department of Anesthesiology and Perioperative Medicine

Background: Pulmonary edema is a rare complication during pregnancy, incidence reportedly less than 0.1%, however reports exist following methylergonovine administration. Use of methergine in patients with hypertension is contraindicated but it remains widely employed as a second line agent for postpartum hemorrhage.

Case Description: A 37 yo G7P0 presented for planned primary cesarean section for fetal transverse lie, known placenta previa, and abdominal cerclage in place. Pregnancy and medical history notable for prior COVID-19 infection during the second trimester (not requiring hospitalization), A2GDM, prior hemorrhage following dilation and curettage, recurrent pregnancy loss, and remote seizure. Preoperative testing and laboratory studies within normal limits. Cesarean section begun following uncomplicated spinal anesthetic placement; phenylephrine infusion along with supplemental oxygen started prior to incision, and oxytocin bolus then infusion started after delivery of placenta followed by methylergonovine 0.2mg IM administration for ongoing uterine atony and bleeding. Within 3-5 minutes, ECG notable for HR 155 with widened QRS complex, blood pressure 177/128 and patient report of shortness of breath and gagging. Tachycardia and hypertension persisted despite cessation of phenylephrine infusion however the patient continued to have worsening symptoms now with persistent cough, nausea while also demonstrating worsening hypoxemia (SpO₂ 90-92%). Copious frothy secretions noted from bilateral nares as SpO₂ continued to decline, prompting immediate conversion to general anesthesia and endotracheal intubation. Approximately 1L fluid suctioned from ET tube as remainder of cesarean section expedited, course further complicated by >1.5L blood loss and difficult ventilation requiring frequent ET tube suctioning and PEEP 18 cm H₂O to maintain ventilation and oxygenation. With ongoing tachycardia and hypertension and continued ET tube output, ICU transfer sought however final OR count revealed missing lap sponge. Abdominal x-ray confirmed retained object necessitating patient transfer back to OR bed for retrieval of retained sponge. During this re-exploration, the patient developed significant hypotension necessitating vasopressor infusion, arterial line placement, and increasing respiratory support for transfer to the ICU. Postoperative course complicated by worsening pulmonary edema, profound cardiogenic shock with EF 30% and left ventricular wall motion abnormality noted on echocardiography. Condition improved with maximal inotropic and vasoactive support with epinephrine, vasopressin and phenylephrine infusions in addition to continuous diuresis, ultimately methylene blue administration. Workup including coronary angiogram unremarkable, cardiac function and pulmonary edema improved rapidly followed by extubation POD2 and discharge home POD5.

Discussion: Intraoperative hemodynamic instability has a wide differential, and careful attention must be paid to the clinical scenario as well as maintaining thorough knowledge of administered medications. Our patient's report of symptoms helped guide early management

of her progressive deterioration. Her flash pulmonary edema and cardiogenic shock was thought secondary to acute LV failure likely as a result of elevated afterload due to methylergonovine-induced vasoconstriction, and serves as an example of a known but rare complication of a commonly used medication.

Hypoxia Due to Endotracheal Stenting in a Patient with Active Tuberculosis

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Introduction:

Current indications for the use of endotracheal stents include lung cancer, airway strictures, tracheobronchomalacia, and other lung diseases that occlude the airway. Rarely are endotracheal stents used for the management of patients with tuberculosis as only 4% of tuberculosis cases involve the trachea.

Though endotracheal stents may maintain a patent airway and provide symptomatic benefit, significant complications do exist such as pneumothorax, hemoptysis, stent migration, stent obstruction, infection, fibrosis, granulation tissue overgrowth, stent fracture and tumor ingrowth and must be considered for proper airway management.

Case Description:

A 68-year-old male with a past medical history of hypertension, type 2 diabetes mellitus, chronic kidney disease, and an active tuberculosis infection undergoing treatment with RIPE therapy presented with tracheal stenosis due to granulomatous tissue obstruction in the distal trachea near the carina.

An endotracheal stent was deployed and upon follow-up bronchoscopy for stent evaluation. The patient experienced multiple cardiopulmonary arrests after brief periods of breathing in room air. After one such sudden respiratory decompensation, bedside bronchoscopy by the on-call anesthesiologist revealed endotracheal stent migration covering bilateral mainstem bronchi with copious secretions in the netting of the stent blocking any effective oxygenation. Secretions and mucus plugs from recurring pneumonia were believed to be at the root cause of multiple airway decompensations. Subsequently, the patient was transferred back to interventional pulmonology where bronchoscopy of the trachea revealed appropriate airway remodeling and early stent removal after only 2 months. The patient had no further sudden hypoxic decompensations.

Discussion:

Complications with the use of endotracheal stents include pneumothorax, hemoptysis, stent migration, stent obstruction, infection, fibrosis, and stent fracture. The complication rate for endobronchial stent placement is 40-60% and can be as high as 87% within 20 months post insertion.

Hypoxia in a patient with endotracheal stenting undergoing anesthesia or in the ICU requires consideration of common endobronchial/endotracheal stent complications, including stent migrations, stent-associated infections, and stent obstructions due to secretions.

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Resolution of Intraoperative Ventricular Fibrillation by Magnet Removal on a Magnet Deactivated Permanent Automated Implantable Cardioverter Defibrillator

Andrew Myers, MD; Mitchell Weksler, MD

Abstract

This is a case report involving a 66 year old female that developed intraoperative ventricular fibrillation that was resolved by removing a magnet from an automatic implantable cardioverter-defibrillator (AICD) during a left forearm guillotine amputation under regional anesthesia with monitored anesthesia care (MAC). This patient was admitted for mechanical ground level fall after syncopal event and subsequent implantable cardioverter defibrillation while at home following a hemodialysis session. She had a past medical history of dilated cardiomyopathy (ejection fraction of 10%), paroxysmal atrial fibrillation on coumadin, systemic lupus erythematosus, end stage renal disease on hemodialysis via a right upper extremity AV fistula, recurrent deep vein thrombosis, and dual lead permanent pacemaker AICD placement for secondary prevention. When she presented to the emergency department, she self-reported AICD firing 3 times in the last 6 months. The device was interrogated and showed that she had several episodes of polymorphic ventricular fibrillation which resulted in defibrillation events. Additionally, because of her fall she was found to have a 4mm right subdural hematoma that required no surgical intervention and a left ankle fracture that urgently underwent an uneventful open reduction internal fixation under regional anesthesia with MAC. Anticoagulation was held for her subdural hemorrhage for two weeks. While recovering as an inpatient she was also found to have a right ventricular thrombus and severe tricuspid regurgitation on transthoracic echocardiogram. Ultrasound of lower extremities revealed superficial venous thrombi, but workup revealed no identifiable cause thus it was attributed to an underlying hypercoagulable state. Throughout her admission she received routine hemodialysis and monitored telemetry showed no episodes of ventricular tachycardia or fibrillation. However, roughly 2 weeks into her hospital course, she became increasingly hypotensive and somnolent and upgraded to ICU for undifferentiated shock. In the ICU she lost pulses in left upper extremity and was taken for emergency vascular surgery for an attempted brachial thrombectomy. For that procedure she underwent a supraclavicular nerve block and received minimal sedation without issue. Postoperatively the left hand was determined to be non-viable per vascular surgery and the orthopedic service was consulted for mid forearm amputation. The patient again underwent a supraclavicular nerve block with 30mL of 0.5% bupivacaine in the preoperative holding area. In the operating room, a magnet was placed over the AICD on the left chest to prevent any electrical interference from the Bovie monopolar cautery and the defibrillator function. She received monitored anesthesia care with a dexmedetomidine infusion at 0.5 mcg/kg/hr. At about 1.5 hours into the case the patient became progressively hypotensive with systolic blood pressures reading 70 mmHg on the arterial line. Intraoperative EKG showed an acute change to ventricular fibrillation pattern so the decision to remove magnet was made. Upon removing the magnet, the patient received a defibrillation shock from her AICD then resumed sinus rhythm. Patient continued throughout the intraoperative period in paced sinus rhythm without hemodynamic concern. This case demonstrates a unique solution for a medically complex patient in the perioperative setting.

Title: Anesthetic Management In A Patient With Hypertrophic Cardiomyopathy Undergoing Total Knee Arthroplasty

Author: Jennifer Nam, MD,¹ Pamela Chia, MD, MS,¹ Rana Movahedi, MD¹

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Background:

Hypertrophic cardiomyopathy (HCM) is characterized by left ventricular hypertrophy with a wide array of clinical manifestations and hemodynamic abnormalities. Symptoms can include fatigue, chest pain, palpitation, and dyspnea. The preanesthetic evaluation for patients with HCM focuses on decreasing risk for dynamic left ventricular outflow tract (LVOT) obstruction, minimizing ischemia, avoiding arrhythmias, and managing chronic medications.¹ Hemodynamic goals during perioperative management include avoidance of hypovolemia, vasodilation, tachycardia and increased contractility.²

Case Description:

A 68-year-old female with a history of HCM, scoliosis and primary osteoarthritis of the right knee underwent a robotic right total knee arthroplasty. Her preoperative stress echocardiogram showed normal LV function with an ejection fraction of 68%, mild asymmetric left ventricular hypertrophy, no LVOT obstruction at rest but with Valsalva, a LVOT gradient of 62mmHg and post exercise of 75mmHg. She also demonstrated systolic anterior motion of the mitral valve with mild to moderate mitral regurgitation.

An adductor canal catheter was placed in the preoperative area for postoperative analgesia. She then underwent a spinal block and monitored anesthesia care (MAC) with a propofol infusion and phenylephrine drip for surgical anesthesia. In the postoperative period, she was started on an On-Q pump infusion with ropivacaine and could ambulate POD 0 with minimal discomfort. She was discharged home on POD 1 and the On-Q pump was removed on POD 3.

Discussion:

This patient underwent a successful total knee arthroplasty with a combination of regional, spinal and MAC anesthesia. She did not have any gradient-related symptoms but had episodic palpitations and SVTs prior to surgery, rate-controlled with low dose metoprolol. This medication was continued in the perioperative period since not only would it help potentially blunt a stress-provoked gradient but also reduce heart rate and prolong left ventricular filling.³ Though there was concern about her scoliosis, she underwent spinal anesthesia with no complications. Starting the phenylephrine infusion at the time of spinal dose administration helped maintain her systemic vascular resistance (SVR) to avoid any obstructive symptoms. It was important to minimize postoperative pain since uncontrolled pain could cause an increase in inotropy and heart rate. Also, her stress echocardiogram demonstrated her LVOT obstruction was more significant when under stress. Thus, it was imperative to have adequate pain control after her

surgery by immediately starting the local anesthetic infusion through her adductor canal along with supplemental oral analgesics in the postoperative area. Overall, the various anesthetic modalities used for this patient helped address each of her hemodynamic goals which included maintaining a normal heart rate, SVR, and contractility, ultimately leading to a positive outcome. For HCM patients with specific hemodynamic considerations, a combination of different anesthetics could be an appropriate alternative.

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Fire Safety in Electroconvulsive Therapy: A Quality Improvement Project

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Burn injuries and operating room fires pose significant risks to patients and staff, necessitating the preparation and implementation of appropriate fire safety protocols. However, this same detailed attention may not be given to procedures outside the operating room such as electroconvulsive therapy (ECT), which has multiple risk factors for skin burns and fire. Here, we propose a fire safety protocol for the ECT setting which incorporates the same key points of a traditional operating room fire safety protocol, including procedure risk assessment, possible ignition and fuel sources, and an action plan. For a critical event such as a fire, preparedness and appropriate assessment are essential for patient and provider safety.

Title: An Unexpected Case of Methemoglobinemia in a Patient with Thoracic Epidural
Authors: Lee Nguyen MD, Einar Ottestad MD
Institution: Stanford University

Background

Use of neuraxial anesthesia is common for postoperative pain control, especially in open abdominal surgeries. Neuraxial analgesia may reduce systemic opioid use, thereby reducing adverse effects of opioids such as respiratory events and ileus. This case report describes a patient who developed methemoglobinemia after undergoing combined general and neuraxial anesthesia.

Case Description

A 59-year-old woman (4'11" 55 kg) with history of high-grade serous carcinoma of gynecologic origin and unprovoked pulmonary embolism underwent radical cytoreductive surgery including bilateral oophorectomy, colectomy, tumor debulking, and partial abdominal wall resection. Preoperatively, a thoracic epidural was placed at T9-10 levels in anticipation of postoperative pain. Intraoperative analgesia was achieved through epidural infusion of bupivacaine 0.25% at 4-6 mL/hr. Postoperatively, she was transitioned to bupivacaine 0.0625% at 8 mL/hr per our institutional guidelines. On postoperative day (POD) 1, there was insufficient dermatomal coverage of her incision, therefore bupivacaine was switched to lidocaine 0.5% with the goal of systemic absorption. By POD 2, serum lidocaine levels were $2.1 \mu\text{g mL}^{-1}$ (therapeutic levels 3-5 $\mu\text{g mL}^{-1}$).

On POD 3, she developed acute onset dyspnea and hypoxemic respiratory failure which required oxygen at 15 L/min when previously not requiring any. She denied cough, chest pain, leg pain, and stated this felt different from her prior PE. Her lungs were clear and chest x-ray was unremarkable. Notably, that day she started around-the-clock benzocaine spray and benzocaine lozenges for throat discomfort following endotracheal tube intubation. On 15 L/min face mask, arterial blood gas with co-oximetry showed discordant PaO₂ at 285 mmHg and SpO₂ at 91%. Her methemoglobin level was elevated to 6.5% (normal range 0-2%). A diagnosis of methemoglobinemia was made, and toxicology and intensive care unit were consulted. They recommended supportive care, trending arterial blood gasses, and discontinuing all local anesthetics. Due to her thromboembolic history, a chest CT was ordered. As her oxygenation and methemoglobin levels improved throughout the day, methylene blue was not administered. By the end of the day, she was weaned to room air.

Discussion

During methemoglobinemia, the iron group in hemoglobin is oxidized from Fe²⁺ to Fe³⁺ which does not bind oxygen. This results in decreased oxygen delivery to tissues despite elevated arterial partial pressures. Methemoglobinemia is often acquired from oxidant medications such as local anesthetics. In a systematic review, two-thirds of local anesthetic-induced methemoglobinemia cases were attributed to benzocaine. In this case, despite being within the safe daily limit of lozenges, she was also prescribed throat spray at the maximum recommended dose. Rarely, epidural analgesia has caused methemoglobinemia. Despite having received topical benzocaine, neuraxial analgesia cannot be ruled out as a contributing factor to this patient's symptoms as she was receiving lidocaine at near therapeutic levels. The first line treatment is methylene blue, which produces a reducing agent, leukomethylene blue. Treatment is recommended for methemoglobin levels >30% and asymptomatic, >20% and symptomatic, or lower with cardiopulmonary distress. For patients who receive general and neuraxial anesthesia and develop hypoxemic respiratory failure, methemoglobinemia must be considered a potential cause.

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Background: Very long chain acyl-Coenzyme A dehydrogenase deficiency (VLCADD) is an autosomal recessive genetic disorder that affects fatty acid metabolism. Deficiency in this enzyme can lead to metabolic crisis, cardiomyopathy, and rhabdomyolysis during periods of fasting or increased metabolic demands as energy production increasingly relies on catabolism of fat storage (1). Ryanodine receptor 1 (RYR1) mutation is a rare inherited neuromuscular disorder that affects the sarcoplasmic reticulum calcium release channels of the skeletal muscle. The RYR1 gene mutation has highly variable clinical penetrance, with some patients being asymptomatic, while others can experience exercise-induced rhabdomyolysis and myalgia (2). Both of these genetic disorders are associated with malignant hyperthermia (3). In addition, patients with VLCADD should avoid anesthetics prepared in fat emulsions, such as propofol and etomidate (1).

Case Description: A 10-year-old patient with confirmed RYR1 mutation, VLCADD, recurrent stress-induced rhabdomyolysis, and exotropia presented for bilateral strabismus surgery. Medications included dantrolene 25 mg daily. She was pre-admitted to the hospital one day prior to procedure for initiation of maintenance IV fluids and frequent electrolyte checks. The patient was started on dextrose-containing maintenance fluids while NPO. Preoperative labs were notable for elevated creatinine kinase (280 U/L) and mildly elevated liver function tests.

On the day of surgery, the patient was given intravenous midazolam preoperatively. To prevent accidental exposure to volatile anesthetics, the Aisys anesthesia machine was flushed for 30 minutes prior to the case, charcoal filter was added to a fresh new breathing circuit, and carbon dioxide absorbent was replaced. All possible malignant hyperthermia triggers were removed from the room. General anesthesia was induced and maintained with ketamine, dexmedetomidine, and remifentanyl. Rocuronium was used for muscle relaxation. Intubation with direct laryngoscopy was uneventful. Patient remained hemodynamically stable and normothermic throughout the case. Bispectral Index System was used to monitor depth of anesthesia. Maintenance IV fluids continued at the same rate during the procedure. Labs were not checked intra-op given the short duration of the case. Neuromuscular blockade was reversed with sugammadex and the patient was extubated and brought to PACU without issue.

Patient remained stable in PACU and inpatient overnight. Post-op labs were unremarkable with downtrending creatinine kinase (181 U/L). She was discharged the following day.

Discussion: This case posed a unique challenge, as the patient has two rare genetic disorders that increase her morbidity and mortality with anesthesia. Coordination and communication between anesthesia, surgical, genetics, and pediatrics teams were critical as VLCADD patients are at high risk of cardiac arrhythmia and sudden death under catabolic stress (1). Given the severity of her VLCADD, propofol and etomidate were avoided as advised by her genetics provider. Since both VLCADD and RYR1 mutations are associated with malignant hyperthermia, we followed MHAUS' prevention guidelines (4). All possible triggers were removed from the operating room, including volatile anesthetics and succinylcholine (5). Propofol was also removed from the room

to avoid accidental use in the setting of VLCADD. Additionally, the malignant hyperthermia cart was placed in the operating room and accessible to providers.

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Gone Too Far?: Intentional Right Mainstem Intubation

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One lung ventilation is utilized to assist a variety of surgeries on thoracic or mediastinal structures. It can be achieved by using bronchial blockers (BB), double lumen tubes (DLT), or endobronchial tubes. A 66-year-old female was initially admitted to the medical ICU for sepsis and acute hypoxic respiratory failure requiring intubation and mechanical ventilation. Patient subsequently underwent Video-Assisted Thoracoscopic Surgery (VATS) for persistent left sided loculated pleural effusion/empyema. Initial attempt for one lung ventilation using a bronchial blocker was unsuccessful due to inability to seat BB into left main bronchus. It was later found that the cuff popped from chipped teeth as balloon was not able to be inflated on subsequent attempts of placing BB. No other properly sized BBs were available at the time. 2nd attempt using DLT was unsuccessful because team was unable to pass DLT due to very anterior larynx and inability to manipulate neck into proper extension. 3rd attempt involved re-intubating with 8.0 endotracheal tube into right mainstem bronchus for purpose of one lung ventilation. Fiberoptic scope used to confirm placement. Throughout all attempts at placing airway, patient tolerated the procedure well with no desaturations noted. Case proceeded well without issue and no other perioperative complications were observed. Although right mainstem intubation has traditionally been seen as a “misplaced airway” that requires fixing, this case illustrates that under appropriate circumstances right mainstem intubation is a viable option to help safely facilitate thoracic surgery when one lung ventilation of the right lung is desired.

Title: Intraoperative Transesophageal Echocardiography Helps Identify a Malignant Intrapericardial Mass: A Case Report

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Background:

Primary cardiac lymphoma is rare, commonly clinically silent, and often discovered post-mortem. Even when symptomatic, the prognosis of cardiac lymphoma is poor as diagnosis is usually delayed.¹ We present the case of a young male with progressive dyspnea and describe the role of intraoperative transesophageal echocardiography (TEE) in diagnosis.

Case Description:

A 45-year-old male presented to an outside hospital with progressive dyspnea and was found to have a large right sided hemothorax. A right sided chest tube was placed with serosanguinous output. He was transferred to our hospital for a higher level of care. On arrival, he was in respiratory distress and intubated. He had persistent tachycardia to 140 beats/min and transthoracic echocardiography demonstrated a large pericardial effusion. Pericardiocentesis yielded 1300 mL of fluid. He had refractory hypotension on norepinephrine, vasopressin, phenylephrine, and epinephrine, and veno-arterial extracorporeal membrane oxygenation (VA-ECMO) was initiated. He developed an evolving groin hematoma and was emergently taken to the operating room for revision of the right distal cannula.

In the operating room, the endotracheal tube was clamped for transfer to the anesthesia machine as the peak end expiratory pressure was set to 12 mmHg. His ventilation was poor with high peak airway pressures and end-tidal CO₂ was absent. When the endotracheal tube was disconnected, copious pink frothy secretions poured out. Greater than 1.5L of fluid was removed and ventilation improved. TEE demonstrated a large mixed echogenicity mass anterior to the right ventricle and cardiac tamponade. Based on these findings, a subxiphoid pericardial window was performed and identified a firm, white mass that was biopsied. The femoral VA-ECMO catheter was successfully replaced along with a distal perfusion catheter. Pathology demonstrated a T-lymphoblastic lymphoma/leukemia. He received chemotherapy, and he was weaned off vasopressors and VA-ECMO several days later, but he ultimately succumbed to his disease.

Discussion:

Malignant intrapericardial masses such as lymphoma can lead to life-threatening complications including cardiac tamponade.² Although there are no specific guidelines for the management of these rare cases, echocardiography has proven useful for assessing cardiovascular function, structure, and compression.^{3,4} Intraoperative TEE was instrumental in identifying the etiology of cardiogenic shock and prompted the surgeon to perform a pericardial window.

Intraoperative management was complicated by cardiac tamponade, cardiogenic shock, flash pulmonary edema, and ventilatory difficulty. Although VA-ECMO maintains oxygenation and arterial CO₂, maintenance of pulmonary ventilation is important to limit lung damage and improve outcomes.⁵

This case demonstrates the nebulous presentation of primary cardiac lymphoma and highlights the immense challenge of caring for a patient with cardiac tamponade, cardiogenic shock, and flash pulmonary edema. TEE was instrumental in identifying tamponade etiology and expedited the diagnosis of intrapericardial lymphoma.

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Title: Innovative, High Fidelity, Repetitive Intentional Airway Practice Utilizing Knowledge Donor Cadavers at the Medical Student Level

Authors/Institution: Emma Parenteau¹, Zohal Sarwary¹, Kristina Chapple¹, Hahn Soe-Lin MD^{1,2}

Creighton University School of Medicine¹, Trauma Surgery & Surgical Critical Care Department at St. Joseph's Hospital and Medical Center²

Introduction:

Procedural experience of direct laryngoscopy, video laryngoscopy, or emergency surgical airway (cricothyroidotomy or slash tracheostomy) is commonly an opportunity afforded only to residents and fellows. The traditional apprenticeship model of medical education exposes trainees to high acuity, high stakes clinical scenarios at the cost of increased patient safety risk. The advent of dedicated “airway teams” in hospitals has further improved patient safety outcomes by shunting these high risk procedures to high volume dedicated teams of experts, but at the cost of decreased live patient experience in emergency settings for students in training. Presently, early exposure to intubation for trainees includes synthetic patient simulators which aim to mimic human anatomy but are not qualitatively similar. Enhanced medical student (MS) training can lead to improved patient outcomes and efficiency in high stakes clinical scenarios. To bridge the learning gap from medical school to advanced airway procedures, we aimed to train MS using high fidelity, deceased whole body donors referred to as Knowledge Donors (KD) preserved with a novel non-formaldehyde solution maintaining their tissue turgor, neck and pulmonary compliance. Combining repetitive, intentional training with high fidelity KDs, this pilot study creates an innovative model for intubation demonstrated by accelerated learning curves, student confidence, and competency at no risk to patient safety.

Methods:

Second year MS (MS2) were provided with instructional guides, videos, and in-person demonstrations on both manikins and KDs. Students then completed a series of 3 intubation procedures on KDs (2 female and 1 male). The primary outcome was procedural competency and time to completion by an experienced proctor. Secondary outcomes measured self-reported confidence via pre and post simulation surveys.

Results:

9 MS2s completed intubations. 13/27 intubations placements were judged as proficient with the majority of failures due to verbalizing appropriate steps. Of the failures, 8/9 did not repeat the same mistakes.

Efficiency measured by the time (in minutes) to complete intubation (2.8, 2.2, 1.5; $P < .001$) decreased significantly after repetition.

Participating MS2s were able to demonstrate competency by verbalization of ET tube location, equipment, and administered medication.

Analysis of the pre and post surveys found that students reported increased confidence in procedural competency following the simulation with KDs.

Conclusion:

In this pilot study, we have demonstrated that novice learners can achieve increased competency, efficiency and confidence on intubation with few repetitions by incorporating high-fidelity KDs into their training. Further studies are necessary to correlate this finding to performance in live clinical settings.

Title: Molecular dissection of Right Ventricular Remodeling in Pulmonary Arterial Hypertension: Unraveling of Novel Therapeutic Targets

Authors: John Park MD, PhD, Somanshu Banerjee PhD, Soban Umar MD, PhD

Introduction: Right ventricular (RV) function is a significant prognostic determinant of morbidity and mortality in pulmonary arterial hypertension (PAH). The adaptation of the RV to elevated pulmonary pressures can lead to extensive RV remodeling that contributes to RV dysfunction and arrhythmias. Here, we dissect the RV transcriptome of PAH rats with significant RV failure to further understand the pathogenesis of RV fibrosis and its relationship with metabolism and arrhythmogenesis.

Methods: Adults male Sprague Dawley rats received either a single subcutaneous injection of pulmonary endothelial toxin Monocrotaline (MCT), VEGF-receptor antagonist SU5416 with 3-weeks of hypoxia (10% oxygen) followed by 2-weeks of normoxia (SuHx), or PBS for control (PBS). PAH and RV failure were confirmed by echocardiography and RV-catheterization. RNA sequencing was performed on rat RV tissue, followed by differential expression and pathway analysis. RNA and protein expression were measured using qPCR, immunofluorescence, and western blot. Metabolites were extracted from RV tissue followed by LC-MS analysis at UCLA Metabolomics Core Facility. Rat RV transcriptome were compared against patients with decompensated RV function with end-staged PAH using the publicly available Gene Expression Omnibus dataset (GSE198618). The transcriptomes were queried against full connectivity map data to identify perturbagens. Pharmacological administration of BAPN or thrombospondin-4 (THBS4) siRNA to PAH rats were administered intraperitoneally or intravenously, respectively.

Results: Both MCT and SuHx rats had severe PAH, RV hypertrophy and RV dilation compared to control. Transcriptomic analysis of differentially expressed genes in the RV from MCT and SuHx revealed significant dysregulation of biological pathways involved in cardiac fibrosis, metabolism, and arrhythmogenesis. Similarly, PAH patients with decompensated RV (HdRV) showed comparable signature as MCT and SuHx rats. We identified Lysyl Oxidase-like (LOXL) and THBS4 as one the top extracellular matrix proteins involved in fibrosis from MCT, SuHx, and HdRV, which was validated using western blot and immunohistochemistry. To identify metabolic dysregulation associated with cardiac fibrosis and RV hemodynamics, we analyzed metabolites in RV of SuHx and MCT rats. We found key dysregulated metabolites involving glycolysis, oxidative phosphorylation, fatty acid metabolism, inositol metabolism, and citric acid cycle. Given the causal roles of altered ATP-signaling and calcium homeostasis with arrhythmias, we identified 15 common transcripts encoding various ion channels among MCT, SuHx, and HdRV. We used data-driven repurposing with the transcriptome signature to predict drug candidates that can be used to reverse altered gene expression in fibrosis, metabolism, and arrhythmias. Pharmacological inhibition of LOXL or THBS4 in PAH rats attenuates RV hemodynamics and fibrosis.

Conclusions: Our comprehensive RV transcriptomic and metabolomic analysis of MCT, SuHx, and HdRV identified significant biological pathways involving cardiac fibrosis, energy metabolism, and ion channels. We showed an intimate relationship between these biological pathways and together may act as substrates for RV failure and malignant arrhythmias. We highlighted potential molecular targets for pharmacological interventions involved in RV remodeling in hopes to treat RV failure and arrhythmias.

Title: Novel Approach For Treating CP Upper Limb Spasticity With Radiofrequency Neurotomy

Authors: Kishan Patel, M.D., Muhammad Maaz, MBBS., Jeremy Chastain M.D.

Introduction:

The use of Radiofrequency Ablations for pain is based on the premise that the transmission of currents near nociceptive pathways interrupt pain impulses.¹

RFAs are generally targeted at sensory nerves so motor function can be preserved. After a literature search, we did not see many examples of RFAs being used for the intentional ablation of motor nerves.

Case Presentation:

Patient is a 29M who was born with Cerebral Palsy. Patient initially presented with concerns of left shoulder pain and spasticity of the upper extremity. Parents were concerned about the patient accidentally pulling out his GJ tube. He previously had treatments to address the issue including surgical neurotomy and Botox.

Initially we had attempted a Axillary RFA which provided relief for only one week. We then attempted a combined Axillary and Suprascapular RFA in hopes of targeting some motor nerves as well. However, the spasticity returned after 2 weeks. It became apparent that the movement at the shoulder and elbow was leading to this pulling behavior. At that time, we decided to proceed with another RFA of the brachial plexus, this time at the interscalene level to find a more proximal target. We then utilized the RF needle to help identify the specific motor response we were looking to eliminate. The brachial plexus was identified and traced up to the interscalene level. The needle was directed towards the plexus and once it was placed in the proper location; the generator was used to provide motor stimulation to identify the trunk responsible for the deltoid. We targeted this to prevent shoulder abduction via the deltoid muscle. Once the proper motor response was identified, the ablation was performed. In his follow up, the patient's parents endorsed that he had a significant reduction in spastic episodes of his extremity and pain, thus indicating that the procedure was successful.

Discussion:

The brachial plexus arises from the C5-C8 and T1 cervical nerve roots. Two nerves affected in this block that stick out are the Musculocutaneous and Radial nerves. These nerves innervate the flexor and extensor muscles of the arm and forearm respectively.² The axillary nerve block is also reliably blocked and it innervates the deltoid muscle.

Brachial Plexus blocks have been used in a variety of procedures involving the upper limb and shoulder to help alleviate acute pain. In that sense, ablations of the brachial plexus at various levels can be a useful method to treat conditions such as spasticity as well. However, their actual clinical significance is still somewhat unclear. This warrants further studies to see if these results can be applicable to a larger patient population.

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Title:

CRISPR Mediated Chemotherapy wit Destruction of Recurrent Therapy-Resistant Glioblastoma Multiforme

Introduction:

Glioblastoma (GBM) is a common and lethal primary brain cancer. Despite treatment, growth of recurrent tumor occurs frequently and often leads to therapy resistance and patient demise. At recurrence, a third to a quarter of all gliomas have hypermutated genomes following chemotherapy, with mutational burdens orders of magnitude greater than in normal tissue. Such tumors result in poor survival, making novel therapies an urgent need. CRISPR systems have revolutionized medicine by enabling genome engineering through RNA-guided introduction of DNA double-strand breaks. We leverage hypermutation to exploit two avenues of cancer vulnerabilities. First, we quantified mutational landscape progression in a patient's GBM by whole-genome sequencing and uncovered targetable repeat elements. We show that CRISPR-mediated genome destruction by targeting highly repetitive loci enables rapid elimination of GBM cells, an approach we term "Genome Shredding". We investigate repetitive targets across vertebrates to define minimal thresholds for efficient cell ablation and identified the non-coding genome as key source of effective and conserved targets for Genome Shredding. Secondly, we identify unique sequences in a patient's recurrent GBM that carry a chemotherapy mutational signature, demonstrating a path for the destruction of cancer through genome-specific CRISPR targeting

Methods:

Competitive proliferation assay

To assay the effect of Genome Shredding on cell viability and depletion, U-251, LN-229, T98G, LN-18, SF11411, GL261, and DF-1 cells with or without Cas9 expression were transduced at ~50-70% efficiency with lentiviral vectors to deliver mNeonGreen tagged sgRNAs. The percentage of mNeonGreen+ cells was quantified by flow cytometry at 1-, 2-, 3-, 5-, and 7-days post-transduction.

Quantification of sgCIDE Targets

Reference genomes for the hg38, mm10, and gal6 assemblies of the human, mouse, and chicken genomes were downloaded from the UCSC genome browser. FASTA files were extracted and the GuideScan was utilized to determine the identity, coordinate, and target occurrence of gRNAs in the Cas9 CRISPR system. Circos plots were generated using the Circa software.

Results:

Genome Shredding enables rapid cell elimination

Propidium iodide (PI) staining and quantification of live cells revealed that sgCIDEs induced growth inhibition starting at day one post-transduction, and cell death starting as early as day two. These experiments show that targeting of highly repetitive sequences leads to rapid elimination of GBM cells.

Chemotherapy Signature

In the recurrent GBM, we discovered 129 unique essential gene loci. Variant analysis revealed that >99% of unique targetable essential gene mutations in the recurrent GBM were C>T conversions. Together, this demonstrates that TMZ-signature mutations in recurrent GBM can result in unique, cancer-specific sequences that are targetable by CRISPR.

Conclusions:

We demonstrate CRISPR system's ability to be used as a novel cancer chemotherapy that is effective at stages where a cancer is recurrent, metastatic, or chemo-resistant. We provide an innovative paradigm leveraging the non-coding genome and therapy-induced mutational signatures for robust GBM cell depletion and treatment of recurrent GBM, and other tumors with hypermutated genomes. This novel and innovative approach to cancer therapy signals a pathway in which anesthesiologists can become CRISPR oncologists as this therapy will require careful close, intensive monitoring, as CRISPR based medicine is administered systemically. The design, administration, and management of CRISPR based chemotherapy is ripe for the field of anesthesiology.

Title: Subarachnoid Infiltration Following Retrobulbar Block for Ophthalmic Surgery

Authors: Ryan C. Phan, MD¹; Evan Bohnenblust, MD¹

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Background: Most ophthalmologic procedures in adults are performed under local anesthesia (LA). Ophthalmic nerve blocks effectively achieve akinesia and analgesia, providing optimal surgical conditions without the need for general anesthesia. Commonly used regional anesthesia techniques include retrobulbar (intraconal), peribulbar (extraconal), and sub-Tenon's (episcleral) blocks. Central nervous system (CNS) toxicity is a rare but potentially devastating complication of retrobulbar anesthesia.

Case Description: A 69-year-old female presented for right eye cataract extraction with intraocular lens implantation. Her medical history included insulin-dependent diabetes mellitus and hypertension. On preoperative assessment, the patient was afebrile, heart rate 107/min, blood pressure 148/58 mmHg with an unremarkable physical exam. She received 0.5mg midazolam prior to transport to the operating room. In preparation for retrobulbar anesthesia, 25mcg fentanyl was administered. After negative return of blood on aspiration, retrobulbar block was performed with a combination of 1.5mL of 2% lidocaine and 1.5mL of 0.75% bupivacaine. One minute after the injection, she became tremulous and acutely agitated with complaints of perioral and contralateral eye pain. Three minutes later, she was unresponsive to verbal stimuli with concurrent tachycardia to 154/min and blood pressure 150/120. On ophthalmology exam, she had developed contralateral ophthalmoplegia. The planned procedure was aborted, and the patient was transported to the recovery unit with immediate evaluation by neurology. Postoperative labs and imaging were unremarkable. She was observed for 4 hours with full recovery and subsequently discharged.

Discussion: Incidence of CNS complications following retrobulbar block has been shown to be 0.044% to 0.27%. CNS spread of LA can occur via subarachnoid injection through infiltration of the dura mater sheath of the optic nerve or directly through the optic foramen leading to partial or total brainstem anesthesia. Symptoms of subarachnoid infiltration include agitation, ptosis, mydriasis, dysphagia, dizziness, confusion, contralateral ophthalmoplegia, loss of consciousness, respiratory depression or arrest, and cardiac arrest. Treatment is supportive, with oxygen therapy, antiepileptics, vasopressors, and airway management potentially required. Our case demonstrates a clinical picture consistent with subarachnoid infiltration given the patient's acute agitation, contralateral ophthalmoplegia, and unresponsiveness following administration of a retrobulbar block. While subarachnoid infiltration is rare, it is worth considering whether alternative methods of anesthesia would be indicated for this patient if she were to return for surgery. Retrobulbar anesthesia was once considered the "gold standard" for ophthalmologic procedures. Topical anesthesia or a sub-Tenon's block both represent viable alternatives with less risk of CNS complications compared to retrobulbar blocks, while avoiding general anesthesia. In comparing these alternatives, sub-Tenon's blocks provide greater analgesia and less discomfort compared to topical anesthesia. It is crucial for anesthetists to recognize possible adverse reactions to ophthalmic nerve blocks and effectively manage any complications.

Title: Designing a Targeted Intervention to Decrease Perioperative Blood Wastage

Authors: Thibault Philippine, Christine Nguyen-Buckley, MD

Institution: David Geffen School of Medicine at UCLA, Los Angeles, CA, USA

Introduction

Donated blood products are indispensable resources, however the COVID pandemic has compounded supply issues and resulted in unprecedented shortages^[1]. One modifiable, institutional contributor is blood product wastage. Prior efforts have shown that simple, low-cost solutions can lead to marked reductions in waste, which would help alleviate supply deficits ^[2-5].

We aimed to identify perioperative sources of blood product waste and to address them with simple, targeted interventions.

Methods

We used Plan-Do-Study-Act (PDSA) methodology. Blood product wastage data was obtained from UCLA Ronald Reagan Hospital and was narrowed to the perioperative setting. We then created a brief, pre-intervention survey to assess confidence and knowledge in blood product ordering, storage, and return. Confidence was measured on a scale of 1-5, and knowledge of proper storage conditions for products was assessed. The survey was distributed to anesthesiology attendings and residents, perfusionists, CRNAs, nurses, technicians, and hospital assistants. Based on the data and survey results, a multidisciplinary team designed interventions to target identified sources of blood product waste.

Results

Institutional blood wastage is tracked as a percentage of total units issued (WAPI) and is ideally less than 1% ^[2]. During a 12-month period at our center, WAPI was measured at 0.57%. Of these wasted units, the perioperative setting was responsible for 29% of red blood cells (RBC), 55% of fresh frozen plasma (FFP), 53% of platelets, and 68% of cryoprecipitate. The most significant sources of waste were inappropriate storage resulting in unacceptable temperatures, ambiguity in the return protocol resulting in misplaced products, and expiry of ordered but unused units. The survey garnered 78 responses, and revealed a mean confidence rating of 4.2/5 for ordering, 4.0/5 for storing, and 3.3/5 for returning blood products. Of note, anesthesia residents identified their uncertainty in the return process with a mean rating of 2.24/5. Storage conditions were accurately identified by 100% of participants for RBCs, 97% for FFP, 88% for platelets, and 69% for cryoprecipitate.

Targeted interventions included educational outreach via announcements to perioperative staff, reminder emails, and posted materials in well-trafficked locations. Educational initiatives emphasized appropriate storage conditions, ordering indications, and clarified the return protocol for unused products. We revised existing platelet and cryoprecipitate labels to clearly indicate they were not to be refrigerated, and created visual aids on transport coolers.

Conclusions

This quality improvement project utilized PDSA methodology to identify sources of blood product waste and develop targeted interventions to address them. An evaluation of the interventions via the analysis of subsequent wastage data and a post-intervention survey is planned.

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Title: Retrospective Cohort Study of Pheochromocytoma: The Perioperative Perspective

Authors: Daniel Plack, Amy Kloosterboer, Jai Madhok, Fred Mihm

Institution: Stanford University Hospital

Introduction: Pheochromocytoma is a neuroendocrine tumor that involves adrenal medullary cells (or extra-adrenal paragangliomas) that secrete a variable amount of catecholamines. Secretion of epinephrine (E) and norepinephrine (NE) by these tumors can result in dangerous changes in blood pressure and organ injury that correlate with the patient's preoperative symptoms of headaches, palpitations, panic attacks, diaphoresis, fatigue, and more. These patients are classically started on alpha- and beta-adrenergic blockade prior to surgery. Surgical resection of pheochromocytoma poses a unique challenge to anesthesiologists as manipulation of these tumors is linked to unpredictable swings in blood pressure throughout the operation from catecholamine release. We examine the pheochromocytoma experience at a single center where the perioperative anesthetic care is virtually completely provided by a single anesthesiologist with decades of experience.

Methods: This study was approved by Stanford Institutional Review Board. The electronic and paper medical records of 154 patients that were evaluated for possible pheochromocytoma by a single anesthesiologist were reviewed. Those who did not undergo surgery and those who did not have pathological confirmation of pheochromocytoma after resection were excluded.

Results: 83 patients had pathological confirmation of pheochromocytoma. Date of surgery ranged from July 1998 to December 2019. The average age was 53-years-old. 45% were male. 33% had an open resection vs. laparoscopic. 34% had preoperative diabetes mellitus. For patients with known plasma metanephrines, 63% were mixed NE/E, 31% were NE-only, and 6% were E-only secreting tumors (normal values for plasma metanephrine <0.50 nmol/L and plasma normetanephrine < 0.90 nmol/L). Patients were on an average of 1.7 anti-hypertensive medications preoperatively. 16% of patients had a preoperative troponin elevation suggesting active myocarditis.

45% of patients had hypotension during the operation after resection requiring at least one vasopressor infusion. 35% of all patients had post-operative hypotension requiring a vasopressor infusion in the ICU. 10% of all patients remained on vasopressors after 24 hours in the ICU.

All patients were started on a D5W infusion in the postoperative period. 29% of patients required additional treatment for hypoglycemia in addition to D5W, from either D50 boluses or escalation to D10 or D20 infusions. Of those treated for hypoglycemia, 29% had a preoperative diagnosis of diabetes mellitus. 36% of patients with mixed NE/E tumors were treated for hypoglycemia compared to 25% with E-only and 21% with NE-only secreting tumors.

Conclusions: Virtually all patients were on preoperative alpha blockade with an average of 2 anti-hypertensive agents. 94% of pheochromocytomas in this cohort were NE-only or NE/E-producing. While most patients did not require vasopressors in the post-operative period, predicting who will remain problematic. Some patients, 35%, will become hypotensive in the postoperative period or have intraoperative hypotension that persists after surgery and anesthetic recovery. A preoperative diagnosis of diabetes mellitus, which is classically attributed to catecholamine-driven insulin resistance in this

patient population, is a poor predictor of post operative hypoglycemia. Rates of post operative hypoglycemia are highest in patients with E-secreting tumors. Anesthesiologists should continue to have a low threshold for direct ICU admission in the post-operative period for patients undergoing pheochromocytoma resection.

Abbreviations:

E: epinephrine

NE: norepinephrine

Title: Does Methadone Increase Constipation and Post- Operative Ileus Risk in Major Spine Surgery: A Retrospective Case-Control Study

Authors/Institution: Romain Rabany, Colin Kirsch, Emma Parenteau, Areen Badwal, Zohal Sarwary, Brian Wilhelmi M.D. J.D. Creighton University School of Medicine

Introduction: Postoperative ileus (POI) and severe constipation (SC), defined as a pathophysiological state of reversible inhibited motility 48 hours post-surgery, are common complications, with an incidence rate of 10-30% for all surgeries. Due to the nature of POI and SC, both conditions have the possibility of delaying progression of care, extending hospital length of stay, increasing morbidity and mortality, and requiring extension of additional surgeries to fix the iatrogenic disease.

POI and SC have been linked to stimulation of the peripheral mu opioid receptor, as such, Methadone is gaining traction as a pain analgesic. Presently, the use of intraoperative Methadone and its relation to POI and SC in Multilevel Spine Surgery (MSS) has not been extensively investigated. A better understanding of methadone and its effects perioperatively relating to POI and SC can help reduce morbidity and mortality related to surgery as well as hospital efficiency.

Methods: This retrospective case-control study of patient charts included 286 adult patients who underwent a multilevel spinal surgery (MSS) from May 2013- March 2019 at the Barrow Neurological Institute at St. Joseph's Hospital and Medical Center. Electronic patient chart records were accessed through the Cerner Electronic Medical Record System. Exclusion criteria included: preoperative history of severe constipation prior to surgery, prior colon surgery resulting in colostomy, and preoperative regular daily use of methadone. The remaining patient records were divided into: MSS post-surgical patients without SC or POI and MSS post-surgical patients with SC or POI. Statistical analysis was done using Microsoft Excel. Continuous variables were compared using the Wilcoxon Rank Sum Test and a chi-squared analysis/Fisher's exact test was used to assess categorical variables.

Results: 282 patients (118 males, 164 females) were included in this chart-review study. Of these patients, 173 had no methadone administered, while 110 had methadone. Both groups did not differ in any major demographic characteristics. Continuous outcomes including hospital length of stay, ICU length of stay, and days until first PT/OT session were not significantly different between the two groups. Post-op outcomes including hypotension, gastroparesis, infection, UTI, AKI, ATN, pneumonia, DVT, PE, dialysis, and dysphagia did not differ between the two groups. One major demographic difference between groups was ASA physical status. A patient with a higher ASA physical status was less likely to get methadone during surgery ($P<0.01$). First 24hr total morphine after surgery were reduced in the non-methadone group compared to the methadone group (113.3mg vs 158.9mg; $P<0.047$). No correlation between the amount of methadone administered and the number of spinal levels operated on during surgery.

No correlation between post-op ileus/gastroparesis and length of surgery or number of levels operated on.

Conclusion: This study found that intraoperative Methadone administration in MSS is not correlated to POI and SC in MSS. Further trials are needed to investigate the effects of Methadone on ICU length of stay as this trending statistic could give reason for the cessation of methadone in MSS.

Epidural Blood Patch for Refractory Headache due to Intracranial Hypotension with Subdural Hematoma following Combined Spinal-Epidural Analgesia: A Case Report

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Abstract

Background:

Headaches are common in the peripartum period with a wide differential ranging from the benign to morbid pathologies. Intracranial subdural hematoma (SDH) in the setting of post dural puncture is an extremely rare but potentially morbid occurrence with important treatment implications [1].

Case:

A 39 year old woman presented to the ER with worsening headache 3 days after receiving combined spinal-epidural (CSE) for an emergent C-section. CT imaging showed a subdural hematoma (SDH). Despite repeat CT imaging showing no expansion of the SDH, ongoing symptoms including hypertension secondary to post-partum pre-eclampsia requiring intravenous magnesium therapy prompted the necessity of epidural blood patching; a MRI demonstrated evidence of intracranial hypotension with cerebrospinal fluid (CSF) extravasation at L2-3 with extension to L1 - correlating to the level of the CSE. Thus, the pain management service performed an L2-3 interlaminar epidural blood patch with confirmation by contrast of spread bilaterally extending to L1 matching CSF leak as seen on MRI. Within 24 hours of blood patch, the patient's pain resolved with no procedural complications including neurologic symptoms in the lower extremities.

Conclusion:

We report an extremely rare complication of combined spinal-epidural analgesia, which can occur due to puncture of spinal dural puncture. We also show that the patient's headache resolved precipitously following an uncomplicated epidural blood patch matching the CSF leak pattern on MRI imaging. The case highlights the opportunity to use MRI imaging and fluoroscopic guidance to ensure optimal epidural blood patching in cases with subdural hematoma secondary to CSF leak.

–Word count: 249/250 max

Citations (1 min, 3 max)

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Woke up with this terrible back pain... I've got COVID?!?

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Introduction

Early vaccines against COVID-19 provided substantial protection, including against several new variants. However, the Omicron (B.1.1.529) variant evaded much of that protection. It also produced a different set of symptoms from the original SARS-COVID-19 virus and its early variants, including a less severe respiratory disease. This heavily mutated variant resulted in flu-like upper respiratory symptoms and myalgia (specifically low back pain) but lower incidence of respiratory distress, which was common with the first variants^{1,2}.

Case description:

Our patient was a 47yo female who reported waking up to 10/10 lumbar pain. She had never experienced this type of pain and thought it might be how sciatica should feel, however it didn't radiate. When completely awake, she noticed other symptoms: malaise, headache, rhinorrhea, fever, nausea, vomiting, and slight shortness of breath. A COVID home test was positive. She said that a hot pad decreased pain to 8/10. Her pain persisted for about 2 days until symptoms began improving with Paxlovid. Her symptoms including back pain recurred at the end of the course for another 3-4 days. Her back pain gradually diminished with the other symptoms, with no recurrence.

Discussion:

This case highlights an interesting presentation of Omicron. The patient's back pain severity tracked that of the other symptoms, disappearing with infection resolution, without recurrence after 2 months. Back pain was not a common symptom before Omicron. The Zoe study, formerly the COVID Symptom Study, is a health research project of British company Zoe Limited which uses a mobile app that runs on Android and iOS³. The Zoe study found that 1 in 5 people with Omicron had back pain, ranking it in top 20 symptoms. There is currently no definitive explanation of Omicron's lower back pain, which highlights the need for further investigation to determine whether it typically resolves with the infection or becomes a chronic condition.

Conclusion:

We hope to emphasize the need for further investigation of unusual COVID symptoms, including any effects of vaccination and/or Paxlovid on their presentation or course, and how COVID-induced back pain may be distinguished from more purely musculoskeletal back pain coincidentally presenting for the first time during COVID illness. Ultimately, we hope that clinicians can better understand this condition/symptom and treat patients experiencing back pain related to Omicron infection.

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Title: Pericapsular Nerve Group (PENG) Block in a 14-year-old male presenting with bilateral hip pain after MVC

Authors: Anna Reviere MSIII, Marshall Reviere MSIII, Ricardo Falcon MD, Tim Petersen PhD, Codruta Soneru MD

Introduction: The pericapsular nerve group block (PENG) is a newly utilized regional anesthetic technique used for hip arthroplasty (1) or for analgesia in ED for hip and pelvic fractures (2). PENG targets the femoral nerve, obturator nerve, and accessory obturator nerve as its articular branches pass between the psoas tendon and ilium at the level of the ilioinguinal ligament (3). This novel block provides analgesia to the hip joint's anterior capsule and to the femoral head and neck.

Case presentation: Our patient was a 14-year-old 63.5 kg previously healthy male. He was in a car accident, and presented to the operating room for Acetabulum ORIF (Right) for acetabular fracture. Surgeon requested a procedural PENG block for optimal postoperative pain control. Ultrasound guidance was used to inject a 30 ml bolus of 0.25% bupivacaine. His general anesthetic was uneventful. The block resulted in adequate pain control with no complications from the procedure. Postoperative pain was lower (FLACC 4,0 in the first 12 hours postoperative), than preoperative (FLACC in the 8's range).

Discussion: There are several options for pain control for hip surgery: opioids, peripheral nerve blocks, neuraxial anesthesia.

While systemic opioids are effective for pain control, their adverse effects (nausea, constipation, depression of breathing), generally worsen patient satisfaction when compared to nerve blocks.(4)

Neuraxial blockade complications include dural puncture, urinary retention, meningitis, leg weakness interfering with early ambulation, backache, transient neurological symptoms, total spinal anesthesia, spinal or epidural hematoma, epidural abscess, meningitis, arachnoiditis, cardiac arrest, urinary retention, and local anesthetic toxicity. (5)

With the PENG block, there is a catheter option allowing continuous local anesthetic infusion, but this was not done for this particular patient.

Conclusion: We present this case to relate our experience with a 14 year old needing emergency surgery requiring general and regional anesthesia. Our approach prioritized hemodynamic stability and postop pain control while minimizing opioids and avoiding the risks of neuraxial approaches. The patient reported pain control as satisfactory.

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Is two hand mask ventilation a better choice during anesthesia induction than one hand ventilation in pediatric population?

Authors: Marshall Reviere MSIII, Umar Cheema MD, Robert Sutter MS, Ricardo Falcon MD, Tim Petersen PhD, Codruta Soneru MD

It is generally accepted that two-handed facemask (FM) ventilation is more effective than one-handed FM ventilation (1,2), raising the question of why it isn't used more often in pediatric anesthesia inductions.

Predisposing factors for pulmonary aspiration include increased gastric contents, increased tendency to regurgitate, and laryngeal incompetence. However, absence of these factors is not entirely protective; aspiration may also occur in patients without any of them, even if fasting. Gastric insufflation during hand ventilation in patients with an unprotected airway can raise gastric pressure, leading to regurgitation and eventual aspiration (3).

The upper esophageal sphincter ordinarily prevents air from entering into the esophagus during breathing, and reflux of esophageal contents into the pharynx to prevent airway aspiration. Similarly, the lower esophageal sphincter (LES) prevents regurgitation of the gastric contents. However, this unidirectional valve function can be deactivated by esophageal distention, which induces peristaltic movements to remove the esophageal content to the stomach or the pharynx. Also, reduction of LES tone and subsequent regurgitation can occur via transient increase in the gastric pressure.

Literature indicates that the 2-hand technique maintains desired tidal volumes (TV) at lower peak pressures than does the 1-hand version. Peak airway pressure of only 15 cm H₂O was associated with gastric insufflation incidence of 35%, according to real-time ultrasonography in an adult study (3). Lower pressures were associated with reduced incidence, perhaps due to a threshold effect.

While research on gastric insufflation during different ventilation techniques in pediatrics is needed, it seems reasonable to attempt to use the technique with reduced incidence of gastric insufflation.

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The Wisdom of an Ischemic Heart

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INTRODUCTION:

Coronary collateral circulation (CCC) describes connections between epicardial coronary arteries. While anatomical CCC are found in healthy patients; importantly, an ischemic myocardium can develop new collaterals and strengthen existing connections. In CAD this dynamic blood flow provides critical blood supply to vascular territories whose original supply has been compromised. Collateral blood flow can prevent myocardial necrosis, and even meet the metabolic demands of an unstressed heart allowing for normal systolic function; however, >90% of patients with a well-collateralized occlusion will experience ischemia and require stenting or surgical intervention¹. We present a case of severe multivessel CAD with impressive CCC undergoing CABG.

CASE:

A 74-year-old male with a 46-pack-year history, T2DM, HTN, HLD, dialysis-dependent ESRD, CAD, and ischemic cardiomyopathy presented for CABG. In 2018 he had an NSTEMI and underwent an atherectomy and stenting to the ostial and proximal LAD. An ECHO performed at that time showed an LVEF of 45% and inferior & anteroseptal hypokinesis. He was started on DAPT and underwent yearly TTE monitoring. The most recent TTE showed normal RV function and revealed a drop in LVEF to 35% with worsening septal hypokinesis. Cardiac catheterization showed right-side dominant circulation and increased atherosclerotic burden: 70% proximal LAD stenosis distal to the prior LAD stent, 99% ostial ramal stenosis, 99% ostial circumflex stenosis, 99% stenosis of the first obtuse marginal stent, and total chronic occlusion of the RCA. The patient endorsed mildly decreased stamina but exercise tolerance remained > 6 METS. He underwent unremarkable 4x vessel CABG. He was weaned off cardiopulmonary bypass with minimal inotropic support, all vasopressors were off by POD3 and he was discharged home on POD9.

DISCUSSION & CONCLUSIONS:

A red blood cell must take an impressive journey to supply this patient's myocardium. For the left lateral territories blood passes through a significantly stenosed LAD > diagonal branches > collaterals > ramus > more collaterals > obtuse marginals > and finally the circumflex artery. From the circumflex artery, these cells can further continue to supply the right heart via collaterals > PLB. Alternatively, right sided myocardium can also receive blood supply via LAD > anterior septal perforators > collaterals > retrograde through inferior septal perforators > PDA > RCA to its proximal total occlusion near its ostium. Despite the lengthy and circuitous route, there remained TIMI 3 blood flow and normal wall motion in the most distal territories.

Although this patient's CAD was progressing, he presented nearly asymptomatic and denied anginal symptoms. His lack of classical cardiac chest pain highlights the power of collateral circulation to mask worsening CAD in an unstressed heart. General Anesthesia can cause myocardial stress through hemodynamic swings and changes to myocardial supply, which may be devastating in a heart reliant on a single coronary artery. As such, Anesthesiologists must use

caution in patients with CAD and optimize hemodynamics during general anesthesia, even if patients are asymptomatic.

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Title

Patient Perceptions of Perioperative Anesthesia Education Among Those Without Anesthesia Consults

Authors/Institutions

Sarah Roberts, McMaster University

Emily Thornburn-Wilson, McMaster University

Introduction

The pre-operative anesthesia clinic consult is a valuable time for anesthesiologists to tailor their anesthetic plan, and for patients to learn more about what to expect in the perioperative period. However, not every patient received a clinical encounter with an anesthesiologist to optimize them for surgery. A questionnaire was developed to assess the impact of anesthesia clinical encounters on patients with regards to their knowledge, preparedness and anxiety in the preoperative period. The results of this study will guide development of a resource to provide patients who have not received an anesthesia clinic encounter.

Methods

Consent was obtained from patients prior to their participation. Questionnaires (paper and QR code to virtual survey) were placed in preoperative packages provided to patients undergoing scheduled surgery. Questionnaires were administered to patients in the Day Surgery department of a community hospital. No identifying data about any of the participants was collected. Wilcoxon-Mann Whitney tests were used to analyze data as variables were assumed to be not normally distributed.

Results

A total of 29 anonymous questionnaires were completed and used in the analysis. Those that met with an anesthesiologist felt more knowledgeable about their anesthetic compared to those who had not ($p < 0.001$). Those who had not previously met with an anesthesiologist wanted to know more about what to expect after surgery (pain, nausea, etc.) compared to those who had ($p = 0.029$). There was no statistically significant difference in the two groups around anxiety, desire to know more about different types of anesthetics, levels of awareness and pain during surgery, or post-operative pain control.

Conclusions

Overall, patients who did not meet with an anesthesiologist in consult prior to their procedure felt less knowledgeable about their anesthetic and wanted to know more about what to expect after surgery compared to those who had met with an anesthesiologist in consult. These findings represent an area of focus for future initiatives aimed at improving patient care experience among those presenting for scheduled surgery who have not completed an anesthesia consult prior to their procedure.

Title:

Systemic absorption of normal saline irrigation during laser TURP and cystolitholapaxy causing severe hyperchloremic metabolic acidosis

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Background:

Monopolar transurethral resection of the prostate (TURP) requires electrically non-conducting irrigation fluids (i.e., electrolyte-free) to avoid thermal burns due to electrical dispersion. These fluids contain osmotically active solutes but remain hypotonic (1); thus, systemic absorption (e.g., > 1,000mL (2)) may result in TURP syndrome (i.e., complications due to hyponatremia and hypoosmolality) (1). In contrast, the risk of electrical dispersion is avoided with bipolar and laser TURP, allowing the use of isotonic electrolyte-containing fluids such as normal saline (NS) that mitigate the risk of TURP syndrome. Additionally, laser TURP results in superior field hemostasis, further reducing systemic absorption of irrigation fluids and overall complications (3). However, despite this, NS use in related procedures is known to cause acid-base disturbances (3-5).

Case Description:

A 79-year-old male with benign prostatic hypertrophy and bladder stones underwent laser TURP and cystolitholapaxy with general endotracheal anesthesia. Surgically, the procedure was technically challenging due to significant nodular hyperplasia/vascularity and recurrent resectoscope outflow clogging during cystolitholapaxy that required clearing with boluses of NS irrigation, each resulting in bladder distension. Continuous bladder irrigation with NS was used throughout, and the total irrigation volume used was unknown but was acknowledged to be more than routine.

After four hours, treatment-refractory hypotension (i.e., vasoplegia (6,7)) and hypoxemia developed with mean arterial blood pressure 50 mmHg and pulse oximetry 65%. Arterial blood gas demonstrated profound metabolic acidosis with pH 7.0, HCO_3^- 12.6 mEq/L, and base deficit -17.5mmol/L and hypoxemia with PaO_2 60 mmHg. Additional labs revealed Na 140 mEq/L, Cl 129 mEq/L, Hgb 9.4 g/dL, and slightly elevated lactate 3.1 mmol/L. Intraoperative transesophageal echocardiography was remarkable for reduced preload due to either hypovolemic or distributive shock (6-10). Following assimilation of this data, bladder perforation was initially considered, and exploratory laparotomy was performed but was unrevealing. The procedure was subsequently completed, but due to on-going hemodynamic instability, the patient was admitted to the intensive care unit intubated with the working diagnoses of distributive shock due to vasoplegia. The suspected etiology was excessive systemic absorption of NS irrigation, resulting in severe hyperchloremic metabolic acidosis (6,7,11) and pulmonary edema due to fluid overload. Following discontinuation of NS irrigation and administration of sodium bicarbonate (4) and diuretics, the patient rapidly improved.

Discussion:

Laser TURP with NS irrigation avoids classic TURP syndrome. However, systemic absorption of NS can occur and result in complications due to hyperchloremic metabolic acidosis (3-5), historically referred to as a dilutional acidosis (12). The fundamental management of dilutional acidosis is administration of sodium bicarbonate, with dosing determined by calculation of the bicarbonate deficit (4).

Risk factors for excessive systemic absorption of NS irrigation in our case included increased prostate size, prostatic vascularity, total surgical time, and the high volume of irrigation fluid used (13). In addition, repeated bladder dilations are known to accelerate systemic absorption (3). In conclusion, when risk factors for systemic absorption of NS irrigation fluid are determined intraoperatively during laser TURP, particularly in the setting of treatment-refractory hypotension (6,7) and/or hypoxemia, hyperchloremic metabolic acidosis and fluid overload must be considered.

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A Parturient with Glanzmann's thrombasthenia : A Case Report

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Introduction

Glanzmann's thrombasthenia (GT), an autosomal recessive bleeding disorder defined by a qualitative or quantitative defect in integrin $\alpha\text{IIb}\beta 3$ - a protein responsible for platelet aggregation, poses risks during pregnancy such as miscarriage and hemorrhage within the antepartum and postpartum period¹. In this case study, we present a 34-year-old G1P0 woman with GT who underwent term Cesarean section (CS) after 2 failed inductions.

Case

Our patient is a 34-year-old G1P0 woman with GT diagnosed in childhood. She had a strong family history of GT, easy bruising, and mucocutaneous bleeding with menses and dental procedures managed with OCPs and aminocaproic acid (Amicar). She was initially admitted at 23w6d with increased work of breathing, upper back pain, and fever and found to have a right pleural effusion and right middle lobe lung mass on CTA chest, presumed to be a hemothorax after a negative infectious and neoplastic workup. She underwent US-guided thoracentesis with chest tube placement and 800cc bloody fluid drained. She was started on factor 7 replacement and Amicar and continued to improve until she was discharged on 2L oxygen. She obtained necessary testing; of note, her antiplatelet antibody screen was negative; thus, no antepartum IVIG was recommended. She was admitted at 38w0d for an induction of labor (IoL) that she ultimately failed, and a decision was made to try for spontaneous labor. She was then admitted at 39w4d for a repeat IoL which she failed again, and finally, underwent CS under general anesthesia (GETA), rather than neuraxial, due to category II fetal tracings. Prior to CS, her Hgb was 11.2 and platelets were 175. She was given 2 units of platelets and 1g tranexamic acid (TXA) preoperatively as well as 1 unit of platelets and 1g TXA intraoperatively. She was observed for 5 days post-operatively without any hemorrhage requiring factor 7 replacement and was subsequently discharged.

Discussion

GT poses multiple threats to both mother and fetus as the mother can develop antiplatelet antibodies which, if transported over the placenta, can result in severe neonatal thrombocytopenia¹. Our case highlights the importance of involving anesthesiologists early in a GT patient's care in order to maximize safety; for example, the decision to undergo GETA vs neuraxial anesthesia due to the risk of hematomas and permanent neurological damage². Overall, we discuss the multidisciplinary approach required in the pre-operative, peri-operative, and post-operative care of patients with GT.

¹ Wijemanne, A., Watt-Coote, I., & Austin, S. (2016). Glanzmann thrombasthenia in pregnancy: Optimising maternal and fetal outcomes. *Obstetric medicine*, 9(4), 169–170.

² Peterson, W., Tse, B., Martin, R., Fralick, M., & Sholzberg, M. (2021). Evaluating hemostatic thresholds for neuraxial anesthesia in adults with hemorrhagic disorders and tendencies: A scoping review. *Research and practice in thrombosis and haemostasis*, 5(4), e12491.

Title

Impact of Race and Socioeconomic Factors on Readmission After Total Knee and Total Hip Arthroplasty: A Retrospective Study

Authors

Joshua Sadik, MD, Theodora Wingert, MD, Tristan Grogan, MS, Pamela A. Chia, MD, MS

Background

Total joint arthroplasty has become increasingly more popular as advances in surgical techniques and perioperative care have streamlined and improved patient outcomes. However, little is known about how patients' socioeconomic status and demographics influence post-operative outcomes following surgeries in which peripheral nerve blocks were employed. Prior studies have found readmission rates following total knee and total hip replacements to range from 2% to 8% in the United States; however, no studies have focused on patient demographics and socioeconomic status in the context of readmission and the use of regional anesthesia perioperatively. The primary goal of this study was to determine whether racial, gender, demographics, and other socioeconomic factors are correlated with readmission after total joint arthroplasty.

Methods

The UCLA Department of Anesthesiology and Perioperative Medicine has the Perioperative Data Warehouse (PDW) that extracts and maintains a repository of validated clinical data from the electronic health record system. From the PDW we analyzed 7,752 patients and evaluated relationships between patient demographics, including race and healthcare payors, with 30 day readmission rates for total knee and hip arthroplasty. We used a chi-squared test with post-hoc analyses on the Pearson residuals to determine if readmission rates differed among groups. All analyses were performed using R statistical software.

Results

Race representation of the patients analyzed as depicted in Figure 1 did not show difference in readmission rates between groups. However, when patients were stratified by healthcare payors, preliminary results found that Medi-Cal patients were more likely to be readmitted 30 days post surgery ($p < 0.05$). Results also suggested that patients with commercial payors were less likely to be readmitted 30 days post total joint arthroplasty ($p < 0.05$). Further analyses to control for confounders and to evaluate the type of regional anesthesia used within each group are in progress.

Conclusion

Despite the perceived equity in patient care, preliminary data suggests that disparities among health care payors exist. Our goal is to understand these differences so we can improve the precision of our medical care by creating customized pathways to help reduce and eliminate these disparities and decrease rates of readmission.

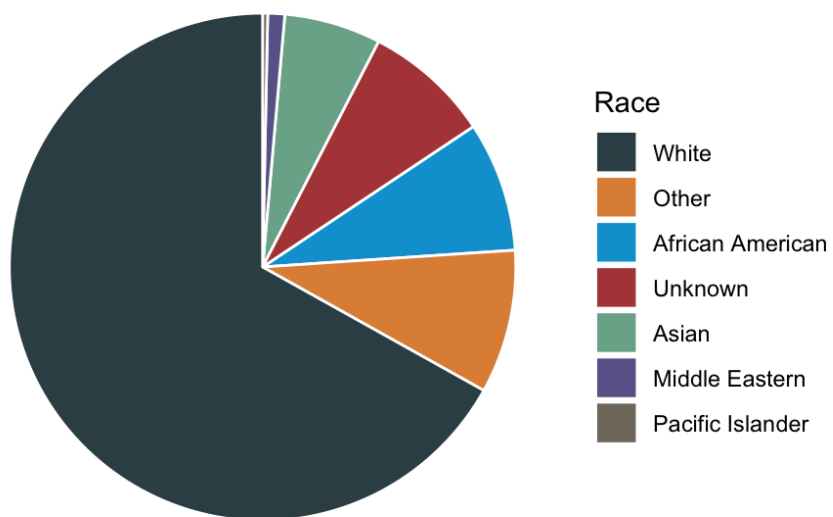


Figure 1. Race representation of 7,752 total joint arthroplasty patients

Submitter: Omar Salman

Pediatric renal biopsies at UCSF and many other institutions are currently performed with pharmacologic sedation or under general anesthesia (GA) to maximize patient comfort and anxiolysis. Although this has become standard practice, there are both short-term and long-term consequences for using sedation and GA, including aspiration, laryngospasm, and neurocognitive effects. Prior studies have evaluated alternatives to pharmacologic sedation for minor medical procedures in pediatric patients, including acupressure, aromatherapy, hypnosis, and music therapy. Virtual reality (VR) is a low-cost and commercially available distraction tool that engages the user in an immersive and interactive experience. Prior studies have evaluated the potential role of VR in reducing pain and anxiety associated with IV placement, port access, induction of GA, and IUD placement. Renal biopsies are a relatively non-invasive and common pediatric procedure performed among patients admitted for transplant surveillance or evaluation. This study aimed to assess the feasibility of VR as an acceptable adjunct to pharmacologic sedation for pediatric renal biopsy patients.

In this nonrandomized feasibility study, 32 children aged 5-17 scheduled for routine renal biopsy at UCSF Benioff Children's Hospital were offered the option to use a virtual reality (VR) headset as part of their renal biopsy experience. The study utilized the Oculus Go VR headset, which displayed an interactive game as an adjunct to pharmacologic sedation. Pre- and post-procedural anxiety and pain, as well as satisfaction with the VR experience, were assessed from the patients and their caregivers, as well as the sedation and biopsy providers. All study subjects were continuously monitored as per standard of care throughout the procedure, including heart rate, respiratory rate and oxygen saturation, as well as total exposure to pharmacologic sedation medications and recovery time. This study assessed each patient's pain and anxiety using multiple validated scales, including the Children's Fear Scale (CFS 0-4 scale), the Childhood Anxiety Meter (CAM 0-10 scale), and the Observation Scale of Behavioral Distress (OSBD 11-point behavioral scale). Using these scales as well as a pre- and post-survey, our study demonstrated that VR is an acceptable adjunct to pharmacologic sedation and may in some cases be sufficient to provide analgesia and anxiolysis as a distraction technology for children undergoing renal biopsies.

Title:

Perampanel Overdose Leading to Need for Critical Care Supportive Measures

Author(s)/Institution(s):

Jaime Jay Sanchez; Ioana Pasca

Loma Linda University, Anesthesiology and Critical Care

Background:

Perampanel is an adjunct anti-seizure medication with a growing number of overdose cases, which generally describe prolonged unconsciousness with complete recovery of baseline mental status. We report a case of perampanel overdose on a patient with reduction of baseline mental status to GCS 3, along with hemodynamic compromise requiring critical care supportive measures.

Case Description:

A 34-year-old male presented to the ED for intermittent worsening hypoxia. Past medical history included intellectual disability, spastic quadriplegia, epilepsy status post (s/p) right frontal craniotomy four years prior, hydrocephalus s/p ventriculoperitoneal shunt placement, chronic hypotension, bradycardia, and hypoxia requiring night-time supplemental oxygen. He was admitted to the floor and started on antibiotics for presumed pneumonia. He continued his home regimen of perampanel, however, he received, by error, perampanel 32 mg instead of the usual 8 mg. The next morning, the patient was GCS 3 with non-miotic pupils. He was hypotensive and had a HR of 39 BPM. Repeat arterial blood gas labs showed worsening hypercapnia and acidosis, and the patient was intubated for respiratory failure and airway protection. Lumbar puncture and other infectious workup were negative. After toxicology and neurology consultations, the acute mental status decline and hemodynamic instability was thought to be due to perampanel overdose on hospital day 1. Treatment included withholding perampanel for 72 hours and supportive care. By hospital day 4, the patient's mental status improved to GCS 10T and perampanel was restarted. On day 5, pressors were weaned off. The patient was discharged on hospital day 10.

Discussion:

This case presents a unique situation in which a patient overdosed on perampanel and had hemodynamic compromise in addition to prolonged unconsciousness. This case shows possible increased severity of perampanel overdose adverse effects for patients with baseline bradycardia and hypotension.

Difficult Airway Management in an Irradiated Neck Resulting in an Emergent Tracheostomy

Authors: Alexa Sangalang MD, Ashley McDonald CRNA, Seema Ghandi MD, Nichlesh Patel MD, Albert Yen MD

Affiliations: University of California, San Francisco Department of Anesthesiology and Perioperative Care

Introduction:

Patients with a history of head and neck radiation therapy (HNRT) are at high risk of difficult airway management due to chronic sequelae such as temporomandibular joint fibrosis and non-compliant neck tissue, leading to trismus and neck inflexibility. Neck radiation changes are the most significant clinical predictor of impossible mask ventilation and 50% of patients with HNRT experience difficult intubation^{1,2}. Below, we describe the case of a patient with history of HNRT who required emergent tracheostomy.

Case:

A 61-year-old female with a history of nasopharyngeal carcinoma, who had undergone multiple rounds of chemoradiotherapy as well as a partial glossectomy, presented with failure to thrive, and chronic aspiration. An MRI with anesthesia was needed for surgical planning for a newly discovered radiation-induced skull base chondrosarcoma. The airway exam revealed a Mallampati IV, poor mouth opening, and limited neck range of motion. The patient had two previous anesthesia records. The first was a difficult intubation in 2018, in which a C-MAC only achieved a grade III view and the epiglottis could not be manipulated, requiring a bougie introducer. The second was two weeks prior to the MRI, in which the patient was an easy mask ventilation and successful intubation with a GlideScope T3 blade (grade IIb view).

For this case, anesthesia was induced with propofol and fentanyl. The patient was masked easily before succinylcholine was given but developed trismus after the medication. A GlideScope blade was able to be inserted (grade IV view), but the Eschmann introducer could not be advanced. What was observed was extremely edematous arytenoids obscuring the pathway through the vocal cords. Intubation attempts using various tools, including the Miller 2 blade and slim fiberoptic scope, both individually, and combined with GlideScope were unsuccessful despite optimizing relaxation with propofol and rocuronium. Likely due to the repeated attempts at laryngoscopy, the patient then became difficult to mask and oxygen saturation began to fall. The patient was reversed (sugammadex, naloxone), and an LMA was attempted, but was unsuccessfully seated. Subsequently, four hand mask ventilation with maximum APL was successful in restoring oxygenation. ENT was called and successfully performed a bedside emergent tracheotomy. The patient was then brought to the operating room to formalize the tracheotomy. While in the OR, ENT had difficulty identifying anatomical landmarks on laryngoscopy due to global laryngeal edema. Subsequently, it was theorized that the chronic aspiration caused continuous inflammatory insult to the arytenoids resulting in an extremely swollen larynx.

Discussion:

Though previously noted as a successful and easy intubation, this patient demonstrates that each situation is unique in and of itself. In situations that predispose to difficult airway management, equipment and preparation for multiple different techniques should be prepared beforehand to allow for ease of progression down the difficult airway algorithm. Awake intubations should be given special consideration for post-HNRT patients, despite previously noted successful intubations. This case emphasizes the importance of thorough preoperative evaluation and having a well-prepared airway management plan with multiple alternate techniques for patients with previous HNRT.^{3,4,5}

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2. Jain D, Khan Joad AS. Head and neck radiotherapy - A risk factor for anaesthesia?. *Indian J Anaesth*. 2020;64(6):488-494. doi:10.4103/ija.IJA_864_19v
3. Kheterpal S, Healy D, Aziz MF, et al. Incidence, predictors, and outcome of difficult mask ventilation combined with difficult laryngoscopy: a report from the multicenter perioperative outcomes group. *Anesthesiology*. 2013;119(6):1360-1369. doi:10.1097/ALN.0000435832.39353.20
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5. Dillon JK, Christensen B, Fairbanks T, Jurkovich G, Moe KS. The emergent surgical airway: cricothyrotomy vs. tracheotomy. *Int J Oral Maxillofac Surg*. 2013;42(2):204-208. doi:10.1016/j.ijom.2012.10.021

Title: Intrathecal Pump Protrusion: A Rare Complication

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Background:

Intrathecal drug delivery systems are effective in treating patients who have chronic or malignant pain while reducing systemic side effects of oral opioid medication. Risk of complication is low, but complete protrusion of drug delivery devices through the abdominal skin has not been reported to our knowledge. This paper highlights the presentation of this very rare complication.

Case Presentation:

A 42-year-old male had an intrathecal drug delivery system implanted approximately five years ago for chronic pancreatitis. For the past year, the pump reservoir had been empty as the patient's pain had improved and the patient no longer needed analgesia. The patient presented to the emergency department with a physical exam demonstrating a protruding pump out of the left lower abdomen. Following two days of intravenous antibiotic therapy and infectious disease clearance, the patient's intrathecal pump was explanted in the operating room without difficulty. The patient was subsequently discharged home a few days later on intravenous antibiotics after intraoperative cultures grew MSSA and enterococcus. The patient was then lost to follow-up.

Discussion:

Intrathecal drug delivery systems are becoming increasingly utilized for the treatment of chronic pain. The implantation of intrathecal pumps, however, comes with increased risk for complications such as granuloma formation or infection. MRIs and high resolution CT scans can ensure rapid diagnosis and early treatment which is vital in the prevention of systemic sepsis and further complications. This patient's intrathecal pump was not being utilized for the past year, and it is unclear if the explant of the pump was previously discussed with the patient. Our case highlights the importance of patient education and determining the appropriate candidate for an intrathecal drug delivery system. This patient was frequently lost to follow-up and did not present to the emergency department until significant protrusion of his pump had occurred. Pain physicians should remain prudent to prevent potential complications of intrathecal pump placement and be prepared to manage such complications.

Management of Perioperative Embolism Accompanying Lower Extremity Bone Fracture and Repair: A Case Report

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Introduction:

Although clinical guidelines have been proposed to recognize early signs of perioperative pulmonary embolism, management can vary significantly depending on emboli location, subtype, and pathogenesis.¹⁻³ We present the case of bilateral pathological proximal femur fractures with surgical reconstruction complicated by intraoperative pulmonary embolism, managed with continuous transesophageal echocardiography (TEE) and consideration of intermittent femoral vein clamping.

Case Report:

A 60-year-old female with progressively worsening bilateral lower extremity pain and past medical history significant for HER 2 negative, ER/PR positive right breast cancer six years status post partial mastectomy. The X-ray and CT scans of the pelvis demonstrated bilateral proximal femur fractures concerning possible osseous metastatic disease. The patient underwent left femur intramedullary fixation under general anesthesia. Intraoperatively, during reaming of the proximal femur, the patient developed sudden decreases in end-tidal (ET) CO₂ and sustained desaturations of 86 to 88 percent on 100 percent FiO₂. Emergent intraoperative TEE revealed multiple pulmonary emboli associated with reaming of the proximal femur (Figure 1). Vasopressors were administered for hemodynamic support and, after discussion with the surgical team, we decided to occlude the ipsilateral femoral vein while reaming the femur to reduce acute embolic load. This maneuver significantly reduced the presence of cardiac emboli as seen on live TEE. The patient was able to recover enough hemodynamically to allow for the completion of the procedure. On postoperative day seven, the patient was discharged under stable conditions with outpatient oncologist follow-up.

Discussion:

Perioperative emboli are associated with the fractures of long bones and the surgical interventions that follow.^{1,3} Clinical guidelines for early recognition have been outlined.^{1,3} In our case, the patient developed decreases in ET CO₂ and oxygen desaturations of 86-88 percent, prompting intraoperative TEE imaging. Increased clinical suspicion of fat emboli was deliberated given its association with reamed intramedullary nailing.² Additional origins were considered including thromboembolism given the patient's history of breast cancer and its increased incidence with orthopedic intervention.¹

The management of symptomatic pulmonary embolism centers on maintaining adequate oxygenation while preserving forward-flowing circulation and end-organ perfusion.^{1,3} We

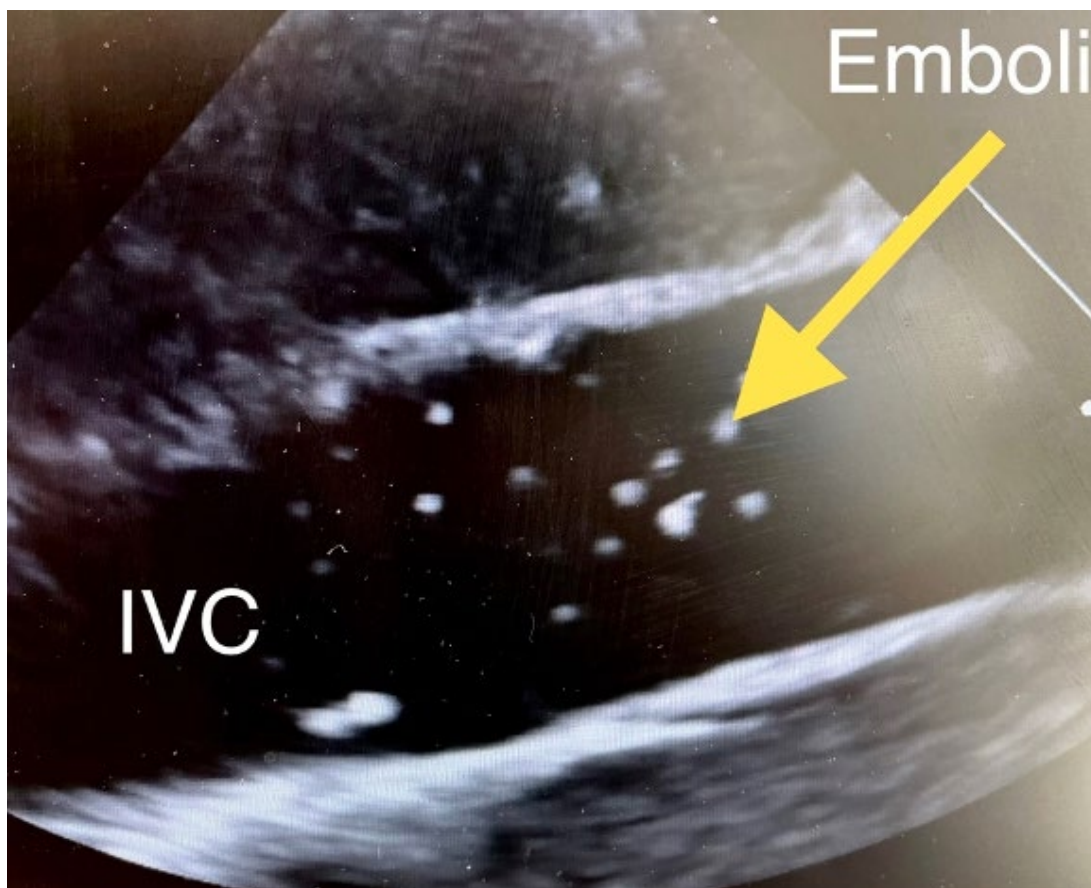
introduce the intraoperative maneuver of TEE monitoring coupled with ipsilateral intermittent femoral vein occlusion while reaming the femur to reduce acute embolic load in high-risk cardiac patients presenting for proximal femur intramedullary fixation.

References:

1. Porres-Aguilar M, Rivera-Lebron BN, Anaya-Ayala JE, León MCG, Mukherjee D. Perioperative Acute Pulmonary Embolism: A Concise Review with Emphasis on Multidisciplinary Approach. *Int J Angiol.* 2020;29(3):183-188. doi:10.1055/s-0040-1709501
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Tables/Figures:

Figure 1. Intraoperative Transesophageal Echocardiogram (TEE) demonstrating circulating emboli in the inferior vena cava (IVC).



Title: Anti-Anesthesia Man: Management in a Patient with Contraindications to Several Anesthetic Agents.

Authors/Institution: Ryan Scott, Anesthesiology Resident, Naval Medical Center San Diego and Michelle Petrie, Pediatric Anesthesiologist, Naval Medical Center San Diego.

Background: In patients with contraindications to common anesthetic agents there is often a need to become creative with our anesthetic management and to maintain proficiency working outside of our usual practice patterns. This can be increasingly challenging in urgent or emergent situations.

Case Description: We present a 37 year old male patient with complicated diverticulitis who was in need of an urgent exploratory laparotomy with likely bowel resection. The patient's family history was significant for his father experiencing malignant hyperthermia during a wisdom tooth extraction in the early 1980's. His mother had presumed pseudocholinesterase deficiency after experiencing 12 hours of respiratory weakness following a general anesthetic with succinylcholine. His own personal history was significant for tonic clonic seizure-like activity experienced shortly after propofol sedation for a routine colonoscopy two years prior.

The anesthetic plan was developed with consideration of these histories and included a total intravenous anesthetic with bispectral index monitoring. The induction included Midazolam, Alfentanil, Lidocaine, Etomidate, and Rocuronium with maintenance using Midazolam, Ketamine, and Dexmedetomidine. He received a pre-operative bilateral T10 Erector Spinae Plane block for intra and post-operative pain control. The anesthetic was largely uneventful, save for one incidence of observed head movement that coincided with a BIS reading of 80. The anesthetic depth was increased and the patient later denied having any intraoperative recall. His postoperative course and recovery were uneventful and the patient was discharged home shortly after.

Discussion: This case highlights the importance of maintaining facility with a variety of anesthetic agents in order to effectively manage patients with very rare but potentially life threatening contraindications to commonly used medications. It also illustrates the importance of completing a thorough evaluation of previous anesthetic reactions and comorbidities.

Title: Double Bronchial Blockers in post-PTE pulmonary hemorrhage

Authors: Aline Silva, MD; Ramon Sanchez, MD

Institution: Department of Anesthesiology , University of California San Diego

BACKGROUND:

Significant pulmonary hemorrhage is reported to occur in approximately 1% of Pulmonary thromboendarterectomy (PTE) cases and is associated with a mortality of nearly 70% (1)

Once such hemorrhage is identified, airway management during active bleeding can be difficult if not impossible. The key issues to management are maintenance of oxygenation and ventilation, identification of site of hemorrhage, isolation of the segment, and appropriate post-operative care.

This case report illustrates one method for controlling airway bleeding in a case of bilateral post-perfusion pulmonary hemorrhage.

CASE DESCRIPTION:

59y/o M with history of HFrEF, COPD and extensive bilateral PE s/p unsuccessful IR mechanical thrombectomy, suspected to have CTEPH vs PA sarcoma brought to OR to undergo a PTE (definitive diagnosis and symptomatic relief).

Intraop course:

- Uneventful induction and intubation with 8.0 ETT SLT.
- Cardiopulmonary bypass initiated, profound hypothermia and circulatory arrest initiated—> distal disease unusually adherent and surgically challenging.
- Eventually bypass was resumed, patient rewarmed, aortic cross-clamp removed —> upon attempted separation from bypass, blood is noted in the ETT.
- Bronchoscopy exam (2) revealed airway bleeding from both the left and right lungs. Stayed on bypass until bleeding controlled.
- BBs were deployed to control the bleeding
- First BB (3) inserted through original 8.0 ETT and deployed into bronchus intermedius, controlling bleeding from right lung.
- Unable to pass a second BB into same ETT.
- Attempted to pass 2nd BB outside of 8.0 ETT through glottic opening under glidescope guidance but unable to do guide BB further down into left main without a conduit.
- Decision made to insert a second smaller ETT size 6.0, under glidescope-guidance, next to the original 8.0, for a total of 2 ETTs through vocal cords.
- 6.0 ETT inserted past vocal cords, with its tip laying above the cuff of the 8.0 ETT (in order to prevent air leak during ventilation).
- 6.0 ETT now serves as a conduit for the second BB. Second BB passed through 6.0 ETT until it reached it's tip. At this point 8.0 ETT cuff deflated to allow passage of the second bronchial blocker.
- Bronchoscope (2) passed down the 8.0 ETT to visualize second BB advancement into left main bronchus and subsequent deployment in left superior lobar bronchus.
- After deployment of second BB, bronchoscopy exam and visual inspection of ETT determines that airway bleeding was contained. Patient was weaned off bypass successfully.

Post Op Course:

- Taken to ICU with adequate oxygenation. The next day bronchial blockers were sequentially removed by pulmonologist under fiberoptic-guidance.
- Patient did well and was discharged home after ~2 weeks.

DISCUSSION:

Several other devices for airway management of pulmonary hemorrhage have been reported including: Univent (4), Arndt Endobronchial blocker (5), Rusch EZ Blocker (6), and double lumen endobronchial tube (7).

Additional techniques to help control pulmonary bleeding include application of positive airway pressure, correction of coagulopathy, topical vasoconstrictors, vascular balloon occlusion, embolization, and pulmonary resection.

In cases of refractory bleeding not amenable to the aforementioned management techniques, ECMO is a viable option to maintain oxygenation while allowing the damaged pulmonary vasculature time to heal.

References:

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2. Bronchoscope: BF-P190, 4.1 mm OD, Olympus
3. Endotracheal tube Uniblocker (9 Fr), Fuji Systems Corporation, Fukushima, Japan
4. Teleflex, Morrisville, NC, USA
5. Cook medical, Bloomington, IN, USA
6. Teleflex, Morrisville, NC, USA
7. Shiley, Medtronic, Minneapolis, MN, USA

Title: Randomized, Double-Blinded Study to Evaluate Analgesic Efficacy of IPACK Block on Recovery after Total Knee Arthroplasty

Authors: Blake Simon, MD, Anthony Xu, Andrew Kolomensky, MD, Elliot Schwartz, MD, Jonathan Hausman, MD, Tony Chiang, MD, Brain Mendelson, MD, Shawn Coleman, MD, Andrew Spitzer, MD, Jun Tang, MD

Institution: Departments of Anesthesiology and Orthopedic Surgery, Cedars-Sinai Medical Center, Los Angeles, CA 90048

Introduction: Postoperative pain remains a problem after total knee arthroplasty (TKA). Inadequate pain control after TKA can impede the recovery process and may result in chronic postsurgical pain and opioid dependency. Although opioid analgesics are still considered the mainstay for perioperative pain management, frequent opioid related side effects and addiction liability has led to the development of opioid-sparing multimodal analgesic regimens. Local anesthetic-based techniques like adductor canal block (ACB) are becoming increasingly popular for pain management after TKA. ACB has been demonstrated to provide comparable analgesia than traditional femoral nerve block without quadriceps muscle weakness. However, it does not adequately address the posterior knee pain. Ultrasound guided IPACK (interspace between the popliteal artery and the capsule of the knee) block has been alleged to be effective to provide significant posterior knee analgesia (1-3). However, potential foot-drop associated with IPACK would impede early physiotherapy. Periarticular local injection (PAI) is routinely performed by surgeon during TKA procedure. Even PAI has a limited analgesic effect, study found that the combination of ACB and PAI provided significantly postoperative pain relief and decreased hospital length of stay (LOS) (4). We designed this prospective, randomized, and double-

blinded study to evaluate our hypothesis that the adding IPACK to ACB and PAI would improve analgesic effects and facilitate early recovery in patient after TKA.

Methods: Following IRB-approval, 42 consenting patients, aged between 18 to 80 yrs old, and ASA 1-3 undergoing primary, unilateral TKA were randomly assigned to one of two study groups. Before the surgery, study patient received ultrasound-guided ACB with 0.25% bupivacaine (with 1:200,000 epinephrine) 20 ml and ultrasound-guided IPACK consisting with either normal saline 15 ml (Group 1) or 0.25% bupivacaine (with 1:200,000 epinephrine) 15 ml (Group 2). All patients received spinal anesthesia with propofol infusion during TKA, and standard multimodal pain regiment perioperatively. In addition, PAI with a mixture of 0.25% bupivacaine (with 1:200,000 epinephrine) 20 ml + ketorolac 15-30 mg was administered by surgeon before the end of surgery. The demographic characteristics, pain scores, opioid dosages (oral morphine equivalence doses), side effects, recovery profiles, and hospital LOS were recorded.

Results: The two study treatment groups were similar with respect to their demographic characteristics. There was no difference between groups in duration of anesthesia and surgery, or anesthetic requirement during surgery. Although the postoperative opioid requirements and pain scores were similar between the two study groups at 0-12 h, 12-24 h, 24-48 h intervals, the morphine equivalence was decreased about 20% in Group 2 who received IPACK. Interestingly, recovery profiles were also similar between the two groups with respect to degree of postoperative knee flexibility, time to ambulate, walking distance, quality of sleep, as well as duration of PACU and hospital LOS (Table).

Conclusion: The findings refuted our null hypothesis. In the presence of ACB and PAI, additional ultrasound guided IPACK did not provide significant benefits on the postoperative pain scores and opioid requirements in patient undergoing TKA. Furthermore, additional IPACK

did not show evidences to facilitate postoperative recovery process.

References:

- 1 Minerva Anesthesiol. 2018;84:1406-12.
- 2 Eur J Orthop Surg Traumatol. 2018;28:1391-5.
- 3 Reg Anesth Pain Med. 2021;46:713-21
- 4 J Arthroplasty. 2021;36:122-9

Table 1

	Group 1	Group 2
Age (yr)	68 ± 9	70 ± 6
Weight (kg)	84 ± 17	91 ± 17
Height (cm)	171 ± 9	170 ± 11
Anesthesia time (min)	124 ± 32	137 ± 35
Surgery time (min)	77 ± 35	86 ± 37
Duration of PACU (min)	113 ± 87	127 ± 77
Time to sit up (hr:min)	8:30 ± 7:32	8:40 ± 7:39
Time to ambulate (hr:min)	11:30 ± 8:29	11:37 ± 7:25
Postoperative 24 h knee flexion degree	68 ± 16	58 ± 28
Postoperative 24 h walking distance (ft)	92 ± 75	93 ± 76
Postoperative 48 h walking distance (ft)	117 ± 65	101 ± 60
Hospital length of stay (h:min)	53:17 ± 14:22	46:28 ± 20:30
Post-op opioid MME (mg)		
0-12 hr	18.2 ± 11.9	14.8 ± 9.9
12-24 hr	16.9 ± 7.3	14.0 ± 8.9
24-48 hr	29.5 ± 17.3	29.1 ± 15.7
VAS pain scores (0-10) (n)		
baseline	0 (0 - 10)	0 (0 – 7)
6 hr	5.5 (0 – 9)	4 (0 – 8)
12 hr	5 (0 – 9)	4.5 (0 – 7)
24 hr	6 (0 – 8)	5 (2 – 9)
48 hr	6 (2 – 8)	6 (2 – 9)
Quality of 1 st post-op night sleep (bad/good) (n)	14/4	15/3

Values are mean ± SD, number (n), or median (range).

Title

Lung isolation through immature tracheostomy via bronchial blocker and fiberoptic bronchoscopy.

Authors

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Lei Xu, MD

Stanford University

Background

Tracheostomy is a common procedure in critically ill patients who require long-term respiratory support. Complications of tracheostomies include hemorrhage, dislodgement, and obstruction and can result in life threatening respiratory failure.¹ These risks can be exacerbated in situations requiring movement of the patient or manipulation of the tracheostomy, particularly in the early post-placement phase.² This case demonstrates successful lung isolation and one lung ventilation in a patient with a new tracheostomy undergoing a video-assisted thoracoscopic surgery (VATS).

Case

Patient informed consent was obtained for this case report. A 64-year-old woman presented for repeat VATS chest washout for persistent large loculated pleural effusion, hemothorax, and strep viridans mediastinal abscess as complications from an esophageal perforation after an anterior cervical spine surgery.

On hospital day (HOD) 27 she received a tracheostomy with a 6.0 cuffed Shiley for persistent hypoxemic respiratory failure. On HOD31 she required a repeat right VATS chest washout necessitating one lung ventilation. Following induction of general anesthesia, a 9 French Arndt bronchial blocker was placed through the tracheostomy. Bronchoscopy was conducted with an Ambu aScope 4 Broncho Slim inserted orally and maneuvered atraumatically into the distal trachea. Under fiberscope guidance, the bronchial blocker was advanced into the right mainstem bronchus (Image 1). For one lung ventilation, the bronchial blocker was inflated, lung isolation was successful, and her left lung was ventilated with tidal volumes of 3-5ml/kg producing PIPs of 26-28mmHg. There were no surgical, anesthetic, or airway complications.

Discussion

The in-hospital mortality rate for patients post tracheostomy is nearly 20%.³ While the mortality prior to discharge in this population is usually related to the underlying disease process rather than the tracheostomy, this remains a vulnerable population who benefit from thoughtful periprocedural care. There is a paucity of case reports or protocols pertaining to this situation. The plan for maintaining a secure airway while attaining lung isolation was developed through discussions with the thoracic and otolaryngology surgery and anesthesia teams.

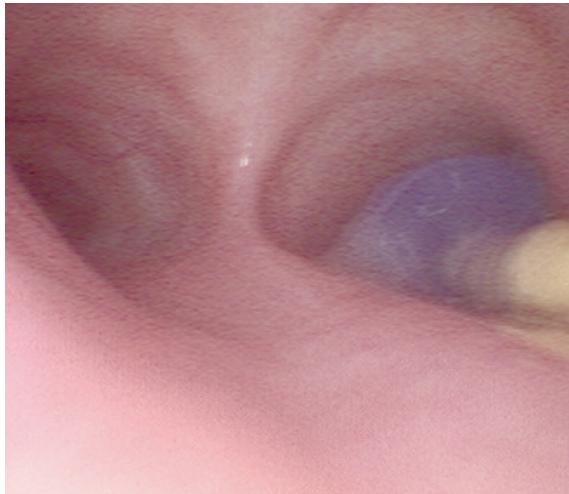
We demonstrate the feasibility of adequate and safe oxygenation and ventilation through a 6.0 Shiley tracheostomy with a 9 French Arndt bronchial blocker. Oral introduction and

advancement of the fiberscope past the cuffed tracheostomy proved effective and safe. In anticipation of possibly losing the secured airway with an immature stoma, we were prepared for oral intubation with direct, video, and fiberoptic laryngoscopy along with the thoracic surgeons ready to re-establish a surgical airway.

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Image 1



Title: Ethnicity and Race in Academic Anesthesia: A Scoping Review

Authors: Zachary P.W. Smothers¹, MD, Alexander S. Roesler², MD, Elizabeth B. Malinzak³, MD, Christy Boscardin¹, PhD

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Abstract

Introduction: Physicians that are an underrepresented minority struggle to advance in academic medicine; systematically being less likely to be promoted, receiving less funding from governmental organizations, and obtaining less leadership positions in academic institutions. This trend is true in anesthesiology, a field that has largely lacked significant gender and racial diversity. While recent research and discussion has confronted this reality, the conversation largely focuses on increasing the representative of women in anesthesia, with relatively little being focused on ethnic or racial representation. To highlight this, a review of the previous decade (2010-2020) was performed.

Methods: To identify relevant articles pertaining to the study topic, we performed a scoping review following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews guidelines. Initial databases included Embase, Scopus, PubMed and Web of Science. Each search consisted of a combination of anesthesiology and diversity language, using appropriate controlled vocabulary, subject terms, and title and abstract keywords. Articles identified were reviewed by two study authors with differences reconciled by an independent third party. To be included in our review, articles had to meet the following the inclusion criteria: (1) an original research study (including surveys, interventions, program descriptions, and other forms of primary research) that (2) focused on the field of anesthesiology (particularly physician anesthesiologists in a resident, fellow, faculty, or administrative position), (3) occurred in a experiential setting where data relating to anesthesiologists could be freely extracted without influence, and (4) described a phenomena relating to race or ethnicity-based diversity.

Results: Our electronic literature database searches retrieved 4779 records with zero articles being found through reference review. After the removal of duplicates, 4442 unique articles were identified, of which 4424 were excluded through title and abstract screening. The remaining 18 articles underwent full text review, producing a total of two studies that met the full inclusion criteria. Both articles included descriptive statistics along with comparison to groups, specifically the general medical workforce and the U.S. population. Both articles were published within the United States, and heavily relied on AAMC data. Toledo et al. was published in an anesthesia related journal while Lane-Fall et al. appeared in a critical care focused publication. The two articles focused on reporting demographics of anesthesiologist with neither article studying nor reporting the results of an intervention directed at improving diversity in anesthesia.

Conclusions: There exists a significant paucity in research studying the impact of ethnicity / race in academic anesthesia. Only two articles out of almost 4,500 retrieved met inclusion criteria and consisted of only demographic data. The little research present supports the claim that the field of anesthesiology has significantly less URM than expected. A large amount of additional research is needed, focusing specifically on establishing the impact that ethnicity / race has on academic anesthesia.

Difficult Airway Management in an Urgent Combined Hemithyroidectomy-Laminectomy for a Patient with Cauda Equina Syndrome

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Background: Cauda equina syndrome (CES) is a serious neurological disorder that requires urgent surgical intervention as untreated CES can progress to paraplegia and permanent incontinence;¹ the need for laminectomy is typically prioritized over interventions. However, a large goiter causing tracheal deviation/compression must be addressed with similar urgency.² Thus, a combined thyroidectomy and laminectomy approach for the management of an airway-compromising goiter and severe spinal stenosis causing cauda equina syndrome is presented.

Case Description: A 47-year-old male with a past medical history of C2-C3, C5-C7, T10-T11, and L2-L5 spinal stenosis, goiter, diabetes mellitus, and morbid obesity presented to the emergency department with worsening bilateral lower extremity numbness and weakness with bladder and bowel incontinence over the prior two weeks. MRI of the T-spine and L-spine revealed severe stenosis of the spinal canal at the T11-T12 and L3-L5 levels, resulting in compression of the cauda equina nerve roots and cauda equina symptoms with possible superimposed conus medullaris syndrome.

On preoperative workup, a prominent thyroid nodule suspicious for mass effect causing rightward deviation of the larynx and trachea was found. CT was significant for compression and narrowing of trachea due to goiter. Though the patient was initially scheduled for an urgent posterior laminectomy, orthopedics delayed decompression to consult ENT for the removal of the large goiter. It was decided by the joint surgical team to complete a combined left hemithyroidectomy while the patient was supine, followed by a prone laminectomy.

From an airway standpoint, patient was a Mallampati 3 despite a thyromental distance greater than three fingerbreadths. The safest airway plan was determined to be an awake video laryngoscopy intubation with fiberoptic on standby and ENT present in case a surgical airway was required. Patient was prepped for an awake intubation, and a 7mm ET tube was placed without resistance on second attempt using video laryngoscopy which afforded an excellent grade II supraglottic view. A post-induction arterial line was placed and patient remained hemodynamically stable for both surgeries. Post operatively, patient remained intubated due to concern for airway edema. He was transferred to SICU for close monitoring and was extubated on post-op day 1 and downgraded to the floor soon afterwards.

Discussion: Surgical decompression for cauda equina syndrome must be completed within 48 hours to prevent irreversible neurologic damage.¹ In this case, decompression was delayed due to a large thyroid goiter causing tracheal deviation and mass effect. Despite the difficult anatomy, and increased risk of needing a surgical airway, the anesthesia team was able to secure an airway on second attempt, allowing the surgical teams to safely proceed with the combined hemithyroidectomy-laminectomy.

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Management of suspected malignant hyperthermia upon rapid sequence induction for laparoscopic appendectomy: a case report

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Background: Malignant Hyperthermia (MH) is a potentially life-threatening condition that can present similarly to several other pathologies. Therefore, early recognition of MH hallmarks permits the timely and effective management of symptoms and mitigates potentially harmful sequelae.

Case Description: A 20-year-old male BMI 35 with no pertinent past medical or surgical history presented to the emergency department with right lower quadrant pain and was scheduled for a laparoscopic appendectomy after CT confirmation of acute appendicitis. His pre-operative vitals showed a heart rate of 98, respiratory rate of 16 with SpO₂ at 99, blood pressure of 127/68, and a tympanic temperature of 38.1°C (100.5°F). A rapid sequence induction was performed with 50mg fentanyl, 100mg lidocaine, 100mg succinylcholine, and 200mg of propofol. During intubation, increased resistance was noted with scissoring the jaw open, but intubation was otherwise completed without complications. 30mg rocuronium was given after intubation. A nasopharyngeal temperature probe was inserted shortly afterwards with an initial reading of 39.9°C (103.9°F). He was placed on the ventilator with 400/16/6/100%, with an initial end-tidal CO₂ of 45mmHg which subsequently peaked to 54mmHg. End tidal CO₂ did not respond significantly to attempts at increasing minute ventilation and remained around 45mmHg. Patient was hemodynamically stable post-induction but remained tachycardic.

Discussion: Initial intraoperative temperature reading was 39.9°C after induction, up from 38.1°C pre-operatively. Along with WBC 9.4, lactate 2.5, and a heart rate of 95, the presentation fit the sepsis picture; however, the degree of hypercarbia and jaw rigidity could not be explained solely by sepsis. This constellation of features elevated MH to a forefront differential. He denied any prior medication use, which lowered the likelihood of serotonin syndrome or neuroleptic malignant syndrome. The timing surrounding the onset of symptoms likewise favored MH as the diagnosis. The patient had no past medical history or prior lab work to suggest the possibility of a thyroid storm or pheochromocytoma. Per the clinical grading scale for determining MH susceptibility by Larach et. al, the patient had an MH rank of 4 and a very likely case of MH. The first dose of 2.5mg/kg Dantrolene was administered approximately 38 minutes after initial symptom presentation. Though there is a 1.6-fold increase in complication rates with every 30-minute delay in dantrolene administration, the patient responded well to the remainder of interventions outlined by MHAUS as evidenced by the acute resolution of hypercapnia and hyperthermia, and fortunately did not present with any evidence of metabolic acidosis, rhabdomyolysis, or kidney injury on subsequent lab work. The patient's excellent response to the remainder of the MH protocol permitted the surgery to be successfully completed under total IV anesthesia. Dantrolene was re-dosed at the end of the case as hypercarbia began to return, and the patient was transferred intubated to surgical ICU for continued close monitoring.

Are Two Images Better Than One?

A head-to-head comparison of short-axis and biplane ultrasound guided arterial access.

Abstract

Introduction: Ultrasound imaging is instrumental for facilitating difficult peripheral venous and arterial access. Needle localization within the ultrasound image is essential for successful vascular cannulation. As new learners approach ultrasound guided cannulation, needle localization is a barrier to mastery. Biplane ultrasonography allows the operator to view orthogonal images in real time and provides additional information about spatial orientation. Arguably, biplane ultrasound may improve needle localization and hasten cannulation. In this prospective study we compared conventional short-axis ultrasound guided arterial cannulation to the biplane ultrasound technique. We hypothesized that biplane ultrasonography would increase the first pass rate of success and decrease procedure duration.

Methods: After IRB approval and consent, anesthesiology residents, postgraduate years (PGY) 2 – 4, providing anesthesia for patients needing arterial access between September 2022 and February 2023 were cluster randomized to use either short-axis or biplane ultrasound guidance. All subjects used a portable ultrasound probe [Butterfly Network, Inc; Burlington, MA] with images displayed on an 11” tablet [Apple iPad Pro, Cupertino, CA]. Study personnel observed and recorded successful cannulation, the time from needle insertion to successful arterial cannulation, and training level (PGY) of the resident performing the procedure. The overall cannulation rate and procedure duration was compared between the two groups across all training levels. The rate of first pass success was also evaluated.

Results: A total of 118 ultrasound guided arterial cannulation procedures were observed, 60 biplane and 58 short-axis. Although the difference was not significant, cannulation was 1.5 times more likely to be successful overall using biplane imaging. The median time required for successful arterial cannulation was 75 sec (IQR 43-178) for the short-axis approach and 103 sec (IQR 41-199) for biplane across all training years. Notably, PGY-3 residents were 3.77 times more likely to successfully cannulate the artery overall compared to PGY-1 residents ($p=0.0259$). The first pass cannulation rate was 32% (19/60) for biplane and 24% (14/58) for short axis ($p=0.004$).

Conclusion: Overall biplanar ultrasound guided arterial access was comparable to the short-axis approach. Biplane may offer a slight advantage with first pass success. Unsurprisingly, senior anesthesiology residents were more facile with arterial cannulation than junior residents. Evaluation of biplane imaging was limited by the design of the portable ultrasound probe. The portable probe has a large footprint relative to the imaging sector. As most residents were accustomed to the small footprint of the high-frequency hockey stick probe, needle localization with the portable probe had a notable learning curve. Additional investigation of the role of biplane imaging in ultrasound guided vascular cannulation is warranted.

Title:

Acetaminophen-overdose induced methemoglobinemia in a patient with suspected G6PD deficiency

Authors:

William Thi, MD, Duraiyah Thangathurai, MD

Institution:

Keck Medicine of USC
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Background:

Acetaminophen is a common pharmaceutical ingestion reported to U.S. poison centers. In overdose, toxic metabolites are known to cause hepatotoxicity. G6PD deficiency may be a risk factor for methemoglobin production in the setting of acetaminophen overdose.

Case Description:

We present a case of an otherwise healthy 27 year-old-male who presented with methemoglobinemia after intentional massive acetaminophen overdose. The patient had no known history of G6PD deficiency or other substances known to induce methemoglobinemia. The patient had a peak methemoglobin measurement of 17.5% and was treated with ascorbic acid instead of methylene blue due to concern for an underlying G6PD deficiency.

Discussion:

The purpose of this case report is two-fold: first, methemoglobinemia secondary to acetaminophen overdose is rare, and we wanted to make other physicians aware of this possibility. Second, we wanted to emphasize the use of ascorbic acid as an alternative treatment for methemoglobinemia when there is concern for G6PD deficiency.

A number of mechanisms may be involved in production of methemoglobin in the setting of massive acetaminophen ingestion including NAPQI-induced oxidation, depletion of glutathione stores, and production of oxidant-metabolites including paraaminophenol. While the majority of acetaminophen overdoses do not result in any clinically significant methemoglobinemia, massive acetaminophen overdose may be complicated by development of methemoglobinemia when there are underlying risk factors. Therefore, physicians should be aware of the possibility that massive acetaminophen ingestion may be complicated by methemoglobinemia in rare instances.

Western Anesthesia Residents Conference 2023 Abstract Submission

Three Cases of Speech Impairment After Liver Transplantation

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Background

Among neurological complications after liver transplantation, impairment of speech is a rare but debilitating aftereffect that can have a variety of neurological and functional presentations. These presentations range from stuttering and dysarthria to complete loss of speech production, with or without aphasia and seizure activity. The cause of aphasia is thought to be multifactorial, with potential culprits including predisposing conditions, immunosuppressive agents, lacunar infarcts, or osmotic demyelination syndrome (ODS). We present three cases of speech alterations after liver transplantation and advocate for heightened awareness of this debilitating complication and avoidance of potentially inciting factors.

Case Descriptions

There were three cases of speech impairment after liver transplantation (1%, 3/345) in the last 3 years at the University of Washington Medical Center. In these cases, the surgical procedure was uneventful and both tacrolimus and mycophenolate mofetil were used for immunosuppressive maintenance. The onset of impairment was within 7 postoperative days. One patient had evidence of ODS on MRI likely due to sodium fluctuation and was managed with the administration of free water, changing immunosuppression from tacrolimus to cyclosporin, and aggressive speech therapy. The imaging study of the other two patients did not demonstrate a cause for their speech changes, but discontinuation of tacrolimus and steroids led to improvement of aphasia. All three patients recovered with varying degrees within 30 days after the onset of aphasia.

Case	MELD	Etiology	Pretransplant neurologic symptoms	CKD (Stage)	ISP (induction)	ISP (Maint.)	Onset (POD)	Symptoms	Imaging	Sodium, Base [Low-Peak]	Possible cause	Treatment	Recovery (POD)
63, M	21	Alcohol	Encephalopathy, Sudden Aphonia with Na fluctuation [144-152]	IV	Basiliximab + Steroids	FK + MMF	7	Worsening Aphonia, Upper motor neuron injury	CPM	146 [150-155]	CPM	Control Na with Free water, Change FK to CyA, PT, OT, ST	37 (Improved articulation)
69, M	12	Alcohol / HCC	None	II	Basiliximab + Steroids	FK + MMF	6	Aphonia	No abnormality	135 [130-135]	FK toxicity	Change FK to CyA, PT, OT, ST	23 (Improved)
56, M	34	Alcohol	None	None	Basiliximab + Steroids	CyA + MMF	3	Aphonia	No abnormality	133 [129-131]	Steroid toxicity	D/C Steroids, PT, OT, ST	10 (Improved)
Abbreviations , CPM, cerebro-pontine myelinolysis, CyA: Cyclosporine, FK, Tacrolimus, MELD: models for end stage liver disease, MMF: Mycophenolate, NASH: non-alcoholic steatohepatitis, OT, occupational therapy, PT: physical therapy, ST: Speech therapy													

Discussion

Though neurological complications are not uncommon after liver transplantation, dysarthria occurs in approximately 1% of liver transplant recipients. The limited literature on this topic suggests the onset of symptoms within 10 days after transplantation and ascribes cause to ODS, cerebral infarct, or neurotoxicity secondary to immunosuppressive agents. Rare cases have been described as secondary to infection. Duration and degree of recovery have varied in the literature.

Early recognition of speech changes is important because diagnosis and management may be challenging. Classic signs such as hyponatremia, major shifts in sodium level, or imaging findings may not be present upon workup. Appropriate dosing of immunosuppressive agents is essential in ruling out toxicity, although the occurrence of symptoms without correlation to immunosuppression level has been described. Temporary suspension of the suspected immunosuppressive has been suggested nonetheless. Ultimately, it is advocated that careful management of sodium fluctuations perioperatively, recognizing risk factors for ODS, early recognition of symptom onset, and thorough biochemical and radiological workup could assist in the prevention and expedited management of this complication.

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Title: Anesthetic Considerations of a Patient with Indeterminate Neuromuscular Blockade Anaphylactic Reaction

Author(s): Yalda Toofan, MD*, Lorraine Sdrales, MD*

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Background:

Perioperative anaphylactic reactions are immediate hypersensitive reactions that are potentially life threatening. Although a number of drugs can cause perioperative anaphylaxis, during anesthesia neuromuscular blocking agents (NMBA) are considered the leading drugs responsible. It is imperative for anesthesiologists to clinically identify early signs and symptoms of an anaphylactic reaction to begin appropriate intraoperative management and avoid future exposure to the presumed culprit drug.

Case Description:

M.M. is a 45 year old man with a history of atrial fibrillation, congestive heart failure, and end-stage renal disease secondary to hypertension, now status post right deceased donor kidney transplant (DDKT) 9/3/22.

Per his outside hospital records, the patient presented for surgery for a new cephalic AV fistula creation 11/17/20. Contrast was injected to perform a venogram. The patient then awoke from the sedation agitated and uncooperative and required endotracheal intubation with Propofol. He then became bradycardic followed by hypotension and a code blue was called. He had periorbital and lip edema and presumed to have had an anaphylactic reaction attributed to either the IV contrast or Propofol.

On 2/4/22 the patient underwent an attempted DDKT but the case was cancelled after induction with Succinylcholine, Propofol and Cisatracurium due to anaphylaxis in which a code blue was called. Patient was noted to have lip and tongue swelling. Anaphylaxis was confirmed with elevated postoperative tryptase.

On 6/9/22 the patient underwent skin testing, both intracutaneous and intradermal, of Rocuronium, Succinylcholine, Cisatracurium, Vecuronium, and Propofol, and all were negative.

On 9/3/22 patient underwent a right DDKT. Ketamine and Etomidate were used on induction, but on first attempt of intubation, there was difficulty passing 7.0 ETT past the vocal cords and the patient went into brief laryngospasm. Patient had bilateral wheezing and peak airway

pressures in 40s which resolved after 10minutes. The patient was maintained under anesthesia with Propofol, Fentanyl, and Rocuronium.

Discussion:

The definitive cause to M.M.'s allergic reaction remains undetermined. The most likely cause is Succinylcholine, but Cisatracurium cannot be excluded.

In the perioperative period patients are exposed to various drugs, any of which could cause severe systemic hypersensitivity reactions. To prevent future anaphylactic reactions it is important to accurately document all drugs so that the causative drug can be more easily narrowed down. Skin testing 4-6 weeks after the inciting event becomes critical in patients who have previously experienced an adverse allergic reaction intraoperatively, and the safest possible anesthetic agents should be chosen accordingly.

Our patient however had a negative skin test with commonly used NMBAs. While reactions to skin test negative drugs is incredibly uncommon a few cases have been reported in the literature attributed to either a false negative result or development of a new sensitivity to that agent.

This case highlights the importance of a high index of suspicion and a carefully planned anesthetic plan when confronted with a patient with a history of anesthesia related anaphylaxis.

Management of a Complicated Pulmonary Embolism after Thrombolytic Therapy with Venoarterial Extracorporeal Membrane Oxygenation

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INTRODUCTION: A prominent cause of mortality are pulmonary embolisms (PE). Massive PE is typically treated with surgery and systemic thrombolytic therapy. After thrombolytic therapy, veno-arterial extracorporeal membrane oxygenation (VA-ECMO) is typically not recommended. Here, we provide a case of an emergent use of VA-ECMO in a patient with a severe PE following the unsuccessful administration of thrombolytic treatment.

CASE PRESENTATION: A 61-year-old man with a past medical history significant for an ascending aortic aneurysm was admitted to the hospital for bacteremia with discitis. He suffered a cardiac arrest during his fifth hospital day. The attempts at resuscitation were successful. Following his cardiac arrest, the patient needed vasopressor assistance and was intubated. Echocardiography revealed severe right ventricular strain indicative of a PE.

Deep venous thrombosis in the right lower extremity was also confirmed by Doppler ultrasound. The patient was administered 50 mg of tissue plasminogen activator (tPA) due to the high suspicion of a PE. An additional 50 mg of tPA was given after the patient's status did not improve. He was transferred to the Intensive Care Unit for cannulation for VA-ECMO, since his condition continued to deteriorate. A total of 42 blood products were transfused to the patient due to excessive blood loss. The source was identified by a computed CT angiography as a 10 cm hepatic hematoma. He then developed abdominal compartment syndrome due to hemoperitoneum and volume overload in the setting of worsening kidney failure and anuria. The patient was eventually stabilized but required ongoing renal replacement therapy. An initial decannulation attempt was made after three days, but he experienced a transient cardiac arrest and needed to be re-cannulated. Twelve days after admission, the patient was eventually stabilized and decannulated.

DISCUSSION: Cannulation for extracorporeal membrane oxygenation (ECMO) immediately following systemic fibrinolytic therapy is not recommended due to the increased risk of bleeding. The use of ECMO can alleviate right cardiac overload, stabilize hemodynamics, and enable effective thrombus removal. According to earlier publications, tPA treatment and subsequent ECMO use result in the effective clearance of saddle pulmonary embolisms. In our case, despite systemic thrombolysis, the patient's hemodynamic condition continued to deteriorate, which eventually prompted the choice to cannulate for VA ECMO. The patient experienced significant blood loss following cannulation, necessitating repeated blood transfusions. However, the patient was ultimately stabilized despite complications. The guidelines addressing the use of ECMO in patients with PE remain ambiguous. The successful stabilization of patients with ECMO use without bleeding problems has been documented in prior reported cases. Our case demonstrates the significance of anticipating potential problems associated with ECMO use after systemic thrombolytic treatment.

Assessing the efficacy of Point-of-Care Ultrasound teaching over a one-month period in an anesthesiology residency program in Rwanda

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Global Health Division

Introduction:

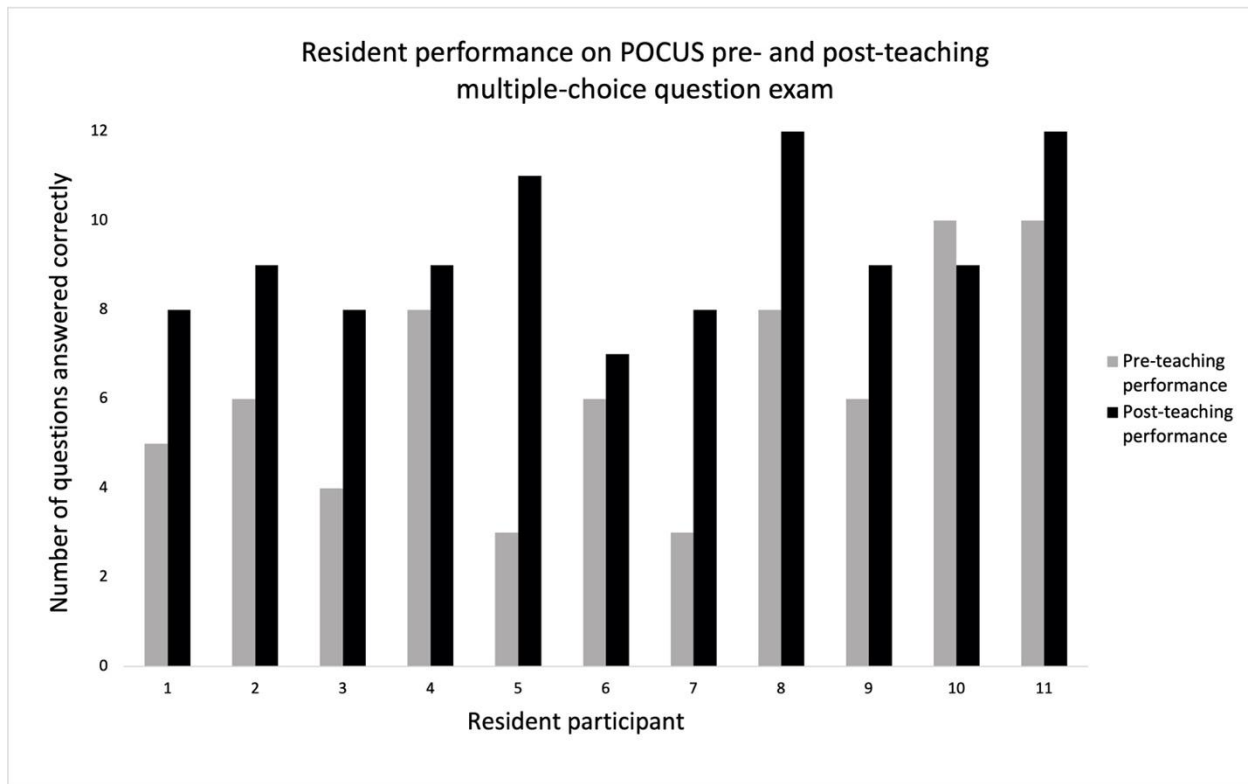
Point-of-Care ultrasound (PoCUS) is an effective diagnostic method in limited-resource settings, allowing for rapid dynamic assessment in various clinical settings. Although there is increasing interest in its use, lack of standardized teaching limits training and its subsequent application in clinical practice. The University Teaching Hospital of Kigali (CHUK) is at the forefront of anesthesiology residency training in Rwanda. As part of Stanford University's partnership with CHUK, we provided three structured on-site PoCUS didactic sessions over a one-month period, daily hands-on guidance examining patients in the intensive care unit, and subsequently assessed resident performance after our teaching sessions.

Method:

Eleven anesthesiology residents were surveyed to assess their confidence level with PoCUS. Each resident's baseline knowledge was assessed with a computer-based, twelve multiple-choice question (MCQ) exam adapted from the American Board of Anesthesiology PoCUS Certification questions. The trainees then underwent three weekly two-hour teaching sessions with standardized patients to obtain basic cardiac and inferior vena cava views and measurements. The same exam was administered one month after the initial assessment. The trainee performance was compared to their own pre-teaching exam using a paired t-test analysis. They were then surveyed at a three-month point for their average number of weekly PoCUS exams.

Results:

From the first MCQ assessment, the mean score across eleven trainees was 6.3/12 with a standard deviation of 2.5. Ten of eleven trainees showed an improvement in their scores in the post-teaching assessment one month later, with a mean of 9.3/12 and a standard deviation of 1.7. The p-value was 0.002. Survey of ultrasound use at three months from initial training showed highly variable use from zero to four per week, depending on the rotation location of any given trainee and the availability of ultrasound machines. Trainees in the intensive care unit at CHUK reported feeling more confident in their PoCUS abilities at the three-month time point.



Conclusion:

Creating standardized PoCUS teaching in limited-resource setting is logistically challenging, with limitations in machine availability and individual interest. After three structured hands-on PoCUS teaching sessions, the anesthesiology residents at CHUK were able to demonstrate significantly improved performance in a standardized MCQ assessment one month after initial assessment, and expressed higher confidence in their ultrasound skill at three months post-teaching. This study is limited in the small size of participants, and follow up is based on self-report without formal evaluation. Long-term reinforcement of hands-on skill is difficult given the inconsistent availability of ultrasound machines at the various hospital sites through which residents rotate, as well as availability of on-site instructors to provide guidance. Still, this finding is encouraging, and moving forward, continuing to implement POCUS didactic sessions with frequent hands-on guidance and evaluations throughout the residency period would likely strengthen proficiency in PoCUS skills and aid in clinical-decision-making in limited resource settings.

Title: Bolus Remifentanyl in a Patient Treated with Buprenorphine: How Much is Enough for Monitored Anesthesia Care (MAC)?

Author(s)/Institution(s): Maegan R. Tupinio MD/ University of Utah, Jeffrey D. Swenson MD/ University of Utah

Background:

Buprenorphine, a partial opioid agonist and antagonist, is growing in popularity for management of chronic pain due to the decreased likelihood of abuse, respiratory depression, and overall side effects. The high affinity, occupancy, and slow dissociation from the mu opioid receptor makes it difficult to manage in the perioperative period and can cause inadequate analgesic coverage, even when using recommended fentanyl derivatives (1). Remifentanyl is a short acting mu opioid receptor agonist with quick onset, short half-life, and short context sensitive half-time (2). When used by bolus, these efficient pharmacologic properties have proven to be highly effective for providing intense analgesia in short duration and highly stimulating procedures, without causing prolonged respiratory depression or loss of consciousness (3,4). Using basic pharmacokinetic properties of remifentanyl, we calculated an effective bolus dose in a patient treated with buprenorphine. The total bolus dose of 800 mg produced effective analgesia without loss of consciousness or response to commands.

Case Description:

A 42-year-old, 83kg male was scheduled for bilateral endoscopic carpal tunnel release and left index trigger finger injection. He was receiving buprenorphine 8mg PO daily for treatment of severe cervical radiculopathy. The patient elected to have the procedure performed using local anesthesia which required extensive and painful soft tissue injections. Five minutes prior to injection the patient received 2mg of intravenous midazolam. He was then allowed to breath 100% oxygen through a closed anesthesia circuit with continuous end-tidal gas monitoring. Following adequate denitrogenation, he received a bolus injection of remifentanyl 200 mcg. After 90 seconds, there was no perceptible change in the patient's respiratory rate or mental status. At this point, the patient received a 300-mcg bolus. After an additional 90 seconds, the patient still had no perceptible change in respiratory rate or mental status. This prompted a final bolus of 300 mcg (totaling 800 mcg). Approximately 60 seconds following the final remifentanyl bolus, the patient displayed apnea unless prompted to breath, but remained conscious and responded to commands. We were confident of adequate analgesia since effect site concentrations causing apnea exceed those providing analgesia. The local anesthetic injections were performed without discomfort reported by the patient and spontaneous ventilation resumed approximately 3 minutes following the final bolus. Throughout the duration of action of the remifentanyl, the patient remained hemodynamically stable, and no muscle rigidity was observed

Discussion:

The recommended dose for remifentanyl by bolus to achieve intense analgesia while preventing muscle rigidity and prolonged respiratory depression is 1-2mcg/kg (3). Our initial bolus dose was slightly higher at 200mcg. We titrated our remifentanyl bolus to effect after waiting 90 seconds after each bolus; the time to reach peak effect (2). However, it took 800mcg total of remifentanyl to achieve the targeted analgesic effect. The balance of achieving a perceptible response while avoiding muscle rigidity and prolonged respiratory depression is extremely difficult in a patient on buprenorphine. Dose requirements for remifentanyl in chronic opioid patients has not been studied. As remifentanyl by bolus injection continues to grow in popularity and use, anesthesiologists will gain more confidence in its benefits and safety.

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Title: Improving the Quality and Accuracy of Dental Examination and Documentation

Authors/Institution:

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Introduction:

Perioperative dental damage is one of the most common adverse events that anesthesia providers face. A thorough and detailed preoperative dental examination is essential to identify existing dental damage, but there is a lack of formal curriculum on proper dental examination procedures. In this quality improvement project, we improved the quality and accuracy of dental examination and documentation at our institution by providing educational presentations, reference materials, and instructions on how to upload a dental photo into the electronic medical records.

Methods:

This QI intervention was structured in PDSA (planning, doing, studying, acting) cycle phases. Educational materials and didactic trainings were designed and a survey was administered to capture the level of knowledge on dental examination prior to the intervention. Trainings were conducted, including a presentation at departmental grand rounds presentation with a subsequent service brief. A post-survey was ultimately administered to measure the efficacy of the training intervention.

Results:

The department pre-survey yielded 60 Responses (28 Attending, 17 CRNA, 14 Resident, 1 Fellow) and asked questions related to training, knowledge of dental examinations, and reporting within the health chart. The majority of respondents had not received formal education on a thorough preoperative dental examination (72%) and none had uploaded a dental photo into the preoperative evaluation note in the prior 12 months. Most participants reported that receiving additional education on dental examination would improve accuracy and thoroughness (84%).

The post-survey demonstrated that most participants found the additional resources helpful to their practice (91%). More dental photos were added to participants' preoperative anesthesia notes following the intervention (34% of participants). There were 4 reported dental injuries in the 3 months following the intervention and all 4 incidents had appropriate dental documentation in the preoperative anesthesia record.

Conclusion:

Focused training on preoperative dental examination is important to increase provider familiarity, reduce liability, and improve the patient experience and outcomes. Identifying barriers to logging dental concerns, such as a lack of preoperative exam time or technological issues, is important to inform any interventions that are taken. Continued training and interventions are needed to maintain a level of awareness of these issues.

Femoral Popliteal Bypass Graft: A Red Herring when Performing Adductor Canal Block

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Background

The Adductor Canal Block (ACB) anesthetizes the saphenous nerve for postoperative analgesia of the lower extremity, providing numerous benefits following knee surgeries.¹ These benefits include effective pain relief, preserved quadriceps strength in comparison to femoral nerve block,² improved participation in rehabilitation and ambulation,² and decreased opioid consumption.³ The optimal injection site of ACB is an ongoing topic of research, and the superficial femoral artery (SFA) and sartorius muscle serve as critical sonographic landmarks. We present a case of femoral popliteal bypass graft (FPBG) masquerading as the SFA during an ultrasound guided ACB, which nearly led to a failed block.

Case Description

A 70-year-old man with a history of peripheral arterial disease, who had previously undergone left FPBG surgery, presented for revision of left total knee arthroplasty due to prosthetic joint infection with an adductor canal block planned for postoperative analgesia. The patient was positioned supine with slight external rotation of the left hip and bent knee. A 13-6 MHz 38-mm linear array ultrasound transducer was placed with a cross sectional orientation over the medial thigh approximately halfway between the anterior superior iliac spine and the superior border of the patella. A large, pulsatile structure was visualized deep to the sartorius muscle and assumed to be the native SFA (Figure 1). However, when scanning proximally and distally, the structure's relationship to the sartorius muscle failed to change as would be expected (from the posterior aspect of the muscle proximally to the anterior aspect distally).¹

After increasing the depth of the ultrasound field of view, the native superficial femoral vessels were successfully identified (Figure 1).

The patient received a single injection ACB using bupivacaine 0.5% (20 mL) with epinephrine (5 µg/mL) without complication and experienced excellent analgesia following surgery for the expected duration of the nerve block.

Discussion

Arterial bypass grafting is a common surgery for patients with occlusive atherosclerotic vascular disease.⁴ This report documents a potential increased difficulty in performing ACB in patients

who have undergone FPBG. In these patients, scanning diligently and broadly to accurately identify the FPBG and the native superficial femoral vessels is imperative, as is an understanding of the complicated sonoanatomy that may exist in these patients. The consequences of misidentifying structures during ACB include insufficient analgesia, increased opioid consumption, need for general anesthesia, local anesthetic toxicity if rescue blocks must be performed, poor participation in physical therapy, and increased time to discharge and overall recovery.

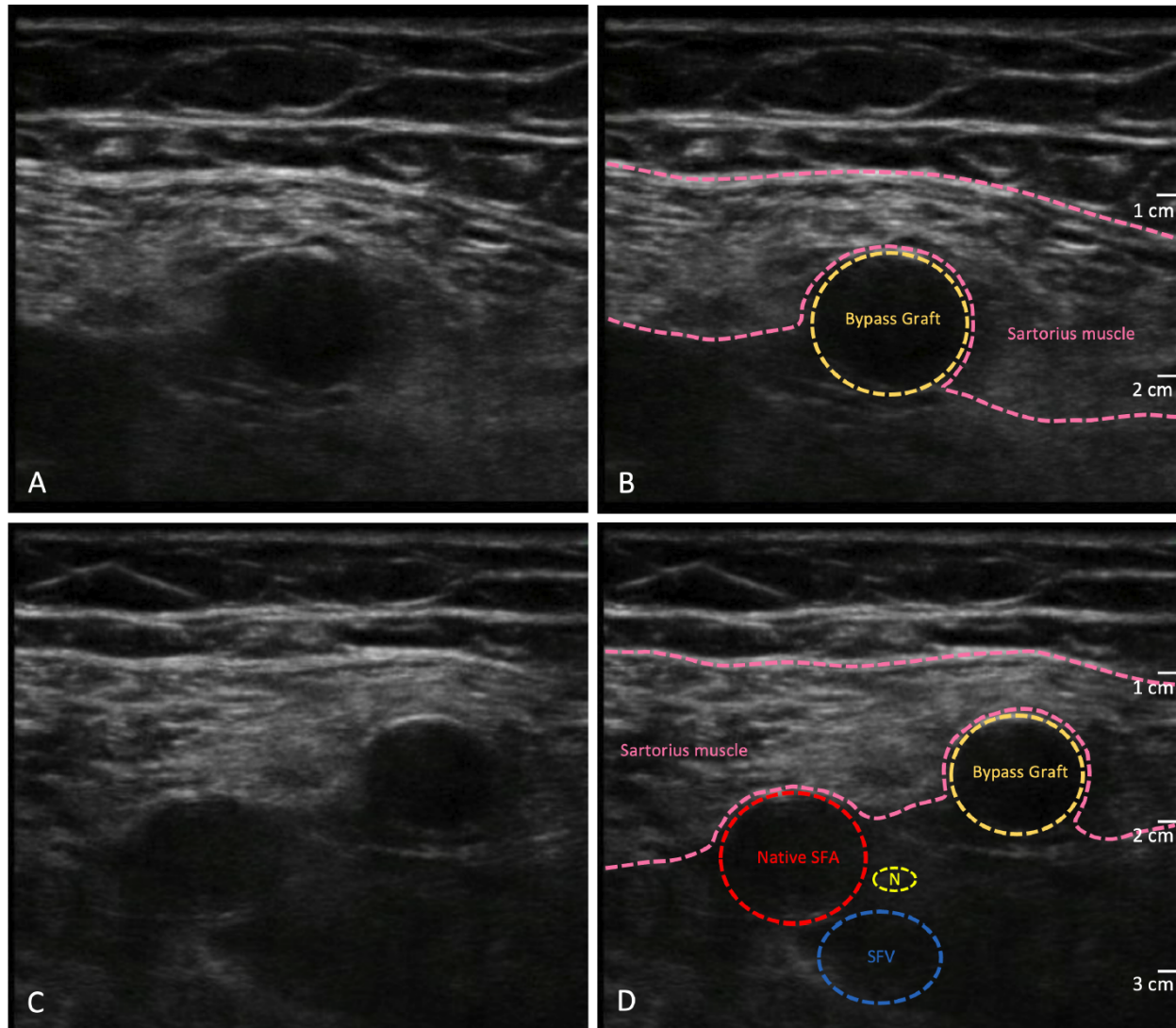


Figure 1. Large pulsatile structure identified as bypass graft (*gold*) deep to sartorius muscle (*pink*) [Panels A, B]. Native SFA (*red*), saphenous nerve (*yellow*) and SFV visualized with increased depth of ultrasound field of view [Panels C, D]. SFA, superficial femoral artery; SFV, superficial femoral vein.

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Abstract - Medically Challenging Case in Obstetric Anesthesia

Title: Challenging Obstetric Anesthesia Management for a Deaf-Mute Patient with Congenital Cardiac Conditions, Morbid Obesity, and Psychosocial Problems

Authors: Shun Yi (Felix) Wan, M.D., Charity May Arañez, D.O., Christopher Der, M.D.

Institution: Harbor-UCLA Medical Center

Background:

Cardiovascular condition is one of the leading causes of maternal morbidity and mortality. To provide care safely in this high-risk population, anesthesiologists should consider careful multidisciplinary actions to plan for labor management. The risks can be higher if patients present along with other significant medical and psychosocial problems. Providing anesthesia care in this setting can be further challenging if labor is complicated with emergencies such as postpartum hemorrhage.

Case Description:

A 24-year-old female patient, G1P0 at 39 weeks, who presented for a scheduled induction of labor. Patient's psychosocial condition was complicated by congenital deafness, developmental delay with limited education, and physical abuse at home. A week prior to induction, patient had an episode of acute psychosis which required inpatient treatment in addition to her severe anxiety. Besides morbid obesity at BMI 41, patient also had a significant cardiac history, including severe congenital pulmonary stenosis with Gerbode defect, tricuspid regurgitation with Ebsteinoid anomaly, bifascicular block, and first-degree heart block. Her complicated cardiac condition was not formally evaluated until she immigrated to the United States at age 19. Since then, patient had undergone multiple pulmonary balloon valvuloplasties.

Discussion:

In this presentation, we discuss the obstetric anesthesia management for this high-risk obstetric patient. Epidural catheter was placed for labor analgesia. However, it was difficult to communicate with her effectively to access her comfort level. With her cardiac condition, it was crucial to dose her epidural infusion and boluses appropriately with close hemodynamic monitoring. After being induced for 55 hours, patient had a vaginal birth complicated by postpartum hemorrhage which required urgent repair of perineal laceration in the operating room. Anesthesia care was again challenged by the need of providing acute and adequate analgesia as well as sedation.

Periprocedural Peripheral Nerve Pain and Symptom Management Pathway

Vanila Singh, MD; Amy Wang, MD; Adrian Anthony, MD; Einar Ottestad, MD;
Vivianne Tawfik, MD; Sarada Sakamuri, MD; Michael Leong, MD; Vafi Salmasi, MD;
Catherine Curtin, MD; Thomas Wilson, MD; Jean-Louis Horn, MD

Introduction: Periprocedural peripheral nerve symptoms are common. Because early diagnosis and aggressive treatment can prevent the transformation of acute to chronic pain, there was a need to revisit how these patients are triaged and managed. Although such a workflow existed between specialists who treat these conditions, an institutionally disseminated and standardized process was lacking for referring physicians. By incorporating further interdisciplinary collaboration, we hereby present our updated periprocedural peripheral nerve pain and symptom management pathway, which will be implemented in a large academic healthcare setting.

Material and Methods: At our large academic hospital, physicians within the departments of anesthesiology, neurology, neurosurgery, and plastic surgery collaborated to develop an interdisciplinary pathway for perioperative patients who experience peripheral nerve pain.

Results: The pathway was categorized into three major steps: 1) identify patient, 2) triage, and 3) management.

Within patient identification, we specified that patients must be in the perioperative period, with or without a regional block, and presenting with painful peripheral nerve symptoms. For inpatients or emergency department patients, the Acute Pain Service should be consulted, whereas for outpatients, an urgent referral should be placed to the Pain Management Clinic.

The patient is then triaged by a pain specialist. Only patients with pain as a symptom move on to the management pathway, whereas patients without pain but with motor or sensory deficits are referred to neurology, neurosurgery, or plastic surgery based on their presentation.

Within the management pathway, symptoms are categorized as readily correctable, painful but not severe, and severe. Patients with readily correctable or reversible conditions (such as dressing compression or immobilization) should have these conditions corrected and re-assessed. Painful but not severe presentation is defined as sensory only, having a discrete distribution, and no motor involvement or loss of function. These patients should be managed with an anti-neuropathic medication and/or an oral steroid course, physical and occupational therapy, a diagnostic nerve block, and nutraceuticals. If the patient has a positive diagnostic nerve block, an advanced intervention such as radiofrequency neuromodulation, cryoablation, or peripheral nerve neuromodulation should be considered. Studies such as electromyography (EMG), nerve conduction study (NCS), and neuromuscular ultrasound (NMUS) should also be considered. Severe presentation is defined as having motor involvement, loss of function, multifocal symptoms, any entrapment or impingement concern, recrudescence, or progression. In addition to the aforementioned management, patients with severe presentation should be referred to neurology and have EMG, NCS, and NMUS completed. For patients with entrapment or impingement concern, Neurosurgery or Plastic Surgery should be consulted for surgical release.

The appendix also outlines specific management and consultation steps for post-surgical inflammatory neuropathy, complex regional pain syndrome, and scar neuroma.

Discussion: Although most postoperative nerve symptoms self-resolve with time, early recognition and management can reduce symptom duration, improve patient outcomes, and prevent the transformation of acute to chronic pain. Early establishment with a pain physician for evaluation, treatment, and referrals to appropriate specialists is key. Utilizing this multidisciplinary approach, we aim to promote timely diagnosis and treatment of perioperative peripheral nerve symptoms at our institution.

Title: Dysmagnesemia is Associated with Prolonged Hospital Length of Stay in the Obstetric Population

Authors: Amber Williamson, MD, Melissa McCabe, MD MSCR, Alexander Qin BS, Jasmine Sran, BS, Alexandra Vacaru, BS, Amanda Chao, MD

Background:

Magnesium is essential for normal physiologic function. It has a vital role in cellular storage, metabolism, and energy utilization; is a cofactor in protein synthesis and neuromuscular function; and enhances nucleic acid stability. While the effects of dysmagnesemia are well studied in the adult population at large, magnesium requirements in the subset population of obstetrics are not fully understood. One study found that serum magnesium decreased from a preconception mean of 0.93 mmol/L to 0.63 mmol/L in the third trimester. We hypothesize that since magnesium is essential for so many functions, dysmagnesemia may be a predictive factor for outcomes in the obstetric population. This study aims to determine whether a correlation exists between dysmagnesemia and hospital length of stay (HLOS) in the inpatient obstetric population

Methods:

This study was a retrospective cohort study, therefore consent was not obtained. Data was collected from electronic medical records of inpatient obstetric patients. Inclusion criteria were American Society of Anesthesiologists Physical Status (ASA-PS) II, III, and IV obstetric patients age 18-46 who presented to Loma Linda University Medical Center (LLUMC) between January 2018 and March 2019 and had a baseline magnesium level obtained prior to any hospital administration of magnesium, if applicable (N=501). A total of 157 patients were excluded for missing data points. Magnesium values were classified as low (less than 0.7 mmol/L), normal (0.7–1.1 mmol/L), or high (greater than 1.1 mmol/L) based on the ranges established by LLUMC laboratory. Kaplan-Meier estimates with log-rank tests were used to evaluate differences in time to event with respect to magnesium status, preeclampsia diagnosis, and anesthesia type separately. A COX Regression model was used to evaluate the combined impact of magnesium status, preeclampsia diagnosis, parity, anesthesia type, and ASA-PS classification on probability of discharge. Statistical significance threshold was set to 0.05. All analyses were conducted in RStudio.

Results:

Median length of stay was 4 days, median age was 29 years, and median magnesium level was 0.8 mmol/L. Ninety-two percent (318/344) of patients were within normal magnesium range (0.7–1.1 mmol/L). Patients with hypermagnesemia comprised 2.6% (9/344) and patients with hypomagnesemia comprised 5% (17/344). Dysmagnesemia was associated with an increased hospital length of stay (HLOS) of 3.43 ± 1.76 days (95% CI), while holding other variables constant.

Conclusions:

Magnesium is critical in many physiologic functions and has important clinical implications. The obstetric population is not excluded from the effects of dysmagnesemia. We aimed to evaluate the prevalence of dysmagnesemia in the obstetric population at our institution and determine whether dysmagnesemia impacts HLOS. We found that 7.6% of obstetric patients at LLUMC had dysmagnesemia, with hypomagnesemia more prevalent than hypermagnesemia. Dysmagnesemia was associated with a prolonged HLOS independent of ASA-PS, type of anesthesia, age, and preeclampsia. More studies should be conducted to evaluate the implications of dysmagnesemia unique to the obstetric population, confirm the association between dysmagnesemia and obstetric hospital stay, determine if there is a causal relationship, and investigate if treating dysmagnesemia prior to the peripartum period improves obstetric outcomes.

Title: Correlation of Pre-Operative Mood and Post-Operative Pain: A retrospective chart review

Authors: Wright, C., Flohr J., Posadas, E. A., Andriella Z., Heifets, B.D.

Institution: Stanford Hospital & Clinics

Introduction: Though anxiety and depression are well-known factors modulating chronic pain, less research exists about those conditions' impact on acute post-surgical trajectories¹. This retrospective chart review assessed pre-operative depressive symptoms (Patient Health Questionnaire [PHQ]) before surgery, as well as PHQ, Brief Pain Inventory (BPI) and Quality of Recovery (QoR) scores on post-operative days (POD) 1, 7, and 30, to describe how post-operative pain varies with pre-operative mood. A subset of patients completed Pain Catastrophizing Scales (PCS). The aim was to determine whether patients with depressive symptoms had increased pain and might benefit from acute pain resources.

Methods:

Patients were identified through Stanford's Perioperative Mental Health Screening Program, an IRB-exempt quality improvement initiative. Patients with surgeries between 2/2020 and 9/2022 were sent the PHQ2 depression screen; those returning scores ≥ 2 completed the more specific PHQ8 (omitting suicidality). Patients with PHQ8 ≥ 5 were referred to psychiatric services and contacted for PHQ8, BPI and QOR on POD 1, 7, and 30. 209 of these patients completed at least one day of post-operative PHQ and BPI or QOR response. 3 patients were excluded because they already qualified for enhanced acute pain resources, for a total of 206 participants.

47 patients submitted BPI responses, considered the gold standard of post-operative pain assessment. To broaden sample size, we also reviewed QOR pain responses for 192 patients. Linear regression showed correlation between QOR moderate pain and BPI average pain responses on POD30 with $r^2 = 0.83$. Preoperative PHQ scores were then related to both BPI and QOR pain scales on POD1, 7, and 30. Where available, PCS was examined for a relationship to QOR and BPI (n=10).

The primary endpoint was degree of correlation between pre-operative mood scores and post-operative pain. Secondary endpoints were return to hospital or referral for uncontrolled acute post-surgical pain (within 7 days); referral to chronic pain clinic within one year for new post-surgical pain; and relationship between PCS and post-operative pain.

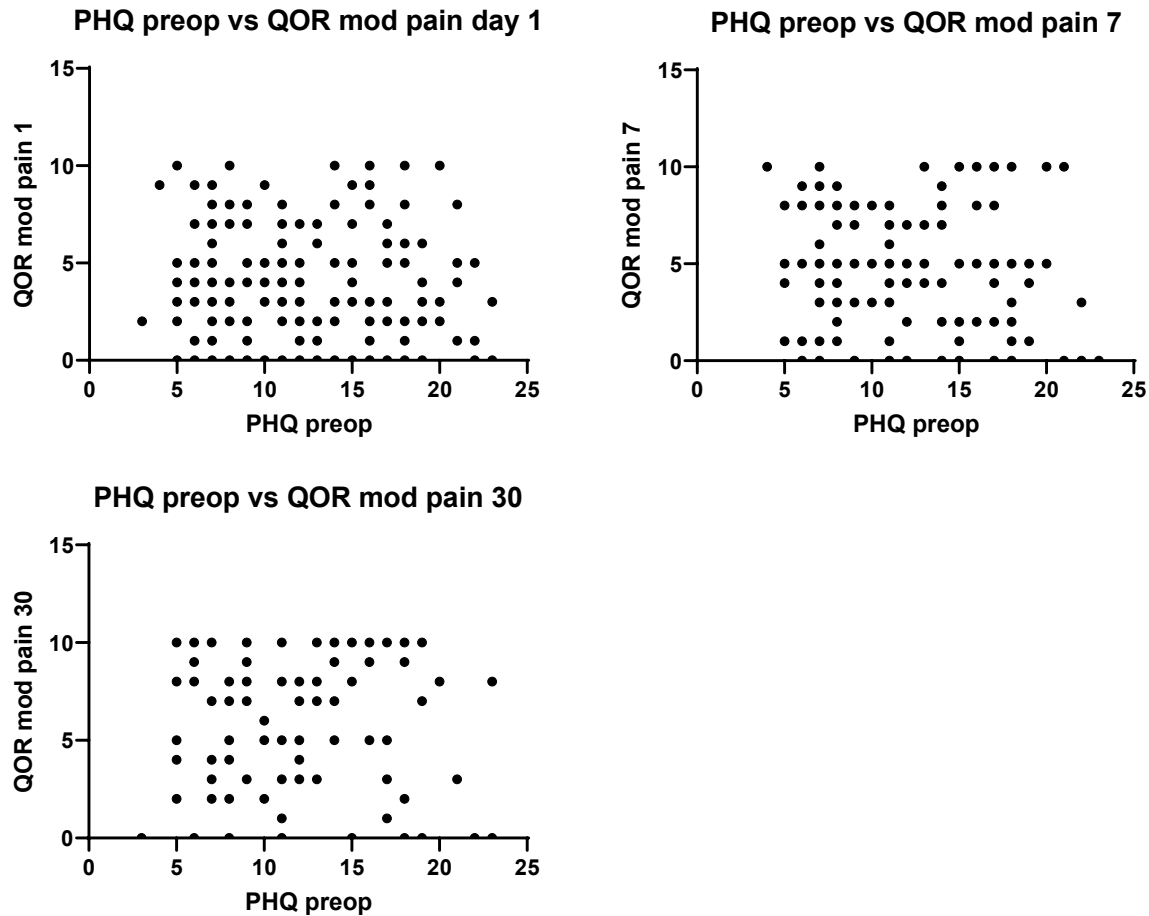
Results:

There was no significant relationship between pre-operative PHQ and BPI or QOR pain scores on POD 1, 7, or 30. Further, there was no statistically significant relationship between pre-operative mood and total QoR scores. Three patients visited the ED for post-operative pain; seven patients were treated for post-surgical pain within one year (PCP visit for "surgical pain"; opioid refill within 6 months; referral to Pain or Palliative Care for post-surgical pain)

Conclusions:

In this sample, PHQ score did not predict pain scores on BPI or QOR, nor did it predict total QOR scores. However, there was possible correlation between PCS and POD30 QOR pain scores, though sample size was limited (n=10, $r=0.44$, $p=0.2$). Though pre-operative mood may not predict which patients will require acute in-hospital pain consults, PCS may be a useful tool to predict prolonged recovery and increased likelihood of referral to chronic pain management.

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Unstable Thoracic Spine Fracture in a Patient with Ankylosing Spondylitis and Concurrent Hemothorax

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Background:

Unstable thoracic spine fractures with associated hemothorax presents a potentially fatal situation.. As this is a rare but critical situation, there are no outcome studies to guide the exact sequence of therapeutic decisions. In a Japanese review of 12 such cases, the reported mortality was 33%.¹ The last reported case in an Ankylosing Spondylitis patient was in 1990.²

Case Report:

We present the care of a 61 y/o morbidly obese, male smoker, with ankylosing spondylitis and an unstable T11-12 fracture due to a “trip and fall” injury and large hemothorax (1 liter) for stabilization of his spine injury. The patient was transferred from an outside hospital where attempted spine fusion was aborted due to loss of neuromonitoring signals during positioning. Due to impending respiratory failure, the patient was intubated preoperatively and a left thoracostomy tube placed. Following respiratory stabilization, due to deteriorating neurologic status, the patient was brought to surgery emergently. This surgery was successful and the patient survived.

Discussion:

In this case, neurologic deterioration with concurrent respiratory failure transformed this case from urgent to emergent. Despite intubation and drainage of 1000 ml of serosanguinous fluid from the thoracostomy tube, the patient’s respiratory metrics improved only marginally. Post intubation on 100% FIO₂ + 12cm H₂O PEEP, SaO₂ = 91%, PIP = 38cm H₂O with TV = 650 ml. Due to concern for ongoing thoracic blood loss, CT Surgery consult was obtained and immediately available during the neurosurgical procedure. The exact source of the hemothorax was never determined.

A critical decision in this case was to delay surgery until it was determined that chest tube output was stabilized and recruitment maneuvers successful at re-expanding the atelectatic left lung, so that mechanical ventilation in the prone position would be tolerated without hypoxemia. Within 45 min, SaO₂ improved to 95% on 60% FIO₂, PIP = 28cm H₂O with TV=650 ml + 5cm H₂O PEEP. Chest tube output during this period was 25 ml. and the decision was made to proceed with surgery.

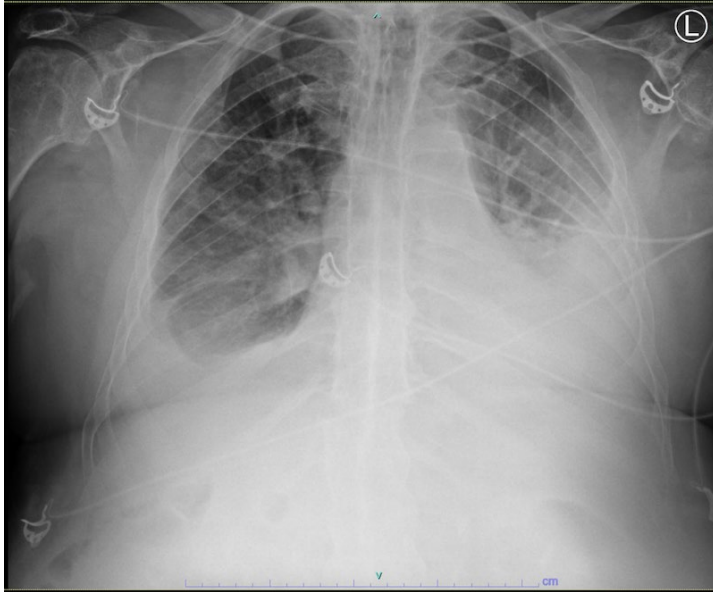
General Anesthesia with invasive monitoring was instituted. Prepositioning neuromonitoring failed to reveal MEP’s or SSEP’s in either lower extremity. Further monitoring was therefore deemed unnecessary. Not unexpectedly, vasoactive infusion support was required to maintain adequate MAP’s throughout surgery and postoperatively. Additionally, the patient remained paraplegic postoperatively, vasoactive infusion support was required for 1 week postop. The patient was extubated on post op day 3 and discharged to a rehab facility on POD #14.

Conclusions:

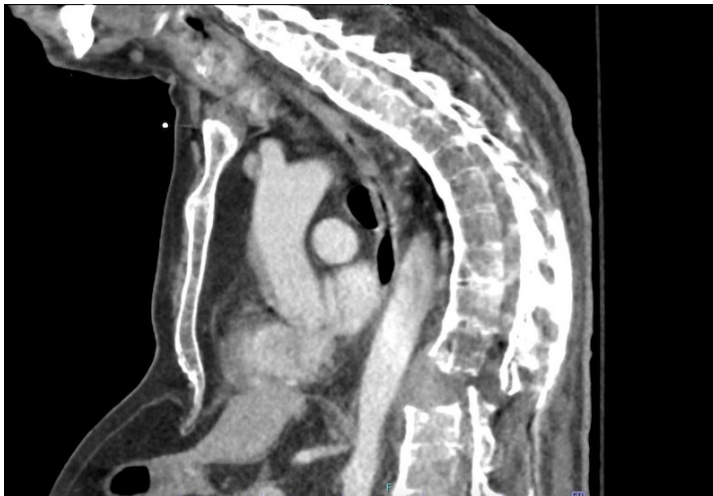
Prioritization of critical clinical elements is essential in the management of complex high acuity patients. Outcomes data, though valuable, are not always available to guide therapeutic decisions, as evident in

this case. Multidisciplinary collaborations are essential to achieve positive outcomes in complex situations.

Pre Op Chest X-Ray



Pre Op Chest CT



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Title: Anesthetic Consideration of Sugammadex Hypersensitivity

Authors: Craig T. Yamaguchi BS, Alastair E. Moody MD, Bryce D. Beutler MD, Catriona E. Moody MD, Patrick Bakke MD *Department of Anesthesiology, University of Utah Health Sciences Center, Salt Lake City, Utah 84132*

Background: Neuromuscular blocking (NMB) agents such as rocuronium bromide have been reported to account for many IgE-mediated anaphylactic reactions during general anesthesia (1). Rocuronium is an intermediate acting nondepolarizing neuromuscular junction blocker with an onset time of 1-3 minutes and is useful in patients with renal impairment, particularly when succinylcholine is contraindicated (2). Sugammadex is approved for reversal of steroid based neuromuscular blocking agents such as rocuronium and vecuronium. Based on the American Society of Anesthesiologists practice guidelines as of January 2023, sugammadex is recommended for patients with mild, moderate, or deep blockade on quantitative Train-of-Four monitoring (3). Sugammadex inhibits binding of steroid based NMB to the acetylcholine receptor at the neuromuscular junction by binding the steroid portion at the center of its cyclodextrin ring. Hypersensitivity reactions to drugs are unpredictable and can be a fatal medical problem in the operating room (4). Sugammadex has been linked cases of significant hypotension, bradycardia and even asystole. In cases where Sugammadex is utilized these side effects should be on the differential if hemodynamic instability is noted.

Case Description: We present a 52 year old female with a past medical history significant for end stage renal disease secondary to polycystic kidney disease who presented for renal transplantation. The case progressed well and the patient was hemodynamically stable throughout the case. At the end of the case the patient was then given sugammadex for neuromuscular blockage reversal. Systolic blood pressure dropped significantly from 120 to 47 in a span of 60 seconds. The patient immediately responded to 20mcg of epinephrine with a stabilization of blood pressure, they were monitored for another 15 minutes before extubation without any changes in their hemodynamic profile. A new rash over the torso and upper arms was visualized prior to extubation. The patient was therefore given diphenhydramine in the PACU. The rash significantly improved and resolved within one hour.

Discussion: Sugamadex is widely used to reverse the effects of neuromuscular blocking agents such as the agents used in our case (5). When injected intravenously, sugammadex's mechanism favors the movements of muscle relaxants away from the neuromuscular junction and encapsulates the muscle relaxants to prevent from further binding onto their receptors and has greater affinity for rocuronium than vecuronium (6). Side effects of sugammadex are rare, but can cause severe hypersensitivity reactions and therefore should monitor the patient during the critical 5-minute period immediately after administration (7). With stronger evidence showing the positive impact of sugammadex while now being recommended over neostigmine, careful consideration should be given to potential interactions and adverse events (3). It's also important to note that the FDA requires women using hormonal contraceptives that receive sugammadex use an alternative form of contraception for 7 days following treatment. While sugammadex has shown to be effective in reversing the effects of NMB agents, anesthesiologists should be aware and take necessary precaution of the potential side effects when administering sugammadex.

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Title:

Abnormal intraoperative end-tidal carbon dioxide capnography tracing in a patient with previous bilateral pulmonary embolism

Authors:

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Institution:

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Background:

Pulmonary embolism occurs when a thrombus travels to the right heart and pulmonary circulation. It is a potentially devastating intraoperative complication, especially with orthopedic surgeries. The gold standard for detection of a pulmonary embolism is transesophageal echocardiography. However, its use is limited as it requires expertise and extra equipment. Here, we present a case of abnormal end-tidal carbon dioxide capnography tracing in a patient with a history of known bilateral pulmonary embolism, and we discuss its potential use in aiding the anesthesiologist intraoperatively.

Case Description:

This is a 33 year old female with a history of gestational DVT and pulmonary embolism who was admitted after a motor vehicle accident with fractures to multiple extremities, including a left distal tibial fracture and bilateral wrist fractures. She initially underwent left patellar tendon repair and bilateral wrist ORIF, then presented with failed patellar fixation two weeks later. She reported having dyspnea and was found to be tachycardic (HR 118) with desaturation to high 80's, briefly requiring supplemental oxygen. CTPA demonstrated large bilateral pulmonary embolism, enlarged pulmonary arteries, enlargement of the right ventricle and straightening of the interventricular septum, suggestive of right heart strain. Transthoracic echocardiogram showed a left ventricular ejection fraction of 56%, moderately reduced right ventricular systolic function, and positive McConnell's sign.

Induction of anesthesia was uneventful. During the case, she was noted to have a sawtooth pattern of her end-tidal carbon dioxide capnography waveform. She was also persistently tachycardic (HR 95-120). Her blood pressure remained stable throughout the case, and she was extubated and transferred to PACU without complication.

Discussion:

The use of end-tidal capnography has been described since 1975, and is a valuable tool for anesthesiologists. The purpose of this case report is to highlight the sawtooth end-tidal carbon dioxide capnography waveform that can be present in the setting of known pulmonary embolism. We also wanted to emphasize its utility as a clinical sign that can aid in early diagnosis and treatment intraoperatively. Pulmonary embolism is a blockage of one or more pulmonary arteries supplying the alveoli, resulting in increased dead space ventilation. Classically, this results in decreasing size of the end tidal waveform due to dilution of the carbon dioxide from ventilated but poorly perfused alveoli. In our case, we noted an irregular saw-tooth end-tidal carbon dioxide waveform which could be due to a ventilation and perfusion mismatch. An irregular capnography waveform may hence be used to support the early diagnosis of pulmonary embolism and should raise clinical suspicion intraoperatively.

Title

Misdiagnosis of LAST as stroke in post-cardiac patient with congestive hepatopathy receiving thoracic ESP infusion.

Authors

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Background

Cardiac surgery is associated with significant postoperative pain, which is increasingly managed with multimodal pain management strategies, including lidocaine.¹ This case demonstrates a confluence of factors that led to LAST in a post-cardiac surgery patient receiving institutional standardized intermittent bolus lidocaine regimen through an interfascial plane catheter.²

Case

A 38-year-old woman presented for a regional nerve block before a minimally invasive mitral valve replacement, tricuspid valve repair, Maze procedure, and left atrial appendage ligation. Her medical history is significant for severe mitral stenosis, moderate-to-severe tricuspid regurgitation, heart failure with preserved ejection fraction, and severe pulmonary hypertension. She received an ultrasound-guided, right T4-T5 erector spinae plane (ESP) catheter for postoperative analgesia.

After a successful surgery, a lidocaine infusion through the ESP catheter was initiated in the CVICU. On POD4, a stroke code was activated by CVICU staff after she developed right hemiparesis, tinnitus, and perioral numbness. Head CT was negative for acute intracranial hemorrhage/infarct. Her serum lidocaine level was elevated at 5.2µg/mL so the infusion was stopped and intralipid was administered. Her neurologic symptoms resolved shortly thereafter.

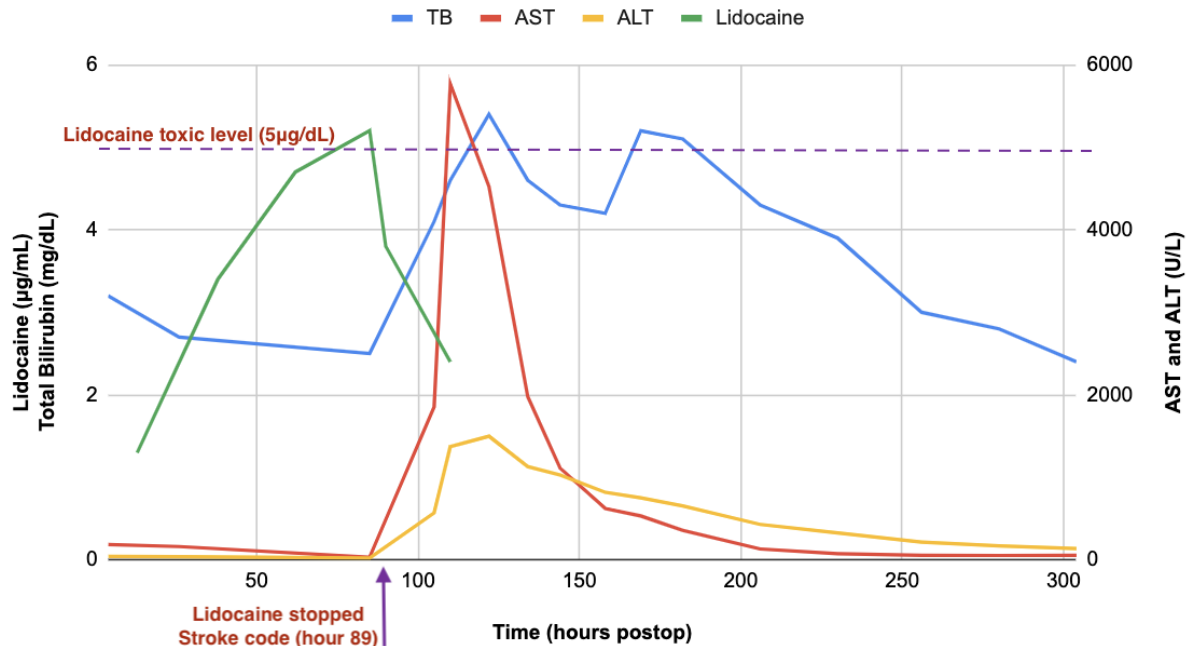
The trend of total bilirubin, AST, and ALT shown in Figure 1 revealed that the patient developed congestive hepatopathy. Further review of the medical records showed that iNO and epinephrine were rapidly titrated off in the immediate postoperative period and she had worsening pulmonary hypertension. She was transferred out of the CVICU on POD10 and discharged home on POD13.

Discussion

Patients with cardiac or liver dysfunction are at increased risk of complications from local anesthetics because of the decreased cardiac depression threshold to LAST and the reduced metabolism of local anesthetics.³ While the underlying cause of the event is unknown and likely multifactorial, this presumed episode of LAST was likely due to impaired lidocaine metabolism from liver shock caused by worsening pulmonary hypertension in the setting of rapid weaning of iNO and epinephrine. Fortunately, she recovered without any persistent hepatic compromise or

effects from LAST. Nevertheless, this case demonstrates that even under constant monitoring, critically ill patients with peripheral regional catheters are still a high-risk population for LAST.

Figure 1: Serum Lidocaine and LFTs During Admission



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Title:

Provider Satisfaction with Automated Labeling System Auditory and Visual Feedback as a Medication Safety Measure in Operating Rooms (OR).

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Introduction:

Medication errors may occur in the OR environment when improperly labeled or inadvertently mistaken with another medication. Organizations like The Joint Commission (TJC), American Society of Anesthesiologists (ASA), and the Anesthesia Patient Safety Foundation (APSF) have identified labeling of medications to be top priorities (1,2,3,4). These priorities support use of Automated Labeling Devices (ALD) that enable barcode scanning with built-in audio and visual feedback in an effort to reduce OR medication errors. However, pre-labeled medications and infusions not prepared by anesthesia providers are often excluded from ALD scanning, bypassing the safety check. At our institution, we utilize the visual feedback of Codonics® ALD to scan medication vials and generate labels. We studied the use of ALD scanning technology (visual plus auditory feedback) for pre-labeled infused medications and surveyed the safety perception by our anesthesia providers.

Inclusion Criteria:

Anesthesia providers including residents, CRNAs, and attendings of Keck Hospital of USC.

Methods:

Codonics® ALD was modified to include pre-labeled medication infusions (e.g. insulin, piperacillin-tazobactam, norepinephrine, epinephrine, nitroglycerin, and levetiracetam) and new scanners were provided. Anesthesia providers were asked to scan these items if needed in two study ORs where auditory feedback alerts were activated. Providers in those ORs completed surveys with 5 questions that was scored on a 7-point Likert scale, while also allowing for comments. User perception and satisfaction were analyzed.

Results:

The pilot ran from June to August 2022. There were 31 surveys, 29 of which were completed with answers to all questions. While 80.6% of participants were "satisfied" or better with the visual feedback ADL workflow, 64.5% reported satisfied or better with the visual and auditory feedback ADL workflow. Additionally, 75.8% "agreed" or better that the current ALD system enhances safety compared to no scanner. Furthermore, 62% agreed or better that scanning drips improved safety, and 51.7% agreed or better that audible feedback was an additional improvement. Moreover, 58.6% agreed or better that the ADL system should provide audible feedback for both vials and infusions. Lastly, 76% wanted more control over the audible

feedback volume; 65.5% wanted the ability to turn the device inaudible, and 34.5% reported if they had the ability to make it inaudible, they would always do so. No medication errors were recorded; however, our study was not designed to quantify errors.

Conclusions:

Preliminary results revealed most providers were satisfied with the use of ALD devices as a safety check, and most agreed that audible feedback was helpful.

As a limitation, users could complete multiple surveys. While these duplications enable bias, they allowed us to track users' perceptions and opinions when using the scanner more than once – all of which were positive. Another limitation was the small sample size and power, preventing us from detecting statistical significance. Nevertheless, trends indicated that more providers were satisfied with the scanners than not and more agreed with the benefits than not.

We conclude that ALDs providing auditory and visual feedback for infusion medications may present an added safety check for OR medication error reduction.

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Racial Disparities in Compensation among U.S. Anesthesiologists: Results of a National Survey
of Anesthesiologists

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Abstract

Introduction

For several decades, there has been a noticeable difference in compensation between different racial and ethnic groups. Previous studies have mainly focused on the intersection of race and gender when it comes to compensation disparities, with White male physicians earning more than Black male physicians and both White and Black female physicians earning less than their male counterparts. In the field of anesthesiology, most studies have only analyzed gender disparities, showing a reduction in annual compensation for female anesthesiologists compared to male anesthesiologists. This study aimed to explore racial and ethnic disparities in compensation among anesthesiologists in the US by analyzing national survey data.

Methods

A survey was sent via email to 28,812 active members of the American Society of Anesthesiologists between September 2, 2018 and October 29, 2018. Primary outcome measure was defined as the amount reported as direct compensation. The data was stratified by race and ethnicity and differences in salary, age, and hours worked were assessed through statistical tests. Linear regression models utilizing log transformed compensation estimates were run as sensitive analysis.

Results

The study sample included 1952 anesthesiologists and was grouped into three categories: non-Hispanic White (77.8%), non-Hispanic Asian (13.9%), and those underrepresented in medicine (URiM) (8.3%). The URiM group consisted of 60.7% Hispanic and 36.8% Black individuals. Anesthesiologists from racial and ethnic minority populations had lower odds (OR = 0.74; 95% CI: 0.61 - 0.91) after adjusting for provider and practice characteristics of being in a higher

compensation range compared to non-Hispanic White anesthesiologists. Further analyses revealed non-Hispanic Asian anesthesiologists had lower odds of being in a higher compensation range compared to non-Hispanic White anesthesiologists (OR = 0.71; 95% CI: 0.56 - 0.90). The median compensation among anesthesiologists from racial and ethnic minority populations was found to be \$16,557 lower compared to non-Hispanic White anesthesiologists ($p < 0.001$).

Conclusion

Our study found a compensation gap based on race and ethnicity among US anesthesiologists, even after controlling for provider and practice characteristics. Anesthesiologists from racial and ethnic minority populations have lower compensation than non-Hispanic White anesthesiologists. Further research is needed to uncover and address the factors that negatively impact the compensation of minority anesthesiologists.

Revision of Total Hip Arthroplasty in a Jehovah's Witness Patient with Difficult Airway due to ankylosing spondylitis- A Case Report

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Background

Jehovah's witnesses belong to a religious organization with over 7.8 million followers whose members refuse blood and blood products including red cells, plasma, and platelets even in life-threatening conditions.¹ Therefore, they are at higher risk for perioperative complications. Documentation of acceptable blood-derived products and blood conservation techniques based on patient preferences should be completed before surgery. Several perioperative techniques have been developed to minimize blood loss and treat acute anemia and coagulopathy.²

Case Description

61 y.o. male patient, Jehovah's Witness (JW), with a past medical history significant for bioprosthetic aortic valve replacement, chronic kidney disease s/p kidney transplant, and atrial fibrillation who presented for complex revision of left total hip arthroplasty. His baseline hemoglobin was 14.3 g/dl. The patient refused any blood product transfusion except albumin and cell saver. He also had a history of a difficult airway and limited neck movement due to ankylosing spondylitis. After dexmedetomidine infusion, we were able to mask ventilate the patient. Anesthesia induction was completed with propofol and low-dose rocuronium bolus. Intubation using an Aintree catheter and fiberoptic scope through the supraglottic airway was successful. An arterial line and 16G IV were placed after intubation. Cell saver was initiated. Due to the inability to give the patient allogenic blood products, we utilized the following measurements, such as permissive hypotension with a mean arterial pressure goal of 65 mmHg, cell-saver technique, hemodilution with fluid resuscitation, and tranexamic acid administration. Intraoperative acetabular fracture further complicated the surgery. When the estimated blood loss reached 1.5 L, a joint decision was made to terminate the procedure without a full revision of the femur. Final estimated blood loss was 2 L. The patient received 3 L of crystalloid, 1.5 L of albumin 5% and 230 mL of salvaged blood. The patient did not require any vasopressors by the end of the case despite 6 points of hemoglobin drop. He was successfully extubated and transferred to the intensive care unit (ICU) for close monitoring. A detailed sign-out was given to the ICU team to ensure a shared understanding of the patient's will and belief.

Discussion

There are several strategies that can be utilized by anesthesiologists when taking care of JW patients. Preoperatively, the patients' hemoglobin should be checked at least 6 weeks before elective surgeries expecting significant blood loss.³ Treatment with iron and/or erythropoietin should be considered if anemia exists. Autologous transfusion can be planned. Intraoperatively, the use of anti-fibrinolytics, such as tranexamic acid, cell-saver techniques, hypotensive anesthesia, and hemodilution are effective methods for managing a large amount of blood loss. Communication between the surgical and anesthesia team is essential to determine the criteria for terminating procedure. Postoperatively, a comprehensive verbal or written handover of the patients to recovery, critical care staff is imperative, ensuring patients' wishes are communicated, understood and respected.

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