55th Annual Western Anesthesia Residents Conference
April 21-23, 2017
The Sentinel Hotel
Portland, OR
Hosted by Oregon Health & Science University
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<th>Day, Year</th>
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| Friday, April 21, 2017 | 12:00 - 7:00pm | Conference check-in & registration  
12:00 - 3:30pm @ The Sentinel Hotel  
4:00 - 7:00pm @ the Columbia store, downtown Portland |
|                | 1:00 - 4:30 pm | Chief Leadership Conference                                                 |
|                | 4:00-7:00 pm  | Social mingling/shopping event/Conference check-in at the Columbia store, downtown Portland |
|                | 4:30 - 6:30 pm| Chief Resident Activity (private Brewvana tour)                             |
|                | 7:00 - 8:30 pm| Chair Dinner, The Sentinel Hotel                                            |
|                | 7:00 - 8:30 pm| Chief Resident Dinner, The Sentinel Hotel                                   |
| Saturday, April 22, 2017 | 6:30 am - 12:00 pm | Registration                                                              |
|                | 6:30 - 7:30 am | Breakfast                                                                   |
|                | 7:30 - 9:30 am | Oral presentations/Exhibitors                                              |
|                | 9:30 - 10:00 am | Coffee Break/Exhibitors                                                   |
|                | 10:00 am - 12:00 pm | Oral presentations/Exhibitors                         |
|                | 12:00 - 1:30 pm | Lunch and keynote speakers                                                  |
|                | 2:00 - 4:30 pm | Oral presentations/Exhibitors                                              |
|                | 4:30 - 7:00 pm | Poster reception, happy hour, and judging  
4:30-5:30 Poster Session 1  
6:00-7:00 Poster Session 2 |
|                | 7:00 pm - on  | Dinner around town                                                          |
| Sunday, April 23, 2017 | 8:00 - 9:00 am | Breakfast & Awards                                                         |
|                | 9:00 - 9:15 am | Intro to mock Deposition                                                   |
|                | 9:15 - 9:45 am | Coffee Break/Exhibitors                                                   |
|                | 9:45 am - 12:00 pm | Mock Deposition                     |
|                | 12:00 pm | Make your own sandwich buffet (to-go containers will be available) |
|                | After 12:00 pm | Optional exclusive shopping opportunity at the Nike Employee Store (everything in the store is 50% off). |
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Dräger
A case of general anesthesia for the patient with a large epiphrenic esophageal diverticulum complicated by severe tracheal stenosis

Background: The joint presentation of elevated aspiration risk and difficult airway is uncommon. Epiphrenic esophageal diverticulum (EED) is a rare disease with an estimated incidence of 1:500,000 cases annually. It is associated with an increased risk of aspiration for patients who undergo general anesthesia, which necessitates prompt securement of the airway upon induction. However, coexisting tracheal stenosis challenges the airway management for these particular patients. There are no published case reports describing these problems as independent issues in a single case. We describe the anesthetic management for a laparoscopic fundoplication in a patient with a large EED and severe tracheal stenosis. Case Description: A 66-year-old woman with EED presented for a laparoscopic esophageal diverticulectomy, Heller myotomy, and Toupet fundoplication for dyspnea and worsening regurgitation. Previous esophagogram showed a 5.9 x 4.6 x 6.7-cm lower esophageal diverticulum (see Figure). During a workup for her dyspnea, the patient was found to have tracheal stenosis with a diameter of 4 mm at its narrowest; consequently, her trachea was dilated to 14 mm in 2014. Her anesthesia record at the time noted an uneventful course including easy mask ventilation following induction. Since the dilatation, there were no changes in symptoms or follow-up procedures to suggest relapse of tracheal stenosis. On the morning of surgery we discussed with the surgical team and assembled appropriate airway equipment and backup devices to accommodate possible conversion to thoracic approach. The patient was pre-oxygenated and placed in the Semi-Fowler’s position. Anesthesia was induced with propofol and succinylcholine following the RSI protocol. We began our intubation attempts with a 35-French (Fr) MallinckrodtTM double-lumen endotracheal tube (DLT; outside diameter [OD] 13.3 mm) and subsequently a 33-Fr DLT (OD 12.3) using a GlideScope, but unexpectedly failed. Then we switched to MallinckrodtTM single-lumen endotracheal tubes (ETT) via fiberoptic intubation. We were unable to pass a 7.0 ETT (OD 9.5) or a 6.5 ETT (OD 8.9), but managed to guide a 6.0 ETT (OD 8.2) through the most constricted portion of the patient’s trachea. Following intubation, auscultation of the lungs revealed clear breath sounds bilaterally. The fundoplication was performed successfully by abdominal approach without need for lung isolation. The ENT team was then consulted intraoperatively to perform tracheal dilation; they replaced the existing 6.0 ETT with an 8.0 ETT (OD 11.0 mm) without resistance. Upon emergence, the patient was fully awake and a negative cuff-leak test was achieved. We subsequently inserted a CookTM airway exchange catheter through the 8.0 ETT tube and extubated her while leaving the catheter in place. The patient maintained a patent airway and the catheter was removed thereafter. The patient’s postoperative course was uneventful; she was discharged home on her third postoperative day. Discussion: We demonstrated the successful anesthetic management of a patient with a high potential for pulmonary aspiration and difficult airway. In this case it was critical to communicate well with the surgical teams, perform a careful assessment of airway and imaging studies, conduct full aspiration precautions, and avoid inadvertent insertion of equipment into an abnormal esophagus.
Poster Presentation

Presenting Author: Dr. Brian Truong University of Washington

Authors:
Dr. Brian Truong University of Washington
Dr. Kyota Fukazawa University of Washington
A Case of Lethal Coronary Artery Disease or Fulminant Lymphohistiocytic Myocarditis?

Background: Myocarditis is the inflammation of cardiac muscle with variable presentations mimicking heart failure, myocardial infarction, arrhythmias/heart block. Epicardial and/or pericardial involvement can lead to effusions and pleuritic chest pain. Its etiology can be categorized by infectious and noninfectious causes, with viruses being the most common among infectious etiologies. Noninfectious causes include autoimmune disorders such as systemic lupus erythematosus and drug-related hypersensitivity myocarditis. Definitive diagnosis is established by endomyocardial biopsy.

Case Description: A 71 year old man with history of chronic atrial fibrillation and renal disease presented to our intensive care unit after sustaining a fall at home, where he was found down by his daughter several hours later. He was febrile, tachycardic, tachypneic, and normotensive upon presentation, with the primary complaint of lethargy. EKG demonstrated prominent ST elevations in leads II, III, aVF and serum troponins were elevated at 23.18. He received a drug eluting stent in his right coronary artery for what was deemed as critical stenosis and his cardiac catheterization also showed a chronically occluded left anterior descending artery with collateral flow. The patient’s course was further complicated by coagulopathy and renal failure, although he experienced improvement of initial symptoms. Regardless, his ST elevations never normalized and his troponin exceeded 100 ng/dl; he also developed tachyarrhythmias and new chest pain on hospital day 5. Repeat catheterization lead to stenting of his left anterior descending artery. Echocardiogram revealed LVEF of 42.3% with inferior and distal RV free wall infarction with the concern of a contained free wall rupture. His clinical status deteriorated with eventual endotracheal intubation and placement of an intra-aortic balloon pump. He eventually succumbed to his illness and passed on hospital day 7. Postmortem biopsy revealed lymphohistiocytic myocarditis.

Discussion: Early identification of myocarditis can be challenging especially in the setting of concurrent coronary artery disease. Lymphocytic myocarditis can be subclinical and progress to dilated cardiomyopathy (or recovery), or as described here in fulminant cardiac failure. Fulminant lymphocytic myocarditis is classified by biopsy-proven myocarditis, severe hemodynamic compromise, rapid onset of symptoms, and fever. Treatment is targeted towards acute heart failure, suppression of arrhythmias, pharmacologic and mechanical circulatory support, and even cardiac transplantation. Evidence to support routine use of antiviral agents, immunosuppressive agents, or IVIG is currently lacking. This case illustrates the importance of keeping a broad differential diagnosis in the setting of worsening cardiac disease in a critically ill patient.

Poster Presentation

Presenting Author: Dr. Alex Suginaka Virginia Mason Medical Center

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Dr. Robert Hsiung Virginia Mason Medical Center
A Case of Local Anesthetic Resistance in a Patient Undergoing Cesarean Delivery

Background: Failure of neuraxial blocks following placement are generally attributed to technical difficulties, poor local anesthetic spread, or under dosing. We report the case of a patient that achieved a surgical block with intrathecal local anesthetic (LA) prior to cesarean delivery but required frequent re-dosing of LA through an insitu epidural catheter. We hypothesize this was due to LA resistance.

Case: A 17 year-old G1P0 at 40 weeks and 2 days with no significant PMH presented to L&D for induction of labor for postdates. An epidural was placed at L3/4, with good pain relief. The epidural was bloused for low pelvic pain/pressure when the patient was 10cm dilated, again with good relief. The patient was diagnosed with Stage 2 arrest after 2 hours of pushing and a cesarean section was scheduled. 15ml of 2% lidocaine with 1:200,000 epinephrine was administered in divided doses to achieve surgical anesthesia. After 10 minutes, the patient had a T8 block, with sparing over T12 dermatome and the decision was made to replace with a CSE. An intrathecal dose of 6mg hyperbaric bupivacaine, 15mcg fentanyl and 150mcg morphine was administered and epidural placed at L3/4. A surgical block to the T-2 dermatome was achieved. The patient tolerated the low transverse cesarean section incision and uterine incision. However, 30 minutes after the spinal dose, at the initiation of hysterotomy repair, the patient experienced severe lower abdomen pain at the pfannenstiel incision described as “tearing”. The epidural was bolused with 10ml 2% lidocaine with epi in divided doses with good relief of pain.

On arrival to the PACU, 1 hour after initial spinal dose and 30 minutes after lidocaine bolus through epidural, the patient reported no pain but was noted to have 5/5 strength and intact sensation in bilateral lower extremities. Upon further questioning, she reported a history of repeated failure of local anesthetic injections at the dentist.

Discussion: There is little research into LA resistance or rapid metabolism. Individuals with Ehlrels Danlos have been known to have resistance to LA (1). A recent genetic variant in voltage gated NA channels was identified in a family experiencing resistance and rapid metabolism of LA (2). This patient experienced good relief with intrathecal and epidural dosing, but had ultrafast offset of anesthesia, possibly indicating a genetic variant in the NA channel or other etiology of LA resistance. Patients should be asked prior to administration of epidural or spinal anesthesia if they have experienced symptoms of resistance in the past. If so, placement of an epidural catheter may be advised for cesarean in case re-dosing is required. References: 1. Arendt-Nielsen, L et al. Insufficient effect of local analgesics in Ehlers Danlos type III patients. Acta Anaesthesiol Scand. 1990;34(5):358-61 2. Clendenen, N et al. Whole-exome sequencing of a family with local anesthetic resistance. Minerva Anestesiologica. 2016;82(10):1089-97

Poster Presentation
Presenting Author: Dr. Donald Luna University of New Mexico Department of Anesthesiology and Critical Care Medicine

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Dr. Donald Luna University of New Mexico Department of Anesthesiology and Critical Care Medicine

Dr. Katherine Seligman University of New Mexico Department of Anesthesiology and Critical Care Medicine
A DESCRIPTIVE ANALYSIS OF THE FIRST 45 PATIENTS RECEIVING LOW DOSE KETAMINE INFUSIONS FOR PERIOPERATIVE ANALGESIA AT MAYO CLINIC ARIZONA

Ketamine is an N-methyl-D-aspartate receptor antagonist with analgesic properties as well as common side effects including psychomimetic effects. Mayo Clinic Arizona recently approved the use of low dose ketamine for post-operative pain control as part of a multimodal pain treatment program. Multiple prospective studies and systematic reviews have shown that ketamine infusions can decrease opiate consumption during hospitalization with an incidence of psychomimetic effects of 7-8%. A recent retrospective study reported sedation in 9.4% of patients receiving ketamine infusions, though co-administration of other central nervous system depressants such as gabapentinoids was not reported. As part of a quality improvement effort, we performed a retrospective chart review of the first 45 Mayo Clinic Arizona patients who received low dose ketamine infusions after the therapy was approved in June of 2016. We determined the type of surgery and the team ordering the ketamine infusion. Opioid consumption prior to surgery, during surgery, and post-operative opioid consumption were calculated as well as the duration of the ketamine infusion. The reason for discontinuation of the infusion as well as adverse events such as hallucinations, dysphoria, diplopia, and nausea were documented. Medication adjuvants were noted such as nonsteroidal antiinflammatory, SSRI’s, muscle relaxants and gabapentinoids. There were a total of 13 neurosurgery surgeries included laminectomy and lumbar fusions. There were a total of 25 colorectal and general surgeries including gastric bypass, Ileostomy creation, laparoscopic colostomy, and laparoscopic sigmoid resection. There were 2 orthopedic surgeries including left above knee amputation, and right femur ORIF. There were 5 patients that were admitted for pain syndromes such as CRPS. The ketamine infusion was started by anesthesia in 27 out of the 45 patients and the remaining 18 were started by pain medicine in the post op period. The patient’s opioid consumption ranged from 0 to 720 daily morphine equivalents with 19 out of 45 patients not taking any opioid prior to surgery. The average duration of the ketamine infusion during the Post-Operative period was 37 hours. Other ketamine related adverse events such as hallucination, dysphoria, and sedation occurred 1/3 of the study population. Out of the 15 patients who experienced ketamine related adverse events 10 of the patients were taking, gabapentinoids, and SSRI’s. The rate of adverse events in our data was higher at 33% compared to 16.2%-22% in other observational ketamine infusion studies with higher infusion rate used in these studies. Also of note that 66% of the patients that experienced adverse events were also taking opioids, gabapentinoids, and SSRI’s as part of their pain regimen. There could be a correlation between adverse events and polypharmacy.

Poster Presentation

Presenting Author: Dr. Jeremy Alvord Mayo Clinic Arizona
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Dr. Jeremy Alvord Mayo Clinic Arizona
Dr. Andrew Gorlin Mayo Clinic Arizona
Dr. Alex Stoker Mayo Clinic Arizona
A Descriptive on a Web-Based Video Curriculum in an Anesthesiology Residency Program: It’s about Staying Relevant with the Millennial Resident

Background: With the vast majority of internet users watching videos, traditional learning via paper text seems passé. To keep up with the demands of millennials, educators need to consider web-based video (WBV) curricula. Moving away from printed materials and didactic lectures allows for passive retention to be replaced by vivid imagery, interactive participation, and acquisition of knowledge, all at the convenience of learning at one’s own pace. With frequent resident rotations (q 4 week intervals) in various subspecialties, the high turnover rate creates an educational challenge to maintain consistency on achieving the learning goals and objectives for each rotation. Moreover, faculty educators must overcome the repetitive and mundane task of ensuring the same material is covered every rotation, while mitigate sounding like a “broken-record” which may be construed as uninspiring and non-stimulating.

Purpose: To provide a descriptive of a WBV curriculum as a supplementary learning resource during the resident’s cardiothoracic anesthesia rotation at Harbor-UCLA Medical Center.

Methods: Utilizing a free app called Adobe Spark Video, a series of WBVs were created from topics deemed essential, which included: 1) Cardiac Vasoactive Infusion Setup, 2) Central Line Placement, 3) Swan Ganz Catheters, 4) Basics of Hemodynamics, 5) Introduction to Echo-getting started, and 6) Cardiac Tamponade. Some of the WBVs involved the residents as the instructors, thus allowing them to participate as fellow educators to their junior colleagues. Anesthesia residents (CA2 and CA3, n=10) were emailed a link to all the WBVs at the start of his/her rotation. After their rotation, they were asked to complete an anonymous on-line survey to determine how effective this format helped them learn new skills and/or cardiothoracic topics.

Results: The video links are: 1) https://voice.adobe.com/a/r16m..., 2) https://spark.adobe.com/video/I3GvkyWhdGbA3, 3) https://spark.adobe.com/video/... 4) https://spark.adobe.com/video/... 5) https://voice.adobe.com/a/mLKx..., 6) https://spark.adobe.com/video/... , respectively. One hundred percent viewed the WBVs, while some residents watched it more than once. Convenience, short video segments (2-5 mins), and the ability to pause/rewind/play were all cited as the most attractive feature. When surveyed about using WBV to learn a new skill, 63.64% preferred to watch an instructional video first on their own, while realistically, only 54% would read about the procedure.

Conclusions: WBV modules offer many advantages, namely: 1) it fulfills the basic learning goals and objectives of the 6 aforementioned essential topics in a consistent manner between trainees, 2) it affords clear expectations of “how” to perform a technical skill that is institution specific, 3) it creates synergy by fostering exploration into more intellectual topics in an interactive format, and 4) it makes learning more efficient by freeing up time to discuss more advanced topics while on busy subspecialty rotations. Millennial learners prefer instructional videos to learn new skills. Since digital technology in learning environments affords many advantages, it must be embrace by residency programs to stay relevant for the future.

Poster Presentation

Presenting Author: Dr. Hany Rayan Department of Anesthesiology, Harbor-UCLA Medical Center

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A diagnosis of small fiber neuropathy in the setting of Gitelman Syndrome

Background: Small fiber neuropathy (SFN) is a disorder selectively affecting small diameter myelinated A-delta and unmyelinated C peripheral nerve fibers. (1) Damage to small somatic nerve fibers results in pain, burning, tingling, or numbness that typically affects the limbs in a distal-to-proximal gradient. In rare cases, small fiber neuropathy follows a non-length-dependent distribution in which symptoms may manifest predominantly in the arms, face, or trunk. (2) SFN has been associated with many medical conditions, most commonly glucose dysmetabolism, but also dysthyroidism, vitamin B12 deficiency, HIV, hepatitis C virus infection, celiac disease, neurotoxic drug exposure, hereditary diseases, and paraneoplastic syndrome. (1) One of the more atypical associated causes of small fiber neuropathy includes a rare renal tubular disorder: Gitelman Syndrome. This autosomal recessive salt-losing tubulopathy is caused by mutation in genes encoding the sodium chloride co-transporters and magnesium channels. (3, 4) The following patient presented with small fiber neuropathy not only of atypical origin but also in an equally uncommon distribution making for a unique and challenging diagnostic process.

Case Description: The authors report a case of a 36-year-old female patient who initially was referred to our pain clinic for evaluation and treatment of fibromyalgia. She described her pain as an electric or burning sensation with insidious onset over several months, first appearing bilaterally in her lower extremities and then spreading to her upper extremities and eventually affecting her back, neck and trunk. The patient’s history was notable for an unintentional 70-kilogram weight loss over a year, despite a normal appetite and diet, in the setting of years of chronic diarrhea, hypothyroidism and macrocytic anemia. Her rapid weight loss resulted in a hospital admission where an extensive work-up failed to reveal signs of malignancy, paraneoplastic findings, autoimmune disorder or acute infection. However, electrolyte imbalances including low chloride and magnesium and a metabolic alkalosis prompted a diagnosis of Gitelman Syndrome. During this time period the patient suffered from progressive imbalance and proximal muscle weakness indicating a large fiber neuropathy. Her continued work up including an epidermal biopsy revealed the patient was also suffering from small fiber neuropathy as evidenced by a markedly low nerve fiber density. Up until this point her gastrointestinal symptoms were hypothesized to be related to chronic clostridium difficile gastroenteritis, however the diagnosis of SFN proved to be a revelation, as Gitelman Syndrome is a rare but known of SFN, which in turn has been well documented to cause enteric dysfunction, thus serving as source of this patient’s painful symptoms, weight loss, malnutrition and subsequent large fiber neuropathy. Discussion: This complex case relates the extensive diagnostic work up of a patient with a rare etiology of small fiber neuropathy, with an unusual manifestation. While the treatment of fibromyalgia and pain due to SFN overlap substantially, the management of SFN focuses on treating the underlying condition, in this case Gitelman Syndrome. Were it not for the persistent efforts, multi-disciplinary approach and excellent intra-disciplinary communication, we may not have arrived at this elusive diagnosis.
Poster Presentation

Presenting Author: Dr. Vishal Khemlani UC Irvine Medical Center, Dept of Anesthesiology

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Dr. Vishal Khemlani UC Irvine Medical Center, Dept of Anesthesiology
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A Matched Case-Control Comparison of Hospital Costs and Outcomes for Knee Replacement Patients Admitted Postoperatively to Acute versus Subacute Care

The Perioperative Surgical Home (PSH) is designed to provide a coordinated, patient-centered approach to surgical care. At one university-affiliated Veterans Affairs (VA) hospital with a PSH, we established an alternate pathway in which total knee arthroplasty (TKA) patients who met medical and logistical criteria (bed availability, ASA 3 or lower, no sleep apnea, and no chronic pain or opioid use history) could be directly admitted from postoperative recovery to an on-campus subacute rehabilitation center instead of the acute care surgical ward. In this retrospective study, we examined whether this “fast track” pathway was associated with lower costs and improved patient outcomes. We examined the medical records of consecutive patients who underwent unilateral primary TKA from July 1, 2015, through September 30, 2016. We initially collected the following data for all patients: 1) postoperative admission unit; 2) age; 3) sex; 4) height; 5) weight; 6) body mass index; and 7) ASA physical status. After including cases admitted to subacute rehabilitation, each case was matched with a control admitted to the surgical ward using baseline variables. The primary outcome was estimated total cost of hospitalization (length of stay multiplied by the average cost per day provided by the VA Managerial Cost Accounting Program for fiscal years 2015-16). Secondary outcomes were hospital length of stay (days); pain scores (0-10 numeric pain rating scale), opioid consumption (mg morphine equivalents), and maximum ambulatory distance (meters) on postoperative days 1 and 2; 30-day morbidity and mortality; and 30-day readmission rate. There were 262 TKA patients during the study period; 14 were admitted directly to rehabilitation. These cases were matched to 14 unique patients admitted to the surgical ward. The estimated total hospitalization cost [median (10th-90th percentiles)] was $30,755 ($23,066-$38,444) for ward patients compared to $17,620 ($13,215-$33,918) for rehabilitation patients (p=0.006). This difference [mean (95%CI)] was $10,143 ($2,174-$18,112). There was no difference in length of stay or other outcomes between groups. In the postoperative period, 1 ward patient required a rapid response for suspected anaphylaxis; 2 rehabilitation patients had presyncopal or syncopal episodes (p>0.999). Within 30 days, 1 ward patient visited the emergency room for pain management without reoperation while 1 rehabilitation patient required manipulation under anesthesia (p>0.999). There were no other cases of major morbidity or death in either group at 30 days postoperatively. For eligible patients, direct postoperative admission to a subacute rehabilitation ward may be less costly than admission to an acute care surgical ward following TKA and may not negatively affect length of stay, pain control, functional achievement, or other outcomes within 30 days of surgery. Compared with outpatient TKA, on-campus rehabilitation still allows physicians to monitor patients for complications and respond quickly although at lower cost than traditional hospitalization.

Poster Presentation
Presenting Author: Dr. Brian Tse Department of Anesthesiology, Perioperative and Pain Medicine, Stanford University School of Medicine, Stanford, CA

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Dr. Edward Mariano Anesthesiology and Perioperative Care Service, Veterans Affairs Palo Alto Health Care System
A Novel Paradigm for a New Class of Anti-Arrhythmic Drugs Based on Targeting Ca Channel Gating Properties

Background: Early after depolarizations (EADs) play a key role in the genesis of arrhythmias in cardiac diseases including congenital and acquired long QT syndrome and heart failure. It is the underlying mechanism of polymorphic ventricular arrhythmias such as Torsades de Pointes, and often underlies atrial fibrillation and VF, which are associated with significant morbidity and mortality. Most pharmacological anti-arrhythmic drug strategy is focused on “ion channel blocking” which has been shown to be ineffective and even pro-arrhythmic in some cases as seen in the CAST and SWORD trials. In this study, we propose a new paradigm for anti-arrhythmic drug development based on modulation of ion channel gating, ie. “ion channel gating modulation” rather than “ion channel blocking”, with a focus on targeting Ca channel gating properties without adversely impacting excitation-contraction (E-C) coupling.

Methods and Results: Optical mapping of cultured neonatal rat ventricular myocyte (NRVMs) monolayer tissue exposed to BayK8644 and isoproterenol revealed robust bursts of EADs resembling those seen in neurons, and is thus an ideal in vitro model of EADs to test anti-arrhythmic strategies. Modulation of the gating properties of the Ca channels with Roscovitine, a chemotherapy agent with unique properties of accelerating inactivation of the Ca channel and reducing late Ca current without significantly impacting the peak Ca current, eliminated EAD bursts in 90% of NRVM monolayers (n=10). Roscovitine did not significantly affect APD (surrogate of QT interval), while peak Ca fluorescence was slightly but significantly increased.

Conclusion: Targeting Ca channel kinetics without adversely impacting E-C coupling may serve as a viable therapeutic strategy for the development of this new class of anti-arrhythmic drugs.

Oral Presentation

Presenting Author: Dr. Marvin Chang UCLA Department of Anesthesiology and Perioperative Medicine

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A Novel Technique for Performing the Infraclavicular Peripheral Nerve Block

Introduction: The infraclavicular approach to block the brachial plexus provides effective anesthesia of the distal two thirds of the arm. The block can be challenging to perform because the cords are situated deep, surround an artery, and the angle of the needle to reach the target is often acute. A common approach is to position the transducer in the parasagittal plane just medial to the coracoid process and inferior to the clavicle. The needle is inserted cephalad to the probe, in-plane and directly caudad. A newly described infraclavicular approach to the brachial plexus involves placement of the probe in an oblique plane, parallel to the clavicle, where the cords of the brachial plexus lie lateral to the axillary artery. We describe the sonoanatomy of this approach and compare it to the traditional approach.

Materials and Methods: After IRB approval, informed consent was obtained from patients at Stanford’s Surgery Center for ultrasound examination. 25 patients were examined. Patients on hospital gurneys were scanned bilaterally using both new and traditional techniques with a linear L12-6 MHz ultrasound probe and GE S8 XD-Clear ultrasound. Traditional Technique: With patient supine, arm was abducted and elbow flexed. The ultrasound probe was placed in the sagittal plane tangential to the medial surface of the coracoid process. New Technique: With patient supine, arm was positioned at patient’s side. The probe was placed at the inferior border of the clavicle, parallel to the clavicle, and lateral to the midclavicular line. The following images and measurements were obtained: Distance between artery and cutaneous surface Distance from artery to pleura Number of veins Topography of cords Results: The sample population (16 males, 9 females) had a mean age of 42.8 years and BMI of 28 +/- 5. The average distance between the upper part of artery and cutaneous surface was 27.0 +/- 6.8 mm with the new technique and 31.3 +/- 7.4 mm with the traditional technique (p-value = 0.0032, unpaired t-test). The pleura was in closer proximity to the axillary artery in the new technique (p-value < 0.0001, unpaired t-test) and there was more variability in the number of veins visualized (p-value = 0.0281). With the new technique, the cords, although not individually identifiable, were clustered together just lateral to the axillary artery, as opposed to clustered around the artery (p-value = 0.0001). Discussion: In this study, we conclude that this new approach to the infraclavicular nerve block may be beneficial because the plexus is a closer target from the skin and the cords are clustered together lateral to the artery, thereby potentially decreasing the incidence of inadvertent vessel punctures and, with catheter placement, improving the tip location close to all 3 cords. Potential disadvantages of this technique include a higher risk of pneumothorax due to the pleura being closer to the brachial plexus and increase in number of visible veins. The proposed variation to the infraclavicular approach of the brachial plexus block is novel, and is a valid, if not preferable, alternative to the more traditional technique.

Poster Presentation

Presenting Author: Dr. Patrycja Olszynski Stanford University

Authors:

Background

The United States is in the midst of an unprecedented opioid epidemic [1]. While opioids are widely used in the perioperative setting, little is understood about how perioperative practices influence chronic opioid use. Recent developments in care redesign processes have promoted the application of concepts such as Enhanced Recovery After Surgery (ERAS) to improve quality of care and patient outcomes. Opioid-free analgesia (OFA) and opioid-sparing techniques are key elements of ERAS protocols.

We recently launched an ERAS program for colorectal surgery, and we report the impact of this implementation on perioperative opioid utilization, postsurgical pain scores, and the incidence of opioid prescription at hospital discharge.

Methods

We conducted a retrospective analysis of adult patients undergoing elective colorectal surgery from January to December 2016. Patients in the intervention group were treated according to our ERAS guidelines. These guidelines incorporate glucose management, goal-directed fluid therapy, postoperative nausea and vomiting prevention, lung-protective ventilation, and OFA and opioid-sparing techniques (regional anesthesia, ketamine infusion, intravenous acetaminophen, and oral celecoxib). We compared patients undergoing surgery with the ERAS intervention to a historical control group of propensity-matched patients who underwent similar surgeries prior to the ERAS intervention.

The primary outcome measure was a dichotomous indicator noting the presence of an opioid prescription on discharge. Secondary outcome measures were pain score on day of discharge (4, mild-to-moderate and ≤ 4, moderate-to-severe), OFA (defined as no opioid administered intraoperatively), and utilization of regional anesthesia.

Results

One hundred and four patients were treated in the ERAS group, and 69 of these patients were matched to a historical control group of 69 non-ERAS patients. ERAS patients were more likely to receive OFA (70% vs 29%, p<0.001) and regional anesthesia (96% vs. 86%, p=0.041) compared to the control group. Moderate-to-severe pain scores were not significantly different in the ERAS and control groups (32% vs 37%, p=0.617), and 94% of patients in both groups were discharged with an opioid prescription.
In both groups, all patients with moderate-to-severe pain (44/44) were discharged with an opioid prescription compared to 90.4% (75/83) of patients with mild-to-moderate pain (p=0.050).

Conclusions

Our retrospective analysis of patients undergoing elective colorectal surgery found that utilization of OFA and regional anesthesia increased significantly after ERAS implementation and was not associated with increased discharge pain scores. However, this did not reduce the incidence of opioid prescription at hospital discharge; nearly 9 in 10 patients with discharge pain scores 4 in both groups were discharged with an opioid.

Our finding that 90% of patients with mild-to-moderate pain following elective colorectal surgery were discharged with an opioid prescription indicates that physician behavior, rather than patient condition, may be the primary determinant of opioid prescribing practices in our study. In addition to redesigning perioperative care processes, efforts should be made to modify physician perioperative behavior with the ultimate goal of curtailing the use of opioids at the population level.

References


Oral Presentation

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A rare cause of severe bradycardia leading to cardiac arrest during general anesthesia

BACKGROUND: Takotsubo cardiomyopathy, commonly known as broken heart syndrome, is a stress-induced cardiomyopathy that mimics acute coronary syndrome, but rarely presents in the perioperative period. We present a unique presentation of Takotsubo cardiomyopathy with severe bradycardia and ST changes intraoperatively.  

CASE REPORT: A 63 year old female with no significant cardiac history presented with left cerebellar and left frontal lobe masses scheduled for sub-occipital craniotomy. Past medical history included hypertension, type 2 diabetes, end stage renal disease, and kidney transplantation, and reported a 12-hour history of malaise. It was discovered postoperatively that she also had significant recent emotional stress with the death of a close family member. After induction of anesthesia and intubation of the trachea, the patient was positioned for surgery. Over the next few minutes she developed profound bradycardia with her heart rate decreasing from 65 bpm to 24 bpm. A wide complex QRS and increasing ST segment elevation in V5 accompanied the bradycardia which was minimally responsive to low dose epinephrine, glycopyrrolate, and atropine. Within minutes she no longer had a palpable pulse and cardiac arrest was recognized. Full ACLS resuscitation was performed with intra operative transesophageal echocardiogram showing apical ballooning of the LV with global hypokinesis. She was taken to the cardiac catheterization lab where angiography showed patent coronary arteries and elevated PA pressures. A ventricular assist device was inserted to offload the LV. Over the next 24 hours cardiac function returned to normal and the device was removed. Unfortunately, the patient was found to have suffered an anoxic brain injury during resuscitation and cardiopulmonary support was withdrawn.  

CONCLUSION: Takotsubo cardiomyopathy can be triggered by emotional stress; in this case it appears to have been exacerbated by induction of general anesthesia. Presenting signs including ST changes, hemodynamic instability, bradycardia, and cardiac collapse can mimic acute myocardial infarction. Her malaise likely reflected early symptoms. Typically, the diagnosis can be made by echocardiogram in the setting of acute coronary syndrome being ruled out on angiogram. Intraoperative bradycardia due to Takotsubo cardiomyopathy, while somewhat rare, should always be on the differential diagnosis when acute coronary syndrome is suspected.

Poster Presentation

Presenting Author: Dr. brad harris University of Utah

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Dr. brad harris University of Utah
A Retrospective Comparison of Anesthetic Regimens and Outcomes for Awake Craniotomies

Dr. Jonathan Myers, Dr. Deepak Sharma University of Washington, Department of Anesthesiology and Pain Medicine

Background: Neurosurgical treatment of some brain tumors and epileptogenic foci require a unique anesthetic management that allows for awakening the patient during surgery and testing of neurological function. This “asleep-awake-asleep” anesthesia makes possible functional mapping that allows resection of the tumor / epileptogenic focus while minimizing loss of neurological function. Prior studies of anesthetic regimens for awake craniotomies at our institution utilizing a propofol infusion and an unprotected airway have reported infrequent complications, however, the incorporation of laryngeal mask airway (LMA) devices and new anesthetic drugs has resulted in a broadening of anesthetic techniques for these procedures.

Methods: We performed a retrospective review of 115 awake craniotomy procedures utilizing a variety of anesthetic regimens and either an unprotected airway throughout or an LMA intermittently. Anesthetic records were analyzed for intraoperative complications including hemodynamic instability, airway compromise, seizures, bleeding, stroke and death. Chart review was performed to assess post-operative complications and surgeon satisfaction.

Results: Complications were uncommon, featuring limited seizures, brain swelling, airway obstruction requiring additional management, and a single incidence of aspiration. The patient who aspirated was able to complete intraoperative language mapping, was treated for an aspiration pneumonitis and discharged without requiring further treatment or follow-up. A general assessment of surgeon satisfaction revealed a single instance in which functional mapping was not possible due to a lack of patient cooperation.

Discussion: Compared to prior studies at our institution, evolving anesthetic regimens and techniques do not appear to lead to an increase in complications or contribute to poor clinical outcomes. In fact, the ASA status and number of comorbidities has increased in the patient population undergoing this procedure at our institution, making a more tailored approach necessary. The availability of additional regimens and airway devices are likely contributors to maintaining a low incidence of complications in an increasingly complex patient population.

Poster Presentation

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A REVIEW OF THE PERIOPERATIVE MANAGEMENT FOR PATIENTS WITH HEREDITARY ANGIOEDEMA

INTRODUCTION
Angioedema (AE) is described as edema due to an allergic, hereditary or acquired condition. Hereditary AE (HAE) accounts for 2% of clinical AE cases and affects roughly 1 in 50,000 people. HAE is transmitted in an autosomal dominant pattern and results in episodic edema of the skin and mucosa of the respiratory and gastrointestinal tracts. In HAE, dysfunction of the C1 esterase inhibitor (C1-INH) leads to elevated bradykinin levels, which increases vascular permeability and causes edema. The most dreaded complication is edema of the upper airway resulting in life-threatening airway compromise and asphyxia. Type I HAE accounts for 85% of HAE and is characterized by deficient levels of C1-INH. Type II HAE is seen in 15% of cases and involves normal or elevated levels of dysfunctional C1-INH. AE development can be unprovoked or triggered by minor things, and the perioperative period is considered high risk for triggering AE.

CASE REPORT
A 69-year-old female with a past medical history of HAE Type II, HTN, DLD, GERD presented for C2-C6 laminoplasty and fenestration of syringohydromyelia causing progressive left upper extremity weakness and sensory deficits. Patient noted that she had three prior tracheostomies, two related to URIs in the 1960’s and the third in 2004 following surgery for an ischemic bowel. She was on long-term prophylaxis with danazol 200mg daily for the past 30 years. On the day of surgery, she received 2000u of IV plasma-derived C1-INH (Berinert) one hour prior to surgery. She then underwent uneventful induction of general anesthesia and intubation utilizing a GlideScope and 6.0 ETT. A CVC and arterial line were placed and the patient underwent successful laminoplasty and fenestration. The patient was extubated in the OR at the end of surgery and taken to the ICU for careful observation overnight. She was continued on her home dose of danazol throughout her stay and did not experience any airway AE during her hospitalization but did complain of abdominal pain for which she received 1500u plasma-derived C1-INH on POD 2, 4, and 6.

DISCUSSION
No routinely administered anesthetic drugs are considered contraindicated in patients with HAE, but estrogen contraceptives, hormone replacement therapy, and ACE inhibitors are known to potentially worsen the disease. Management focuses on increasing C1-INH levels and blocking the actions of kallikrein, bradykinin, and plasmin. This is accomplished by short-term or long-term prophylaxis or with rescue therapy. Long-term therapy is indicated in those experiencing ≥1 attack per month that is unresponsive to rescue therapy or when rescue therapy is not readily available. This is accomplished with C1-INH, attenuated androgens, and antifibrinolytics. Short-term prophylaxis for procedures requiring airway manipulation calls for C1-INH 1 hour before surgery with an additional dose available in case of emergency. Androgens are another option if C1-INH is not available. Rescue therapy for acute AE can be treated with C1-INH, ecallantide, or icatiban. HAE is a rare disease that can pose a significant challenge to anesthesiologists in the perioperative period; therefore one must be familiar with the prophylaxis and treatment algorithms currently available.

Poster Presentation
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A systems-based approach to reducing heparin dosing errors in the cardiac catheterization lab at Seattle Children’s Hospital

Background: Heparin is a high-risk medication as defined by the Institute for Safe Medication Practices. At our institution, the cardiac catheterization lab is often staffed by rotating residents working in an unfamiliar environment with minimal experience prescribing, preparing and administering heparin. Mutiple heparin errors have occurred.

Case Description: A seven month old girl presented to the cardiac catheterization lab for right heart and retrograde left heart catheterization, pulmonary angiography, aortic root angiography, right and left pulmonary artery balloon angioplasty, and embolization of an aortcopulmonary collateral. During the procedure, the interventional cardiologist requested that 50 units/kg of heparin be administered intravenously. The anesthesia resident calculated the dose to be 300 units of heparin and read this back before administering. The cardiologist confirmed the dose. Later, an ACT was found to be critical/undetectable. The attending anesthesiologist found that a 3 mL syringe had been used to deliver the heparin, and confirmed with the resident that 3 mL of 1000 units/mL heparin (or 3000 units) had been administered. Protamine 10mg was administered, and a repeat ACT was found to be within normal range. Direct pressure was applied for 10 minutes following removal of catheter, and there was no evidence of morbidity.

Discussion: Incorrect dosing of heparin has occurred in our cardiac catheterization lab on more than one occasion. The most common error is a ten-fold overdose of heparin, which also occurred in this case. Sources of incorrect dosing can be traced to: incorrect dosing request, incorrect weight-based dose calculation, incorrect units per volume calculation, and incorrect volume administration. A simple read-back of the final volume to be administered has not historically reduced our rate of heparin errors, likely due to bias in hearing the expected dose and not the communicated dose. Therefore, we have instituted a standard process to minimize the risk of heparin errors. This process involves: 1) communication by cardiologist for anticipated heparin administration at pre-procedural “time-out,” 2) request for heparin dose in units/kg by cardiologist at the indicated time, 3) a two-provider independent verification of dose and volume with the catheterization lab nurse, and 4) a job aid to confirm the correct weight-based dose in both units and mL of heparin.

Figures: Figure 1: Syringe used to administer heparin (how overdose was recognized). Figure 2: Process flow chart illustrating opportunities for error and opportunities for recognizing/preventing error. Figure 3: Weight-based dosing guideline for dose verification.

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Poster Presentation
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**Acute Hemorrhage in a Patient with Severe Pulmonary Hypertension and Right Heart Failure**

Background: We are presenting the case of a patient with multiple co-morbidities including systemic lupus erythematosus with pulmonary and cardiac disease with severe pulmonary hypertension and right heart failure from massive right heart dilatation presenting with acute abdominal hemorrhage resulting in abdominal compartment syndrome. Case Description: 40 year old female ASA 5E in the medical ICU was emergently taken to the operating room for an exploratory laparotomy to control bleeding and relieve abdominal compartment syndrome (bladder pressure of 20). She has a history of systemic lupus erythematosus with pulmonary disease and pulmonary hypertension, pericardial effusion secondary to her SLE, and anti-phospholipid antibody syndrome on enoxaparin. She in atrial fibrillation and atrial flutter, on an amiodarone drip. Prior to being taken to the operating room, her pulmonary artery pressures of 90-100/30-40 and central venous pressures 19-29, system blood pressure was 100-110/60-70 on inotropic support such as dobutamine and vasopressin. Transthoracic echocardiography was significant for moderate-sized pericardial effusion, dilated inferior vena cava, severely elevated right atrial pressure, and "massively" and "severely" enlarged right atrium and ventricle, respectively. Her starting hemoglobin was 6.2 and she was saturating 85-90% on 100% oxygen with baseline brain-ox level of 20. In order to treat the severe pulmonary hypertension, inhalational nitric oxide was started 40 ppm without any improvement in pulmonary artery pressures. In the operating room, the patient was induced with small doses of ketamine 10 mg at a time (total dose 50 mg), sevoflurane 1.5%, and morphine was titrated to respiratory rate. Rapid sequence induction with cricoid pressure was performed with succinylcholine 100mg for muscle relaxation. Patient was gradually resuscitated with 6 units of blood, 4 units of fresh frozen plasma and 10 units of platelets. Acidosis was treated with bicarbonate. Epinephrine was increased and a low dose of nitroglycerin drip was started simultaneously with blood transfusions. Blood pressure improved to 120-125/70-75, heart rate was 110, pulmonary artery pressures improved to 75-80, brain-ox increased to 40, and peak inspiratory pressures improved from 40 to 36. Surgical exploration yielded a 4L hematoma in the rectus sheath that was evacuated. Patient’s hemodynamic parameters remained stable at the end of surgery and on transfer back to the Medical ICU. In the post-operative period in the ICU, nitric oxide and nitroglycerin were continued with dobutamine and epinephrine. She was extubated the next day in stable condition, alert and oriented following commands, moving all extremities, and had decreasing inotropic requirements. Discussion: Severe pulmonary hypertension often results in right heart failure, tricuspid regurgitation, and increasing renal pressures which result in renal failure. Transfusion of blood products may exacerbate pulmonary hypertension and heart failure through circulatory overload. The combination of nitroglycerin and nitric oxide with epinephrine and dobutamine are beneficial in minimizing pulmonary hypertension, improving right heart failure and transfusion related problems.

Poster Presentation
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Acute inhalation injury in burn patients: A case report

Background: A burn on the face leads to a high possibility of a concomitant smoke inhalation injury being present. Inhalation injury is associated with a difficult airway and early intubation is critical. Airflow may be obstructed secondary to upper airway edema caused by thermal injury. Oxygen delivery may also be reduced in the setting of lower airway and lung parenchyma injury. Lastly, carbon monoxide poisoning prevents appropriate oxygen delivery to tissues. Case description: We describe the case of a healthy, non-smoking 30-year-old male with no past medical history who suffered an inhalation injury and facial burn due to an apartment fire. Endotracheal intubation was performed immediately on arrival and confirmed by portable chest film. Bronchoscopy was performed to diagnose inhalation injury and to assess the severity. Treatment consisted of supportive care, mechanical ventilation, and appropriate transfer to a burn center. Discussion: We conclude with advice on the optimal airway management in patients with inhalation injury, the role of bronchoscopy and objective grading of inhalation injury, and lastly guidelines in treatment in this population.

Poster Presentation

Presenting Author: Dr. David No Cedars Sinai Medical Center

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Acute pulmonary emboli in patient with total artificial heart

INTRODUCTION  The Syncardia total artificial heart (TAH) is a mechanical circulatory assist device that serves as bridge to orthotopic heart transplantation in patients with irreversible biventricular failure. Challenges of destination therapy with TAH include thromboembolic disease, bleeding, infections from percutaneous drivelines and long-term maintenance of pulmonary-systemic circulatory balance. We describe the first case of long-term use of Syncardia TAH for failed OHT complicated by acute pulmonary embolism that exacerbated underlying pulmonary hypertension and precipitated irreversible right sided TAH failure.

CASE DESCRIPTION  A 30-year-old Caucasian man with a background of idiopathic dilated cardiomyopathy with TAH following failed OHT secondary to antibody mediated rejection, pulmonary hypertension, anemia, DM, and ESRD on hemodialysis presented to the hospital for complaint intermittent loss of consciousness with persistent alarming from device indicating incomplete Right-sided ejection not resolved by exchanging to alternate external driver. In the ED, an immediate concern for device malfunction was raised prompting chest CT-angiogram demonstrating acute large filling defect in the left interlobar pulmonary artery extending into the lower lobe segmental branches. INR upon presentation was therapeutic 3.7 on outpatient anticoagulation regimen including coumadin, ASA and dipyridamole. The patient was admitted for device malfunction secondary to embolic burden resulting in Right-sided device failure. Initial therapies included heparin drip, inhaled nitric oxide, epoprostenol, and CRRT, in attempt to overcome high PA pressures. An IVC cavogram was performed with right heart angiography and pulmonary angiography. The IVC was patent, free of thrombus and the TAH valve leaflets were visualized in real-time fluoroscopy with normal motion. No discrete right heart or pulmonary outflow tract thrombus was appreciated. The patient’s clinical progression despite above supportive therapy was significant for multiple syncopal events secondary to right-sided device failures, requiring intermittent manual pumping of TAH. Inspection of device data and flow graphics did not reveal mechanical failure as internal components as well as external drive lines were appropriately functioning. The increasing frequency of syncopal events prompted systemic fibrinolysis however device failure rate did not improve and the patient developed worsening multiorgan failure that prompted transition of care to comfort measures. Patient has died 12 days following admission after subsequent device failure.

DISCUSSION  The longest documented time a patient receiving TAH support is 1374 days prior to successful heart transplant. The patient described in the case report was supported by TAH device for a total of 1067 days. Complications associated with long term TAH implantation include infection, bleeding, renal failure, chronic anemia and thromboembolic disease. The unique nature of this case is the development of acute pulmonary emboli which had not been previously reported as the majority of reported thromboembolic phenomena were largely associated with neurologic sequelae. Platelet activation and thrombogenecity were likely enhanced with the diaphragm rupture despite full anticoagulation prompting the discussion of thrombolytic therapy and its appropriate use in this extenuating circumstance in the management of grossly elevated PVR. As TAH has been approved for prolonged use as
transplant alternative, additional attention should be directed toward the optimization of the device for thromboresistance and durability

**Poster Presentation**

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Acute tracheal tear after endotracheal intubation: a case report.

Background: Iatrogenic tracheal injuries are a known but rare and potentially life-threatening complication of endotracheal intubation. We present a case of tracheal laceration after endotracheal intubation ultimately treated with surgical repair. Case description: A 32 year-old Caucasian woman, height 160 cm, presented obtunded to the emergency department. Urine toxicology was positive for benzodiazepines, opiates, and tricyclics. Her relevant medical history included bipolar disorder, chronic pain, and opioid dependence, and no history of prior surgery or intubation. She was uneventfully intubated via videolaryngoscopy in the emergency department. Subsequent chest radiograph showed the tip of the endotracheal tube (ETT) projecting over the right main bronchus and the ETT cuff projecting beyond the expected confines of the trachea. On exam she was noted to have extensive subcutaneous emphysema of the neck and chest. Computerized tomography of the chest revealed a 3cm posterolateral tracheal wall laceration initiating 5cm above the carina and extending distally. Surgery consultation recommended conservative management with antibiotic coverage. On hospital day two the patient became febrile and hypotensive with concern for early mediastinitis, and she was taken to the operating room for primary surgical repair via right posterolateral thoracotomy. Under direct surgical visualization and endobronchial fiberoptic imaging, the ETT was carefully advanced to position the cuff distal to the laceration and into the left main bronchus. After closure of the laceration the ETT was withdrawn and the cuff was positioned proximal to the tracheal repair. Low peak airway pressures were maintained until the patient could be transitioned to spontaneous ventilation. The patient was extubated on hospital day three and was neurologically intact. She was discharged on hospital day fourteen on oral antibiotics and follow-up with mental health services. Discussion: Risk factors for post-intubation tracheal injury include: older females (>50 years), small stature (<165 cm), emergent or difficult intubation, inappropriate ETT size, cuff hyperinflation, provider inexperience, tube manipulation without cuff deflation, and anatomical abnormalities or tissue frailty [1]. Physical signs include subcutaneous emphysema, chest pain, pneumothorax, and hemoptysis [1]. Injury typically occurs in the membranous trachea just above the carina [2]. Computed tomography often demonstrates abnormally positioned or overinflated ETT balloon and transtracheal herniation of the balloon through the defect (“dumbbell sign”) [3]. Definitive diagnosis is in the operating room or by bronchoscopy. The need for surgical repair is generally based on the degree of injury and the risk for airway obstruction, massive air leak, or mediastinitis [4]. The most likely cause of the tracheal injury in this patient with multiple risk factors was overinflation of the ETT cuff and subsequent passage of ETT tip through the defect. In conclusion, prevention as well as early diagnosis and management of tracheal tears are critical in preventing adverse outcomes. A high index of suspicion is necessary, especially in the patient with multiple risk factors. References: 1. A&A Case Reports. 2016;6:230–3. 2. Chest 1997;112:774–8.3. RadioGraphics 2014;34(7):1824–1841. 4. Eur J Cardiothorac Surg 2009;35:1056–62.
Poster Presentation

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Acute type A aortic dissection and successful surgical repair in woman at 21 weeks gestational pregnancy with fetal survival

Type A aortic dissection during pregnancy is a rare catastrophe that is associated with high maternal and fetal mortality. Surgical management of the type A aortic aneurysm is imperative to the survival of the mother. The gestational age of the fetus at the time of presentation is the major determining factor of whether delivery before initiation of cardiopulmonary bypass is feasible. The management of this patient requires a multidisciplinary approach. We present a case report of a 31 year-old female who was diagnosed with acute type A aortic aneurysm during pregnancy at 21 weeks gestational age. She underwent aortic valve replacement, aortic root replacement and coronary artery bypass graft x 1. Her intraoperative course involved hypothermic circulatory arrest and two rounds of cardiopulmonary bypass. The remainder of her pregnancy was unremarkable and she returned to the hospital for uneventful vaginal delivery of a healthy baby at 39 weeks gestation.

Poster Presentation

Presenting Author: Dr. Sam Afshar Department of Anesthesiology, University of Arizona, Banner University Medical Center, Tucson, Arizona.

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Dr. Sam Afshar Department of Anesthesiology, University of Arizona, Banner University Medical Center, Tucson, Arizona.
**Adenosine-Induced Intraoperative Cardiac Arrest During Ruptured Intracranial Aneurysm**

**Background:** Most general cases do not involve the need for cardiac arrest to achieve surgical hemostasis; therefore many anesthesiologists never use adenosine during intraoperative management. Nonetheless, it is important to be aware of its use for surgical emergencies. Case Description: 48 year old healthy Caucasian female presented with a sudden onset headache while at dinner the night prior. On admission, CT scan demonstrated subarachnoid hemorrhage from a ruptured supraclinoid aneurysm. Vitals were stable and there were no gross neurologic deficits. She was taken to the OR urgently for craniotomy and aneurysm clipping. She was induced with propofol 150 mg over 5 minutes, fentanyl 100 mcg and rocuronium 50 mg, and intubated with a video-mac and 7.0 ETT. Arterial and central lines were placed, and surgery began uncomplicated. About 2 hours into the case, the surgeon requested burst suppression in anticipation of clipping the aneurysm, therefore propofol 100 mg was bolused. During the dissection, brisk arterial bleeding was noted to arise from the area of the aneurysm resulting in significant blood loss and an inordinate amount of brain swelling. A temporary clip was placed over the proximal right supraclinoid internal carotid artery, but bleeding continued at a rapid pace. Adenosine 6 mg rapid IV push was administered twice, 5 minutes apart. Eventually, the aneurysm was secured with a titanium clip. Due to brain edema, a decompressive craniectomy was performed and an external ventricular drain was placed. She was transported to CT and then to ICU with stable vital signs. She was discharged home on POD #26 with left upper and lower extremity without movement to noxious stimuli. Nearly 4 months later, the patient returned for an uncomplicated right cranioplasty. At this time her neurologic exam had made a great improvement with only some residual left upper extremity weakness.

**Discussion:** Anesthesia goals and objectives for intracranial aneurysm surgery should include having blood available, preventing aneurysm rupture/hypertension, avoiding factors that promote cerebral ischemia/vasospasm, and proper neuromuscular relaxation. Temporary clip application cuts off blood supply to a region of the brain and induces ischemia. This is usually well tolerated for a short amount of time, but it can be difficult to predict the duration. Therefore, many prefer the use of pharmacologic neuroprotection, such as propofol burst suppression, prior to clipping. However, when occlusion/clipping of the parent artery is difficult, or when inadvertent aneurysmal rupture occurs, the emergent administration of adenosine can be used to produce flow arrest that can facilitate clip ligation. Adenosine, commonly dosed at 0.3-0.4 mg/kg ideal body weight, results in a decrease in atrial and ventricular electrical activity. This results in bradycardia, atrioventricular nodal blockade, and sinus pause. This subsequently produces a rapid and profound decrease in systemic and cerebral perfusion pressure for about 45 seconds, which decreases aneurysm neck turgor and facilitates clip ligation. Adenosine has several possible side effects, namely bronchospasm, AV conduction block, coronary vascular steal, increased blood levels if co-administered with nimodipine, and allergy.

**Poster Presentation**
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Airway Fire During Jet Ventilation and CO2 Laser

Steven Hur CA-1, Oana Maties MD, Valeria Cárcamo-Cavazos CA-1, Michael Jung CA-1
UCSF Mission Bay, 12/21/2016

Background: The incidence of airway fires in the US is estimated to be 550-650 a year out of 65 million annual surgeries. Most occur in the outpatient setting and 34% involve the airway. The fire triad consists of three components required to start a fire. They include a fuel source (ETT, TEP), an oxidizer (O2, Nitrous Oxide) and an ignition source (Laser, Fiberoptic light source, ESUs). Fire risk should be assessed prior to every case by the multidisciplinary OR team as prevention is paramount.

Case Description: An 84 year old male with recurrent tracheal papillomatosis was scheduled for a routine CO2 laser ablation. Past medical history was significant for squamous cell cancer of the larynx with subsequent total laryngectomy 15 years ago and tracheal stoma creation. Of importance was the patient’s plastic tracheal esophageal prosthesis, in place day of surgery. The patient was pre-oxygenated with an infant mask over the stoma and general anesthesia was induced with lidocaine, propofol, fentanyl and rocuronium. Anesthesia was maintained with remifentanil and propofol infusions. Intermittent jet ventilation was used to provide oxygenation and ventilation, which the patient tolerated well and without desaturations. Jet ventilation was provided in conjunction with the male Oossof Pilling laryngoscope inserted into the patient’s tracheal stoma. A Hopkins rod telescope was used to perform tracheostomy and bronchoscopy. CO2 laser ablation was used to ablate lesions mostly located in the proximal to mid trachea. While working near the stoma, at the level of the TEP, a sudden spark was observed and it was apparent that the plastic handle of the TEP was burned through. Ventilation was immediately halted; irrigation was injected directly into the scope. The airway was suctioned and examined for any debris. A small fragment of the TEP handle was removed, but no mucosal damage was noticed. Apnea was less than one minute and jet ventilation was resumed. The patient was mask ventilated on emergence and had an uneventful recovery. ENT was consulted and the TEP was eventually replaced.

Discussion: Should an airway fire occur, immediate actions should include removal of the ETT and fuel source, removal of airway debris, pouring saline or water into the airway, and examination (including bronchoscopy) to assess for airway injury and residual debris. The anesthesia provider should stop all airway gas, re-establish ventilation while minimizing oxygen once the fire is extinguished, and consider reintubation in anticipation of airway swelling.

Poster Presentation

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Airway Management in a Patient with Achondroplasia and Cervical Spine Signal Abnormalities

Background
Patients with achondroplasia have a myriad of associated abnormalities which much be considered prior to administration of anesthesia. These patients often have difficult IV access, greater incidence of obesity, obstructive and central sleep apnea, and a tendency towards hyper-salivation. They also often show neurological abnormalities, and suffer from chronic pain secondary to skeletal changes. Furthermore, these patients are often considered “difficult airways”, which makes a thorough preoperative airway examination, and proper preparation for airway management imperative. Several factors contribute to intubation difficulties in achondroplastic patient including: megaloecephaly, macroglossia, pronounced adenoids, cervical instability with risk of medullary compression which makes hyperextension of cervical spine during intubation potentially life-threatening. Our Case 60 year old 4’1 52 kg female with past medical history of achondroplasia, cervical myelopathy, and obesity, presenting for C3-4 and C4-5 anterior cervical discectomy and fusion. Patient presented with baseline left upper extremity weakness and sensory deficits. Outpatient workup included Cervical MRI which showed severe central canal stenosis with cord signal abnormalities at C3-C4, as well as a broad disc bulge at C4-C5. Given cervical cord abnormalities, as evidenced by baseline neurological deficits as well as findings on imaging, which were compounded by the well documented airway challenges associated with achondroplasia, the decision was made for an awake intubation prior to induction of anesthesia. Methods: In preparation of airway manipulation, 0.2 mg of glycopyrrolate was given intra-muscularly thirty minutes prior to intubation. The patient was also given one mg of versed in the pre-operative area immediately before being taken to the operating room. After the patient was comfortably positioned on operative table, two doses of 10 mg IV ketamine were administered. The patient was then asked to gargle 3 mL of 4% viscous lidocaine; this gargle was repeated one additional time. Next, an LMA MADgic mucosal atomization device used to deliver another 2 mL of 2% lidocaine to the posterior pharynx. Then, a trans-tracheal block was placed using 2mL 4% lidocaine, followed by the insertion of an Ovassapian airway coated with 5% lidocaine ointment. Finally, fiberoptic intubation endoscope inserted with “spray as you go” mucosal anesthetization of 4% lidocaine for a total of 2 mL. After the endotracheal tube position was confirmed with fiberoptic scope, the patient underwent successful induction with IV propofol.

Poster Presentation

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Airway Management in Pediatric Patient with Le Fort III Fracture

Le Fort III fracture presents a unique airway challenge to anesthesiologists. It is defined by a fracture line that passes through the nasofrontal suture, maxillo-frontal suture, orbital wall, and zygomatic arch, which separates the midface from the cranium. A postero-inferiorly displaced midface can lead to soft tissue airway obstruction and obscure the airway, making it difficult to ventilate and intubate. Furthermore, methods of intubating may be limited by poor mouth opening and fractures involving the nasal structures. Here we discuss an otherwise healthy 7 year old female with Le Fort III fracture following an automobile collision into a pole requiring ORIF of multiple facial fractures. Physical exam was notable for moderate periorbital edema and a depressed nose. Airway exam was limited as patient was only able to open her mouth 1 to 2cm. Despite the concerning physical exam, patient was able to lie supine without marked obstruction or desaturation. This observation was important to make with regards to airway management. If the patient obstructed while supine, she would not have tolerated a traditional approach to intubation. Given her age, she would not have tolerated an awake fiberoptic intubation either. In such cases, the surgical team could manually reduce the maxillary fracture prior to intubation to clear the airway or as a last resort, consider a surgical airway. Fortunately, this was not the case for our patient. The anesthesia team felt it would be safe to mask induce followed by an oral tracheal intubation with video laryngoscopy as obstruction was limited. In anticipation of a difficult airway, a fiberoptic bronchoscope and cricothyroidotomy kit were available. In the OR, patient tolerated mask induction with sevoflurane, and ventilation was gradually taken over by bag mask ventilation. Patient was successfully intubated using a video laryngoscope with a grade 1 view. ENT readjusts the armored endotracheal tube to submental level for better access to the midface. A fiberoptic bronchoscopy confirms the endotracheal tube is 4cm above the carina. Surgery continues without major complications, however, patient remains intubated at end of case due to concern for post-surgical inflammation. She was extubated POD2 without complications and discharged POD7. This case illustrates the importance of understanding and anticipating the complications associated with Le Fort III fractures.

Poster Presentation

Presenting Author: Dr. Cecilia Wang UC Davis Department of Anesthesiology

Authors:

Dr. Cecilia Wang UC Davis Department of Anesthesiology
**Airway Management in Penetrating Neck Trauma**

Patients with penetrating neck trauma can provide a number of acute and pressing challenges to both the surgeon and anesthesiologist. In this case report, we present a 27 year old man with no significant past medical history who presents with a self-inflicted transverse 12 cm supraventricular neck laceration. Patient was hemodynamically stable on presentation to the trauma bay with adequate hemostasis secondary to a lack of large vessel involvement, but was agitated and combative and required 300mg of intramuscular ketamine prior to evaluation of the airway. It was unclear at that time whether there was airway involvement so the decision was made to transfer the patient to the operating room for a spontaneously ventilating fiberoptic intubation to facilitate a bronchoscopic examination for ruling out airway injury prior to endotracheal intubation for airway protection. In the operating room, received 4 mL of atomized 4% lidocaine into the oropharynx before pre-oxygenation. Patient was given an additional 50mg of intravenous ketamine before gently introducing a GLIDESCOPE size 3 blade into the mouth to initially evaluate for oropharyngeal and laryngeal injury while also stenting the oropharynx open to allow passage of a fiberoptic bronchoscope with a 7.0mm single lumen endotracheal tube loaded onto the back of it. GLIDESCOPE examination revealed an intact glottis with no clear injury, while fiberoptic examination through the glottis opening and down to the trachea was unremarkable. Patient was then induced with 200mg of intravenous propofol before the endotracheal tube was passed over the scope and visualized with the tip 3cm above the carina. Fiberoptic scope was withdrawn and patient received a complex closure with approximation of bilateral supraventricular muscles. Patient was extubated on post-operative day 2 without incident.

**Poster Presentation**

**Presenting Author:** Dr. James Kim UC ir

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Dr. James Kim UC ir
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Airway management of the patient with adenocarcinoma of the lung for intratracheal tumor debridement

Introduction: The incidence of intratracheal tumors are rare occurrences in anesthesiology. These patients often present to the operating room in varying degrees of respiratory distress and compromise. This poses a significant airway challenge for anesthesiologists on both induction and intraoperatively.

Case Presentation: The patient is a 66 yo male with multiple comorbidities and extensive smoking history who presented with two weeks of SOB, hemoptysis, and weight loss. He was noted to be tachycardic, tachypneic, and in hypoxemic respiratory failure with SpO2 in the 50s on 15L NRB. He was temporized on BIPAP with some improvement in oxygen saturations. CT chest revealed a 13.8 cm x 11.5 cm RML mass extending into the RUL and invading into the tracheal carina wall and both mainstem bronchi resulting in significant obstruction. The patient was taken emergently to the OR with thoracic surgery for tumor debridement to relieve the obstruction.

The patient was brought into the OR on BIPAP, saturating in the 80s and sitting in the upright position. The patient would not tolerate even minimal decline from a sitting position. He was induced upright with propofol to facilitate LMA placement. An arterial line was then placed while the patient was maintained on sevoflurane. A flexible fiberoptic bronchoscope was passed through the LMA to directly visualize the mass. The tumor was noted to invade through the subcarina with 100% obstruction of the left mainstem bronchus and 70% obstruction of the right mainstem bronchus. With confirmation that adequate ventilation could be achieved intraoperatively an 8.5 ETT was placed. The surgical team utilized a flexible fiberoptic bronchoscope to begin debridement. Maintenance was achieved with sevoflurane and cisatracurium. The team then proceeded with rigid bronchoscopy for further debridement, sevoflurane was discontinued and the patient was placed on a propofol infusion. Upon completion of the procedure, an 8.5 ETT was then replaced. Intraoperatively the patient exhibited both respiratory and hemodynamic lability requiring intermittent norepinephrine boluses and multiple procedure pauses to restore adequate oxygenation. The patient was left intubated and transferred to the MICU.

Post operatively the patient was unable to be weaned from the ventilator and remained intubated. On POD #2 and #7 he returned to the OR for photodynamic therapy. He was ultimately transferred to an OSH for the remainder of his care.

Discussion: The airway management of a patient with an intratracheal tumor is challenging due to the necessity of a shared surgical field. Careful planning must be utilized and often involves the use of awake fiberoptic intubations, surgical airways and preparation for cardiopulmonary bypass. Given the metastatic extent of disease and rapid acute decline in our patient we utilized a technique which would provide the greatest degree of palliation and least invasive technique possible.
Poster Presentation

Presenting Author: Dr. Christy Slingwine Cedars Sinai Medical Center

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Dr. Christy Slingwine Cedars Sinai Medical Center
Airway Obstruction Presenting in the Emergency Department

Background: Airway obstruction is a common problem that anesthesiologists deal with on a daily basis; however, it is usually in the context of obstructive sleep apnea or residual anesthetic agents causing relaxation of the upper airway musculature. It is less frequent that the anesthesiologist is called upon to aid a patient presenting from home for airway obstruction in the emergency department. Case Description: A 61 year-old 6’3”, 101kg male with a past medical history of a mandibular hemangioma and sarcoidosis presents with upper airway obstruction. The patient had undergone 3 tracheostomies, which were all later decannulated. The first was status-post surgical excision of the mandibular hemangioma. The 2nd occurred after a respiratory arrest and the third after surgical excision of subglottic lesions causing subglottic stenosis, which were thought to be from sarcoidosis with tracheal involvement. After this the patient reportedly recovered to a stable state of health with good exercise tolerance. Two years later he presented to the emergency department acutely short of breath after coughing at home. The patient was seen by otolaryngology. Nasal video-laryngoscopy revealed crusted lesions thought to be tissue extending from the nasal cavity to the supra-glottis. The patient’s vocal cords and a subglottic lesion of unspecified size were visualized. The glottis opening was reportedly only approximately 2mm and there was no visible foreign object. The patient had biphasic stridor. His lungs were clear and his oxygen saturation was 99% on 10 liters per minute of supplemental oxygen via simple facemask. The patient was oriented and able to utter short 1-2 word phrases. Helium 80% - Oxygen 20% (Heliox) was started via a partial re-breather facemask with resolution of the stridor and the patient was transported to the operating room with full monitors where a successful awake tracheostomy was performed. The patient tolerated the procedure well. In the post-anesthesia care unit he was alert and comfortable, breathing spontaneously on tracheostomy mask. Discussion: This case demonstrates the importance of understanding airway obstruction physiology. Anesthesiologists should be equipped to use respiratory adjuncts outside the operating room such as Heliox and to be comfortable with the use of various non-invasive oxygen delivery devices.

Poster Presentation

Presenting Author: Dr. Ryan Hill University of California, San Diego

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Dr. Ryan Hill University of California, San Diego
Allergic Acute Coronary Syndrome: a rare case of near fatal intraoperative anaphylaxis

Introduction: Allergic acute coronary syndrome, or Kounis syndrome is the occurrence of chest pain with allergic reaction and accompanied by clinical and laboratory findings of classic angina caused by inflammatory mediators released during the allergic insult. EKG changes often include ST segment elevations in the anterior and inferior leads. The mediators involved include tryptase, histamine, arachidonic acid metabolites and platelet activating factor, which are thought to contribute to one of the three presentations: Type I with vasospasm of otherwise normal coronaries; Type II with plaque rupture in patients with inactive lesions; and Type III with in stent thrombosis in patients with a significant cardiac history. We present a patient who had intraoperative hemodynamic collapse likely secondary to anaphylaxis (however without classic respiratory or cutaneous manifestations) with ST elevations and cardiac catheterization showing residual spasm concerning for allergic acute coronary syndrome. Case Description: A 55 year old man with a past medical history notable for bladder cancer status post surgical resection, chemotherapy and radiation, hydronephrosis, nephrolithiasis and mild obstructive sleep apnea with a history of anaphylaxis to vecuronium who was scheduled for cystoscopy and nephrolithotomy. The patient was given midazolam as premedication, induced with lidocaine, propofol and fentanyl (no muscle relaxant was used) and intubated uneventfully. Post induction hemodynamics were treated with ephedrine, phenylephrine and glycopyrrolate. He was given cefazolin for surgical prophylaxis. Soon after procedure start, the patient had an acute drop in end tidal CO2, became tachycardic and hypotensive. While blood pressure was being supported he lost pulses and developed marked tombstone ST elevations. ACLS was initiated per PEA protocol. He went into ventricular tachycardia and was defibrillated. Soon after he had ROSC after 13 minutes of ACLS. He was taken to the cardiac catheterization lab which showed clean coronaries and mild spasm in his right coronary artery. CT scan was completed which was negative for pulmonary embolism. He was taken to the ICU intubated and on vasopressors for hemodynamic support. Tryptase was drawn which was markedly elevated, suggesting likely anaphylaxis to one of the agents given in the OR. Discussion: Severe intraoperative anaphylaxis is a rare occurrence, and when it does occur, diagnosis can be difficult. Intraoperative agents most likely to cause reactions include muscle relaxants, antibiotics and latex. Anaphylaxis can present with hemodynamic collapse alone, but more commonly alongside cutaneous or respiratory manifestations. When hemodynamic collapse is associated with signs and symptoms of acute coronary syndrome such as ST segment elevation, and angiographic evidence of vasospasm, one should consider allergic acute coronary syndrome as the etiology, a rare presentation of anaphylaxis with specific cardiac findings.

Poster Presentation
Presenting Author: Dr. mastoora nasiri UCSF
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An Awakening, Breathing, Delirium Screening, and Mobility Program for Mechanically Ventilated Patients Changes Daily ICU Practices

Background: Spontaneous awakening and breathing trials, early mobilization, and interventions to reduce ventilator-associated events may improve outcomes such as delirium, duration of mechanical ventilation, length of stay, or mortality among intensive care unit (ICU) patients. This study assesses the effectiveness of a bundled initiative in changing these practices for mechanically ventilated patients in the ICU.

Methods: Prospective cohort quality improvement project in two adult medical-surgical ICUs. In May 2015, an interdisciplinary team of physicians, nurses, respiratory and physical therapists began rolling out an initiative aimed at increasing six daily process measures for mechanically ventilated patients: spontaneous awakening trials (SATs), spontaneous breathing trials (SBTs), delirium screening, early mobilization, elevated head of bed, and use of endotracheal tubes (ETTs) with subglottic suction ports. Rates of each activity were compared pre- (1/1/15-3/31/15) and 14-15 months into (6/1/16-7/30/16) the initiative using chi-squared (or Fisher exact) tests.

Results: A total of 147 pre- and 155 post-intervention patient-days were included in the analysis. There was a significant increase in the rates of daily spontaneous breathing trials (82.8% vs 52.5%, P=0.001), delirium screenings (95.4% vs 29.0%, p<0.001), percent of days patients mobilized out of bed (22.0% vs 7.8%, p<0.001), elevated head of bed (96.0% vs 82.3%, P=0.003), and use of subglottic ETTs (57.9% vs 3.9%, P<0.001). Rates of spontaneous awakening trials (53.2% vs 45.7%, p=0.43) remained unchanged. Similarly, rates of documented contraindications to SBTs decreased significantly (46.3% vs 66.5%, p=0.001) while those for SATs remained unchanged (42.0% vs 43.1%, p=0.88).

Conclusions: Through education of care providers, updated protocols and electronic documentation, dedicated staff and equipment, and routine project assessment, a multidisciplinary team succeeded in effecting several changes in our ICUs. However, failure to alter spontaneous awakening trials or documented contraindications to them may represent more ingrained practices and/or highlight an area for additional education. Further work is planned to address these barriers and to assess the impact of these practice changes on patient outcomes.

Oral Presentation

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An Unusual Case of Central Line Migration

A 4 year old girl, with a history of tracheoesophageal fistula post reconstruction, tracheomalacia and serial esophageal dilations for strictures, presented to the hospital for dilation of her esophagus. During the EGD, material was seen in the lumen of the esophagus. On closer inspection it was seen that her central venous catheter had eroded and was spanning the lumen. After discovery of the port’s erosion, a procedure was planned to insert a new port and under esophageal visualization removal of the existing subclavian port, which was still aspirating blood. The patient was discharged and brought back in for the procedure. Anesthesia was induced without incident. The right lower extremity port was inserted and removal of left upper extremity port began. An esophageal balloon was inserted just distal to the line and inflated by the surgeon in an attempt to tamponade the esophagus as the line was removed. Unfortunately the esophageal balloon moved distal to the site causing insufflation of the esophagus. The EtCO2 began to drop (an occurrence which had occurred with previous dilations from a presumed tracheal compression)The patient’s SpO2 dropped to 80’s. Manual ventilation began, the lungs were auscultated and breaths sounds were clear. The heart rate began to drop. The surgeon deflated the esophageal balloon and some blood was seen. Suction was passed through the ETT tube, with no return. A small amount of blood was seen from patient’s mouth. The heart rate continued to drop despite 2 doses of atropine 200mcg through a peripheral IV, followed by 3 doses of epinephrine 100mcg doses. Pulses could not be felt and CPR was started. Venous distention in the neck could be seen. RBC in 60ml boluses where given for presumed esophageal and thoracic hemorrhage. TTE was performed by the surgeon and followed by emergent pericardiocentesis with aspiration of about 10mls of air. A second surgeon performed an emergent thoractomy, gaining access to pericardial space, with no evidence of tamponade, the surgeon began direct cardiac massage and confirmed both lungs were pink with adequate inflation. The patient developed VT and needed defibrillation and direct cardiac massage. Resuscitation continued with PALS. The patient returned to sinus rhythm, the blood pressure stabilized without vasopressors. Bilateral chest tubes were placed. A femoral arterial line inserted by Anesthesia attending. The surgeons closed all incisions, and the patient was transferred from the OR to the PICU. After discussion in the department, it was felt that the cardiac arrest was likely caused by an acute air embolus. The esophagus was inadvertently insufflated with the scope at the time of pulling out the line from the subclavian vein. The stabilization occurred once direct cardiac massage was given disrupting the air embolus. The patient was discharged shortly afterwards.

Poster Presentation

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An Unusual Hyperechoic Structure Seen Adjacent to the Pulmonic Valve With Intraoperative Transesophageal Echocardiography

Background: Isolated pulmonic valve endocarditis is rare; approximately 90 cases have been reported. Risk factors include sepsis, congenital heart disease, pulmonic valve lesions, central venous catheters, and ESRD requiring dialysis. Low index of suspicion, subtle, nonspecific presentation, and difficulty visualizing the pulmonic valve with echocardiography make diagnosis challenging. Case Description: A 71 year old male with a past medical history significant for DMII, CAD s/p CABG, Afib, ESRD on hemodialysis, and severe lower extremity peripheral vascular disease with previous bypass surgery complicated by chronic lower extremity wounds and recurrent bacteremia presented to the hospital with findings concerning for angioedema. During his admission, he was found to have VRE bacteremia. He was taken to the operating room for below-knee amputation given concern for vascular graft infection as a source of his recurrent bacteremia. During intraoperative TEE, an oscillating hyperechoic structure was visualized in multiple views adjacent to the pulmonic valve. This hyperechoic structure was not seen previously on TTE or TEE, and it was not visualized on postoperative TTE. After Cardiology and Infectious Disease consultations, this patient was not diagnosed with endocarditis. Discussion: This study highlights that pulmonic valve endocarditis is a clinical diagnosis, although often supported by echocardiographic evidence. In rare or atypical presentations, repeat echocardiography or alternative modalities such as Cardiac CT can be useful in further characterizing suspicious findings as vegetation, thrombus, soft tissue mass, calcification, artifact, or even air. References:


Poster Presentation

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Anesthesiologists as Perioperative Hospitalists and Outcomes in Patients Undergoing Major Urologic Surgery: a historical-prospective, comparative effectiveness study

Introduction
Perioperative care has been identified as an area of high cost with a wide variability in quality. Current management strategies in the perioperative setting are inconsistent with conflicting models involving multiple specialties. In 2014, the Loma Linda University Departments of Anesthesiology and Urology implemented a perioperative hospitalist service (PHS), consisting of anesthesiology-trained physicians, to co-manage patients undergoing major urologic surgery for the entirety of their perioperative period. We hypothesized that implementation of this PHS model would result in an improvement in patient recovery, in a reduction in hospital length of stay (LOS), and decrease costs of care.

Methods
As a Quality Improvement (QI) initiative, the PHS service was formed of selected anesthesiologists who received training on the core competencies for hospitalist medicine. The service was implemented following a co-management agreement with the Department of Urology for the PHS service to medically manage patients undergoing major urologic procedures, specifically prostatectomy, cystectomy, and nephrectomy. After IRB approval, the PHS impact was assessed by comparison of the two years prior, to the two years post-implementation of the PHS. The primary outcome marker was a reduction in length of stay. Secondary outcome markers included: complication rate, return of bowel function (flatus), 30-day readmission, number of consultations, reduction in direct patient costs, and bed days saved.

Results
There was no difference between groups for age, ASA, or operative time for all surgical procedures amongst the three years. Over the two years of implementation, statistically significant reductions in length of stay were demonstrated for all surgical procedures post PHS implementation (p < 0.05). Reductions of the median LOS over the 3 years for prostatectomy, nephrectomy, nephrectomy, and cystectomy were 0.33, 1.0, and 4.6, respectively. Significant reductions in complication rates and return of bowel function (flatus) were also observed for all surgical procedures post PHS implementation (Table 1). The majority of the reductions in complications were secondary to an improvement in length of ileus for all surgical procedures. Additionally, decreases in variable direct costs, total direct costs and frequency of consultations were observed. A total of 246.8 bed-days were saved during the first two years of the PHS implementation.

Conclusions
Anesthesiologists can safely function as perioperative hospitalists, significantly improving both patient recovery and throughput. We postulate that similar outcomes would result in expansion to additional surgical lines.

Oral Presentation

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Anesthesiology in Ghana: a 10 year perspective

Background: Knowing how anesthesia is practiced is a necessary starting point for improving how it is delivered. Our objective is to provide an overview of how anesthesiology is performed and has developed in Ghana based on data from multiple surveys collected over the past 10 years. This information will outline the current state of anesthesia care in Ghana and help to identify directions in which to pursue improved anesthesia care in Ghana and other low resource countries.

Methods: Surveys were administered every three years from 2006 to 2016 to participants of the annual anesthesia refresher course in Kumasi, Ghana. The assessments were completed by nurse anesthetists and anesthesiologists in attendance from various regions in Ghana. They were surveyed about available medications, equipment, personnel, and infrastructure at their facility.

Results: Overall there was a reported increase in resource availability from 2006 to 2016. The majority of respondents described improved, yet still limited access to essential anesthesiology supplies such as anesthesia machines, airway equipment, and medications. Over the last 10 years, access to medications has improved, with a 10-26% increase in availability reported for ketamine, thiopental, succinylcholine, pethidine and bupivacaine, which are now available at 90% of institutions. The largest increases in availability occurred with propofol, midazolam, and isoflurane, which increased by over 50%. Many respondents noted shortages during the post-operative period with limited or lack of recovery rooms and monitors. In 2015 compared to 2006, the highest reported needs were for anesthesia machines (40%), monitors (36%), ventilators (26%), recovery rooms (25%), personnel (13%), and trained anesthetists (11%).

Conclusion: The results of our questionnaire show that anesthetic care in Ghana is still vastly under equipped, although access to vital equipment and medications appears to be improving. With increased access to resources intra-operatively, the focus is now more on the perioperative period with shortages reported for monitors, recovery rooms, and adequately trained personnel. Exploring the stimuli for such changes in availability of equipment, medications and personnel could inform future healthcare policies in Ghana, and current policies in less developed healthcare systems.

Poster Presentation

Presenting Author: Dr. Dulce Boucher University of Utah

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Dr. Dulce Boucher University of Utah
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Dr. Scott Junkins University of Utah
**Anesthetic Considerations In a Patient With History of Ehlers-Danlos Syndrome and Spontaneous TMJ Subluxation**

Background: Ehlers-Danlos syndrome (EDS) encompasses a group of hereditary connective tissue disorders that can vary from mildly loose joints and arthritis to life threatening complications such as aortic dissection (1). It is caused by a genetic defect that interferes with the structure, production or processing of collagen or proteins that interact with collagen.

Case Description: Our patient is a 21 year old female with a history of EDS diagnosed at the age of 19 and spontaneous temporomandibular joint (TMJ) subluxation who presented to our neurosurgery department for consultation with complaints of intermittent and then more consistent, clear fluid drainage from both nostrils accompanied with tinnitus and infrequent headaches over the past 6 months. She was then worked up for a possibility of cerebrospinal fluid leak and rhinorrhea. Of note, her nasal fluid was positive for glucose and beta-2 transferrin protein. It was decided by the neurosurgery department along with otolaryngologist to proceed with endoscopic transnasal repair of the CSF leak. Upon pre-operative examination, patient had a Mallampati score of 1 with 3 finger breadths submental distance and adequate range of motion. Furthermore, it was noted that the patient had limited mouth opening (~2.5 cms) and tenderness over bilateral TMJs. Given these findings, we decided to proceed with fiberoptic intubation for intraoperative airway management.

Discussion: Based on a review conducted by Weismann et al on recommendations for anesthesia and pre-operative management of patient’s with EDS, difficult airway management may occur in many different forms in this patient population (2). These difficulties may stem from temporomandibular dysfunction, premature spondylosis or occipitalatlantoaxial instability (3). Care must be taken to manage the airway of these patients with extra attention given the high risk of joint dislocation and related postoperative neurological complications. Furthermore, given the minimal neck manipulation and mouth opening needed for fiberoptic intubation, this mode of management should always be considered when difficulties are anticipated in the care of patients with EDS.

References:


**Poster Presentation**
Presenting Author: Dr. Hooman Golfeiz Cedars Sinai Medical Center

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Anesthetic Considerations in Occipitoatlantoaxial Instability in the Setting of Ehlers-Danlos Syndrome

Background: Ehlers-Danlos Syndrome is a group of connective tissue disorders that most commonly results in hypermobility. The consequences of this are vast and range from hyperflexible joints, fragile skin, and vascular complications including arterial rupture or valvular heart disease. The disease does not directly effect the nervous system, but neurological symptoms are common and sometimes arise secondary to occipitoatlantoaxial joint instability. This instability effects approximately 1/15 people with EDS and can manifest after repetitive stretch injuries to the ligaments and tendons supporting the head or after a trauma to the neck such as whiplash. Symptoms include paralysis and autonomic dysfunction resulting in orthostatic hypotension, tachycardia, or delayed gastric emptying. Case Description: This is a 22 year old male with a past medical history of EDS, hypermobility subtype resulting in occipitoatlantoaxial joint instability status post occiput to C2 fusion and autonomic dysfunction. In addition, he is heterozygous for CACNA1S, a gene associated with hypokalemic periodic paralysis and malignant hyperthermia. The patient experiences intermittent full body paralysis and apnea as a consequence of his instability. Following his recent fusion, the frequency of paralysis and apnea decreased from several times a day to several times a month but still remained problematic. The patient has adapted well to this and is able to prevent his head from tilting into the position that causes the paralysis. On exam, this resulted after slight jaw protrusion and right sided head tilt. In the event of paralysis, his mother simply moves his head out of that position and the paralysis resolves completely. He presented for surgical implantation of a diaphragmatic pacer so that apnea events could not prove fatal. Discussion: It was imperative that records from his recent fusion were reviewed. The anesthetic plan at that time consisted of general anesthesia with propofol on induction, sevoflurane for maintenance, and rocuronium for paralysis. Airway was managed using direct laryngoscopy with a secure airway. The patient did not show hemodynamic instability at any time during the case. There were no complications following surgery. The case was also discussed with a MH expert who stated that this patient is at an unknown risk to experience MH. It was decided to minimize any risk and avoid MH triggering agents. With that information, general anesthesia with a secured airway was chosen, as the patient may not be able to spontaneously breath throughout the case due to his periodic apnea and paralysis. Slow propofol induction was used with rocuronium for paralysis. The airway was managed using a D-Blade with in-line stabilization to minimize neck movement. Due to the patient’s autonomic dysfunction, an arterial line was placed for closer hemodynamic monitoring. The placement of the diaphragmatic pacer required the patient to be fully reversed at the end of the case to ensure proper functioning of the device. For this reason, sugammadex was used to rapidly reverse the rocuronium. There were no complications.

Poster Presentation

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Anesthetic Implications of Noonan Syndrome (NS) in a Patient Undergoing Mitral Valve Replacement.

Introduction: NS is a relatively common (1 in 1000-2500 live births) autosomal-dominant mutation in the Ras/mitogen-activated protein kinase (MAPK) signal transduction pathway associated with characteristic cardiac, facial, musculoskeletal, and hematologic anomalies. Case description: A 41 year-old male with NS was admitted for decompensated diastolic heart failure. Past medical & surgical history was notable for chronic atrial fibrillation, severe pulmonary hypertension, severe COPD (FEV1<35%), mechanical aortic valve replacement at age 6 and re-do at age 16, and cervical C1-4 spinal fusion. TEE performed on admission was notable for severe MR, severe pulmonary HTN (PAP 64), but preserved LVEF of 65%. After being medically optimized, the patient was taken for MV replacement surgery. Given classic features of NS (small face, micrognatia, limited mouth opening, protuberant upper teeth, short neck) and limited head extension from prior cervical fusion, awake fiberoptic intubation was performed after lidocaine topicalization of the oropharynx and premedication with IV midazolam). After induction of anesthesia, the right internal jugular vein was cannulated for central venous access. Bypass catheters were placed in the femoral vessels by CT surgery prior to sternotomy in the event that CPB became emergent. Sternotomy was then performed and followed by extensive lysis of adhesions. On-pump mitral valve replacement was uneventful. There was no abnormal bleeding. Patient was taken to ICU intubated. The patients’ postop course was complicated by severe hypoxic respiratory failure and prolonged mechanical ventilation, severe thrombocytopenia, acute renal failure requiring CVVH, and acute pancreatitis. Despite these complications, the patient was discharged on post-op day 15.

Discussion: Characteristic features of NS and their anesthetic implications include: - Musculoskeletal: short stature, kyphoscoliosis- difficulty administering neuroaxial anesthesia. - Craniofacial abnormalities: short webbed neck (pterygium colli), micrognathia, limited mouth opening, teeth misalignment – difficult intubation. - Pulmonary abnormalities: chest deformity (pectus excavatum of pectus carinatum), along with kyphoscoliosis – lung disease. - Congenital heart disease: commonly subvalvular pulmonary stenosis and hypertrophic cardiomyopathy, less frequently ASD, VSD, aortic coarctation - hemodynamic instability - Bleeding disorders – factors XI, XII or VIII deficiency, thrombocytopenia- increased blood loss - CNS: epilepsy, intellectual disability- make it challenging to provide care to these patients, who often require general anesthesia for simple diagnostic and therapeutic procedures. - Skin and connective tissue: lymphedema of hands and feet, hyperkeratosis –difficult IV access. - Although cases of MH (malignant hyperthermia) have been described in NS patients, NS is not associated with MH, therefore MH precautions are not necessary. Conclusion: Anesthesiologists should be familiar with Noonan syndrome as relatively common congenital disease, which can pose challenges with airway management, excessive bleeding and implications of congenital or acquired heart disease.

Poster Presentation

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ANESTHETIC MANAGEMENT FOR A CESAREAN SECTION IN A PARTURIENT WITH UNSPECIFIED INHERITED BLEEDING DISORDER

Background:
Neuraxial anesthesia, as the standard of care for Cesarean deliveries (CD), is associated with decreased blood loss. However, parturients with inherited bleeding disorders are at increased risk for epidural hematomas. A small retrospective study has shown that parturients with known factor deficiencies can safely undergo neuraxial anesthesia once the specific factors are replenished. We present the anesthetic management for a CD in a patient with an unspecified inherited bleeding disorder.

Case Description:
A 39-year-old G6P3 95 kg woman at 37 6/7 weeks gestational age presented for a repeat CD. She reported easy bruising, gingival bleeding, and menorrhagia. She also had compartment syndrome from hemorrhage after ankle surgery, persistent menorrhagia after her first two CD, and intra-abdominal hemorrhage after her third CD. Additionally, her mother had menorrhagia and her grandmother died from postpartum hemorrhage. An extensive hematological workup prior to her most recent operation, a cervical spine surgery, was normal for von Willebrand factor (VWF) parameters, fibrinogen, platelet function, and rare coagulation factors. She was then diagnosed with an unspecified inherited bleeding disorder, with a differential diagnosis of a rare VWF dysfunction or undetected defects in fibrin, fibrinolysis, or platelet function. She was successfully treated for her cervical spine surgery with prophylactic fresh frozen plasma (FFP), cryoprecipitate, platelets, and antifibrinolytics. On the day of her CD, the patient prophylactically received 2 units of FFP, 10 units of cryoprecipitate, and 2 units of platelets before placement of her routine spinal anesthetic. Immediately after delivery of a healthy infant, aminocaproic acid was given. Uterine tone remained poor after routine oxytocin administration, but improved with methylergonovine and misoprostol. Blood loss was an estimated 1.5 liters. As a precaution, 2 units of platelets were given postoperatively. Postpartum, the patient continued antifibrinolytics and had an uneventful recovery.

Discussion:
This patient had a considerably increased risk of peripartum bleeding due to an unspecified inherited bleeding disorder. Her previous deliveries were complicated by hemorrhage. Despite the lack of a specific diagnosis, hematology provided detailed recommendations for blood product administration, enabling a safe spinal anesthetic followed by CD. A spinal anesthesia was preferred, despite being the fourth repeat CD, over a combined spinal epidural to decrease the risk of an epidural hematoma. Communication between obstetric and anesthesia teams was crucial to expedite the start of surgery after the spinal placement and to aim for its timely completion. In summary, the careful planning among obstetric, anesthesia, and hematology teams helped achieve an uneventful CD in this patient with an extremely high bleeding risk.

References:

Poster Presentation

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Dr. Hani El-omrani University of Washington
Dr. Laurent Bollag University of Washington
Anesthetic Management for Traumatic Left Mainstem Injury

HPI:

56M restrained driver of pickup truck in MVC with "big rig" at moderate speed and prolonged extrication. CT chest showed extensive diffuse pneumomediastinum with massive soft tissue emphysema, bilateral pneumothoraces, and possible airway injury. Flexible bronchoscopy showed transection of Left mainstem bronchus.

Anesthetic management:

Pre-op a-line and central line placement. Patient preoxygenated with 4L O2 via nasal canula, started on remifentanil, dexmedetomidine, and phenylephrine drip with boluses of ketamine. Awake fiberoptic intubation performed with 37Fr Right-sided double lumen tube. Patient developed ST elevations in setting of hyperkalemia, chest trauma, subdural hematoma, decision was made to keep patient intubated. After repair of left main stem bronchus, the left lung was carefully re-expanded under direct visualization. At the end of the case, the patient was breathing spontaneously, double lumen tube was removed and patient was re-intubated with a single lumen tube, and he was transferred to the SICU. The patient was extubated POD#1.

Discussion:

Anesthetic management of Left main stem bronchus injury, Intraop treatment of hyperkalemia

Poster Presentation

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Anesthetic management of a patient with multisystem atrophy

We present a case report of a patient with MAS. Multiple system atrophy (MAS) is a rare disease: prevalence is estimated at 4.6 cases per 100,000 people. This neurodegenerative disease is characterized by combinations of dysautonomia, cerebellar dysfunction, and parkinsonism. MAS poses a challenge to anesthesiologists because of the potential complications of impaired cardiovascular reflexes, life threatening changes in blood pressure, as well as vocal cord paralysis. Cases of MAS are underreported in anesthesia literature; this report would help in deciding future perioperative management of these patients. Our patient was 58-year-old male with MAS, autonomic failure supported by pacemaker implantation, midodrine, fludicortisone, and pyridostigmine. Patient was to undergo laparoscopic cholecystectomy for acute cholecystitis. He was wheelchair bound, and suffered from bilateral posterior neck spasms with limited neck range of motion. We managed our patient in light of the presenting symptoms. There were no conclusive studies on preference of type of anesthesia for MAS patients; we chose general anesthesia based on the nature of laparoscopic surgery and patient cooperation. To ensure perioperative hemodynamic stability, we adequately hydrated the patient, and optimized pharmacologic treatment: he continued his home medications and received a dose of pyridostigmine pre-operatively. We induced with propofol and remifentanil; as MAS is a neurodegenerative disease, patient was wheelchair bound, and taking pyridostigmine—which makes neuromuscular blockers unreliable—we avoided standard relaxants for induction. Due to our patients’ neck rigidity, we intubated using asleep fiberoptic technique. After discussion with the surgeons on use of cautery and surgery site, we kept pacemaker function intact. Intraoperatively, our patient experienced fluctuations in blood pressure, the first after induction. These were managed with fluid boluses and small doses of phenylephrine, as MAS patients typically have exaggerated responses to vasopressor drugs. Patient was extubated successfully in the operating room, with no reported problems post-operatively, particularly those that afflict this population, such as vocal cord paralysis, stridor, or apnea. Based on this case management, it seems that MAS patients can undergo general anesthesia for laparoscopic surgery with no significant perioperative complications. In the future we suggest routine use of a fiberoptic bronchoscope to intubate this population for better view of vocal cord anatomy. We also would consider etomidate as an alternative induction agent to avoid potential blood pressure lability post induction.

Poster Presentation

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Anesthetic Management of a Patient with Peripartum Cardiomyopathy for a Cesarean Delivery

Introduction:
Peripartum cardiomyopathy (PPCM) is a potentially lethal disease known to develop during or several months after pregnancy [1]. Furthermore, the diagnosis of PPCM is characterized by the absence of another identifiable cause of heart failure and left ventricular systolic dysfunction with an LVEF < 45% [2]. The incidence of PPCM varies geographically; with animal and human studies suggesting a multifactorial etiology which include: angiogenic imbalance, maternal oxidative and hemodynamic stress, pro-inflammatory states, and genetic predisposition [1]. Intraoperative management of PPCM provides a unique challenge to anesthesia providers given the physiologic changes during pregnancy.

Case Description:A 25-year-old G4P3 with a history of PPCM presented for urgent primary cesarean section at 34 weeks of gestation due to decompensated heart failure with paroxysmal ventricular tachycardia. She was previously diagnosed with PPCM one month after her last delivery two years ago. Since then, her cardiac condition has gradually deteriorated. Throughout her pregnancy, she required multiple hospital admissions for diuresis due to dyspnea and syncope. A transthoracic echocardiogram showed left atrial and left ventricular dilation, global left ventricular hypokinesia and a LVEF of 15-20%. According to cardiology, she was not a candidate for placement of an automatic implantable cardioverter-defibrillator (AICD) due to her pregnancy. An EKG study showed sinus rhythm with a heart rate of 97 bpm along with a left bundle branch block. Chest X-ray revealed an enlarged cardiomegadiastinal silhouette without significant vascular congestion or pleural effusion. Blood investigations were within normal limits. Preoperatively, her BMI, blood pressure, heart rate and O2sat on room air were BMI 31 kg/m2, 110/65 mmHg, 98 bpm, and 94%, respectively. A dural puncture epidural technique at L3-L4 level was used to confirm the location of the epidural space to ensure effectiveness of the epidural catheter. The epidural catheter was tested with 100 mcg Fentanyl. 20 ml of 0.5% Ropivacaine was given incrementally in 5ml aliquots over 30 minutes to achieve a T4 level. An arterial line and Swan-Ganz catheter were also placed along with standard ASA monitoring. External defibrillator pads were placed in anticipation of intraoperative arrhythmias. A wedge pressure of 18-20mmHg was maintained throughout surgery, and vital signs were kept within 20% of baseline. 40mg of Furosemide IV was given 10 minutes prior to delivery to counteract the rise in wedge pressure from auto-transfusion. 10U oxytocin were given IM to facilitate uterine contraction after delivery. A total of 200ml of 0.9% normal saline solution was administered. Estimated blood loss was 600ml, and urine output was 200ml. Postoperatively, the patient was monitored in the ICU without any complications and was discharged from the hospital three days later.

Discussion:Management of PPCM poses a challenge to the anesthesiologist. Stringent control of hemodynamics and judicious use of intravenous fluid with goals to avoid sudden changes in heart rate and blood pressure are critical in the management. We believe a dural puncture
technique with epidural placement is a prudent choice as it reduces the chance of epidural failure rates and allows for slow titration of anesthesia.

**Poster Presentation**

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**Anesthetic Management of a Pediatric Patient with Epidermolysis Bullosa**

Intro

A 15 month old normal term Caucasian female infant with a history of epidermolysis bullosa presented to the ED with a two day history of new onset hematuria in the setting of a recent URI. The patient was worked up and found to have acute glomerulonephritis with nephrotic range proteinuria. At the time, her etiology was uncertain (possible MPGN vs Post-Strep vs other), requiring a renal biopsy for further workup. Thus, the patient was scheduled for bilateral percutaneous renal biopsy under ultrasound for new onset hematuria. However, her history of epidermolysis bullosa, a rare genetic mechanobullous condition, characterized by excessive fragility of the skin and mucous membranes, resulting in cutaneous blistering and scarring that can lead to debilitating and even life threatening medical conditions; presents anesthetic challenges that require further consideration and unique tailoring of her anesthesia.

Case

The patient had no prior anesthesia and no family history of anesthesia complications. Besides her epidermolysis bullosa, all her other review of system were negative. Her physical exam was significant for molted skin with multiple erythematous patches and bullae throughout the body, in particular, multiple bullae to the right hip, abdomen, back, hands, and elbows and labia majora. Her airway exam was benign, with a mallampati 1 view and full range of motion. Our anesthetic consisted of trying to maintain spontaneous ventilation w/MAC using IV ketamine, dexmedetomidine, and opioids as needed. Given the risks of trauma secondary to the excessive fragility of the skin, special considerations were made to minimize damage. To minimize the risk of skin friction from agitation or uncontrolled movement during induction, 40mg of PO ketamine was given prior to bringing the patient back to the OR. An IV was subsequently obtained with ultrasound to further minimize IV attempts and trauma. Once IV was obtained, IV ketamine and dexmedetomidine was given for sedation while maintaining spontaneous ventilation. To avoid new blisters, Vaseline was applied to all gloves used for contact and the face mask, as well as backup laryngoscope and endotracheal tube. Furthermore, special padding was placed on the OR table to minimize compression and shearing forces. A major challenge for this patient’s anesthetic management was the use of monitoring technology without damaging the epithelial surface. An ear clip pulse oximeter was placed for oxygenation. To minimize trauma from the BP cuff, we decided to hold off on a BP cuff and use physical exam of palpable pulses for hemodynamic monitoring. In addition, special EKGs were placed with lubrication to minimize sheering.

**Poster Presentation**

**Presenting Author:** Dr. John Liaghat UC Davis Department of Anesthesiology

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Dr. Niroop Ravula University of California, Davis
Anesthetic management of an obstetric patient with major burn injury for emergent C-section

We present the case of a pregnant 34 year old female, 38 weeks gestational age, who presented for an emergent C-section in the setting of 65% full thickness burn injury and fetal distress. Anesthetic management of a patient with full skin thickness burn wounds poses several challenges to the anesthesiologist. Airway management, temperature control, coagulation status and hemodynamic management are of paramount importance. Fluid resuscitation for major burn patients often takes place intraoperatively due to the urgency for surgical intervention, bypassing resuscitation in the emergency room or intensive care unit. Obstetric trauma patients also present challenges. Uteroplacental blood flow is pressure dependent without autoregulation, highlighting importance of intraoperative resuscitation in this case; many anesthetic medications administered to the obstetric patient cross into placental circulation and may affect fetal well-being, especially in the setting of fetal distress. This case demonstrates several uncommon circumstances which led to a challenging intraoperative and postoperative course. Careful resuscitation and medication choice as well as efficient team coordination were key in ensuring this patient's safety during the case.

Poster Presentation

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Anesthetic Management of Emergent Uterine Rupture in a 72 Year-old Parturient

One of the more controversial issues in the management of infertility is the problem of a woman’s age. With increasing age greater than 40, the percentage of successful in-vitro fertilization is dramatically reduced. Additionally, both anesthetic and obstetric complication rates increase as the parturient ages. Obstetric complications include increasing rates of preeclampsia, gestational diabetes, pelvic infections, intra-peritoneal bleeding, placenta-previa, and fetal mortality.1-3 From the anesthesia perspective, the physiology of pregnancy and aging can be in direct conflict, making anesthetic considerations extremely risky and challenging.5-6 Over the last 20 years pregnancy in women over age 50 has dramatically increased, as there is no legal age limit for in-vitro fertilization in the U.S.4 Anesthesiologists and Obstetricians must be cautious and responsible while selecting and treating patients of advanced age with assisted reproductive technology (ART). In this case, we will discuss a 72 year-old parturient who developed a rare life-threatening intra-peritoneal bleed at almost 23 weeks of gestation.

Poster Presentation

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ARDS from massive aspiration during general anesthesia due to gastric outlet obstruction and partial volvulus

Background: Aspiration is defined as either passive or active entrance of either oropharyngeal or gastric contents through the glottic opening and into the distal airways of the lung. Predisposing conditions and risk factors of aspiration include reduced consciousness (resulting in compromised cough reflex and glottic closure), dysphagia or neurological deficits, mechanical disruption of glottic closure and/or lower esophageal sphincter closure (e.g. endotracheal tube, nasogastric tube), and existence of a large reservoir of gastric contents with active emesis. The following case presentation explores these predisposing factors, and offers options to both the prevention and treatment of massive aspiration.

Case Presentation: A 75 year-old Caucasian male with Parkinson's Disease presented with chest pain, nausea, and minimal emesis was found by CT to have a large incarcerated type IV paraesophageal hernia with organoaxial rotation/volvulus and gastric outlet obstruction at the level of the gastroduodenal junction. The patient was brought to the OR for emergent endoscopic decompression. An airway exam revealed narrow mouth opening and a Mallampati class IV airway. Given the small amount of emesis reported, and last oral intake reportedly 2 days prior to surgery, a rapid sequence fiberoptic intubation was chosen. During induction, intubation was complicated by inability to visualize the glottic opening, followed immediately by a large volume of emesis that required suctioning before an endotracheal tube could be secured. After establishing an airway, aspirated gastric contents were noted in copious amounts, and suctioned from the endotracheal tube. 700 mL of regurgitant volume was suctioned from the oropharynx and the trachea together, and an additional 2 liters of gastric contents were suctioned from the stomach during the procedure. Post operatively, the patient's massive aspiration resulted in acute hypoxic respiratory failure, evident by the initial ABG pH 7.32, pCO2 43, pO2 <55, and bicarbonate 22.3 on 100% FiO2 while intubated. CXR revealed patchy bilateral airspace opacities consistent with aspiration pneumonia and developing ARDS. In the Critical Care Unit, the patient was started on methylprednisolone and cisatricurium on post-operative day 1 for ARDS. On post-operative day 2 he was proned in 16 hour increments until his shunt fraction decreased to less than 25%, which lasted approximately 5 days. The patient was discharged on POD 19, and received surgery 2 months later for more definitive hernia repair.

Discussion: Prevention of massive aspiration during anesthesia starts with proper choice of induction technique, in this case awake vs asleep rapid sequence fiberoptic intubation. Prior suctioning via an NG tube may be considered but can be complicated by potential perforation, particularly in the case of existing volvulus and ischemia. For this case, intervention through early pronation and ARDS protocol before clinical deterioration resulted in a positive outcome. Calculation of shunt fractions for guidance of pronation in addition to ARDS protocol may also provide morbidity/mortality benefit. Primary avoidance and prevention of massive aspiration in the setting of anesthetic use is obtained through careful selection of induction technique. Treatment of a massive aspiration with early pronation and vigilant lung protective ventilation appear to be vital for improved outcomes.
Poster Presentation

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Assessment Of Preoperative Anxiety Using Visual Facial Anxiety Scale: An Alternative To The Verbal Rating Scale?

The Visual Facial Anxiety Scale is a simple tool which could be used for assessing preoperative anxiety in the preoperative holding area. Anesthesiologists do not routinely evaluate patients' anxiety levels preoperatively. There are no conflicts of interest among the contributors. Abstract Background—Evaluating preoperative anxiety level can be a difficult task for physicians. The Visual Facial Anxiety Scale (VFAS) was designed as an alternative to the Verbal Rating Scale (VRS) for assessing the level of preoperative anxiety. We hypothesized that the VFAS would provide a stronger correlation between the patient and anesthesiologist categorical anxiety assessments than the VRS.

Poster Presentation

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**Bacterial Endocarditis Leading to Cerebral Mycotic Aneurysm Rupture**

Introduction: Bacterial endocarditis is a multifaceted pathologic process involving damage to the retina, skin, heart, and numerous other organs via embolic phenomena. One of the most feared sequelae of bacterial endocarditis is the neurologic complication of cerebral mycotic aneurysm (MA). Mycotic aneurysms arise from bacterial infection to an arterial wall due to haematogenous infectious spread.[1] The pathogenesis is explained by microembolic vegetations causing a severe inflammatory response in the adventitial layer of the arterial wall.[2] Mycotic aneurysms account for approximately 3% of all aneurysms and require prompt recognition by the clinician to ensure appropriate medical and surgical management.

Intracerebral mycotic aneurysms can occur in 2-3% of cases of infective endocarditis with intracranial mycotic aneurysms accounting for 0.7-6.5% of all intracranial aneurysms.[3] Diagnosis of this condition is challenging as presentation of a MA can range from headache to focal neurological deficits or coma. A ruptured mycotic aneurysm carries mortality rate of 80%.

Case Report: This case describes a 20 year old male with a past medical history significant for congenital heart disease with aortic valve stenosis, aortic valvulotomy, and coronary artery bypass graft who presented to the intensive care unit with acute altered mental status. A week prior to his hospitalization, the patient was involved in a mountain biking accident resulting in multiple open abrasions around the left neck, shoulder, and hip. Several days later, he was admitted to the hospital with staph aureus bacteremia leading to aortic valve infective endocarditis. Sequelae included septic emboli causing mental status and vision changes, skin lesions, acute kidney injury, and hypoattenuating splenic infarcts. During his hospitalization after several days of antibiotics, the patient was noted to be diaphoretic, anxious, and became acutely unresponsive. A computerized tomography (CT) scan of the head at this time demonstrated a 4 mm mycotic aneurysm with left frontoparietal intracerebral hemorrhage. The patient was rushed to the operating room for urgent hemicraniectomy, haematoma evacuation, mycotic aneurysm clipping, and ventriculostomy drain placement. The evening following surgery, the patient remained unresponsive despite being weaned from sedation while intubated. He continued to have rising intracranial pressures greater than 30 mmHg. Following aggressive measures including hyperosmolar 3% saline infusion and 23% saline boluses, there was minimal change in intracranial pressure values. A repeat CT scan of the head showed massive bilateral brain infarction and worsening intracerebral haematoma. Prompt evaluation by the neurosurgical team deemed the prognosis to be unfavorable and further surgical intervention was not pursued.

Discussion: With this case, we outline a unique presentation of endocarditis in a young male with previous aortic valvulotomy and single vessel coronary artery bypass graft ultimately resulting in cerebral mycotic aneurysm rupture. We also present a unique way to manage the underlying problem of refractory elevated ICP with the use of 23.4% saline. This individual had several additional systemic manifestations of bacterial endocarditis including Janeway lesions, splenic and liver infarcts, and acute kidney injury from embolic disease. His course was complicated by malignant intracranial hypertension that was unresponsive to conservative management.
Poster Presentation

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Barriers to Smoking Cessation in the Perioperative Period

Background: Smoking in the perioperative period increases postoperative morbidity and mortality, costing the US healthcare system >$10 billion annually. However, just 12-24 hours of smoking cessation before surgery reduces tobacco-related risk of cardiovascular complications by 50% and cessation for 4 weeks reduces risk of pulmonary complications by 23%. Prior studies found patients are more likely to abstain from smoking if cessation advice is given by a physician. The perioperative period provides a critical opportunity for smoking cessation interventions. The goal of this project was to investigate what barriers to smoking cessation exist for patients in the perioperative period.

Methods: We identified patients who were smokers and underwent surgery at UCSF’s Parnassus, Mission Bay, and Mount Zion hospitals from September 2016 to January 2017. To meet inclusion criteria, patients had to be current smokers, English speaking, and at least a month post-surgery. We conducted a structured telephone interview regarding patient barriers to smoking cessation and clinician counseling in the perioperative period.

Results: Of 143 patients that met inclusion criteria, 40 agreed to participate in our survey. Of these patients, 8 successfully quit smoking, with 50% quitting before surgery, 25% after discharge, and 25% unable to recall when they quit. The remaining 32 patients surveyed were still current smokers but of these patients 67% were trying to quit. When asked to identify barriers to quitting, patients most frequently cited stress management (59%), habit (59%), being around other smokers (31%) and enjoyment of smoking (31%). 68% of patients recalled having a conversation regarding smoking cessation at some point during the perioperative period. Patients most frequently identified having these conversations with surgeons (44%), nurses (33%), or their primary care physicians (26%) but 41% could not recall who specifically had counseled them. Patients had conversations about smoking cessation with providers in Prepare Clinic (19%), their preoperative surgical visits (27%), a different encounter before surgery (19%), the day of surgery (23%), the post-operative period in the hospital (31%), after discharge (4%), or a different time (35%). When patients were offered a referral to a smoking cessation program, 21% accepted. Conclusions: The perioperative period poses a great opportunity to approach patients about smoking cessation. While attempts currently happen informally, having a structured system in place would be beneficial. Our data suggests that our current approach may not be generating as much impact as we are hoping as many patients do not recall being approached about smoking cessation around the time of the surgery. At the same time, our survey confirmed that patients were amenable to smoking interventions as many postoperative patients were still interested in quitting smoking and a subset of these patients accepted referrals to other resources for quitting. We hope to use this data to institute changes that will bring about greater access to smoking interventions for patients in the perioperative period at our institution.

Poster Presentation

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Bilateral Lung Transplantation in a 34 Year Old Female with Idiopathic Pulmonary Arterial Hypertension

Background

Despite recent advances in medical management, pulmonary arterial hypertension (PAH) remains a severe and progressive disease with per-year mortality approaching 15%. Progression of the disease is marked by right ventricular failure as the predominant cause of death. Histological findings in PAH include evidence of vascular remodeling, including intimal hyperplasia, medial hypertrophy and fibrosis, endothelial cell dysfunction, and inflammation. Recent studies have hypothesized a role for abnormal fatty acid metabolism and lipid deposition in both heart and lung tissue as a marker for progression of disease, although the precise relationship is unknown.

Lung transplantation remains the only curative treatment for patients with end-stage chronic respiratory failure. With demand for organs greatly outnumbering supply, patients qualifying for lung transplantation face long wait times, and high peri-operative morbidity and mortality. Here, we describe the case of a 34 year old female with a history of idiopathic PAH (iPAH) who under-went bilateral lung transplantation at our institution (UCLA), following a 34-day course of VA–ECMO, with a discussion of histological features of her explanted lung tissue.

Case Description:

A 34 y/o female with a history of iPAH and hyperparathyroidism underwent bilateral lung transplantation at UCLA. The patient was admitted with severe decompensated heart failure, and despite escalation of medical management, underwent three PEA arrests resulting in the initiation of urgent VA ECMO.

While awaiting a suitable donor organ, the patient developed C. difficile colitis, GI bleed, spontaneous subdural hematoma, and thromboembolic complications. Following 34 days of VA ECMO, the patient underwent bilateral lung transplantation and tricuspid annuloplasty, with intra-operative course notable for evidence of an aortic thrombus on TEE and severe coagulopathy post cardiopulmonary bypass requiring massive transfusion, including receiving PCC and recombinant Factor VII. Post-operatively the patient developed severe lactic acidosis on POD#1 and was started on CRRT. She was extubated on POD #3, but had aphonia and weak cough, and was re-intubated on POD #4, and underwent percutaneous tracheostomy the same day. Post-operative ultrasound imaging showed evidence of splenic and hepatic lobe infarcts. Post-operative transthoracic echocardiography revealed significantly improved RV and RA size, mildly reduced RV systolic function, and normal LV function. The patient was de-cannulated to room air on post-operative day 29, and discharged on post-operative day 36.

Discussion:

We reviewed the histology from explanted lungs and PA of this patient (Fig. 1), which demonstrated fibrosis (1a, 1c), smooth muscle proliferation (1a, 1b), and lipid deposition in the PA (1d). This patient was an example of the ability to use ECMO as a bridge to lung
transplantation, which has become more common in high-volume transplant centers, due to the benefits of avoiding intubation and sedation. An awareness of consequences of prolonged ECMO, including thromboembolic complications and profound intraoperative coagulopathy is critical to patient management. This case highlights the importance of interdisciplinary coordination between cardiac surgeons, intensivists, and cardiac anesthesiologists in the management of complicated patients. We also take a precision medicine approach to investigate the pathophysiologic signature of the disease by doing histologic analysis of the lungs and PA.

**Poster Presentation**

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Bilateral Sympathectomy for Catecholaminergic Polymorphic Ventricular Tachycardia: A focus on Lung Isolation Techniques in Pediatric Patients

Background

Catecholaminergic polymorphic ventricular tachycardia is a type of malignant arrhythmia that is triggered by adrenergic stimulation without detectable structural defects. The prevalence of disease is estimated to be 1:10,000 and is associated with sudden death. Common treatment options include Beta Blocker, ICD, and recently left and bilateral sympathectomy. In the case for bilateral sympathectomy in pediatric population, lung isolation strategies are challenging due to the patients’ small size and equipment availabilities.

Case Description

7-year old 23 kg otherwise healthy male with a history of cardiac arrest secondary to catecholaminergic polymorphic ventricular tachycardia presents for bilateral video assisted thoracoscopic sympathectomy. Labs were within normal limits. After considering the risks and benefits of implantable cardioverter defibrillator versus bilateral sympathectomy, it was decided that sympathectomy was the best option. Given the patient’s small size, lung isolation strategies were challenging due to size limitations with available equipment. After careful consideration, we decided to proceed with the case with a pediatric endobronchial blocker.

The patient was brought into the operating room after premedication with intravenous midazolam. Standard ASA monitors were applied. In addition, external defibrillator pads were placed prior to induction. Smooth intravenous induction was accomplished with propofol, fentanyl and rocuronium. We attempted to place a 6.0 mm ID cuffed ETT, however, we were unable to pass the ETT easily. A 5.5 mm ID cuffed ETT was placed atraumatically with the cuff deflated and minimal leak was detected at 20 mmHg. A 22G radial arterial line and large peripheral intravenous access were placed after successful intubation.

We then proceeded with placement of a 5 Fr Arndt endobronchial blocker into the right main bronchus via direct visualization using a 2.8 mm diameter pediatric bronchoscope. The blocker position was reconfirmed after positioning the patient left lateral. One lung ventilation was initiated with the inflation of the endobronchial blocker balloon under direct visualization. The patient tolerated one lung ventilation on pressure control and FiO2 at 50% without issues. Tidal volume under single lung ventilation was around 120-150 ml with peak airway pressure of 14-15 mmHg. The surgeon reported excellent surgical field exposure and right sympathectomy was completed successfully without complications.

The patient was then repositioned right lateral and re-prepped and re-draped for left sympathectomy. The endobronchial blocker was repositioned into the left main bronchus under direct visualization with the pediatric bronchoscope. One lung ventilation was initiated with the inflation of the endobronchial blocker balloon under direct visualization. Left sympathectomy
was completed successfully without complications. The patient tolerated the procedures well and was extubated at the end of the procedure without event.

The patient was followed closely by cardiology postoperatively. He is doing well without new episodes of syncope or cardiac arrest.

Discussion

Lung isolation techniques in pediatric population can be challenging. Many different techniques are available. This includes utilization of single lumen tube, double lumen tube, univent tube, bronchial blocker, fogarty catheters to name a few. A good understanding of available equipment and careful planning will improve success rate when dealing with these challenging situations.

Poster Presentation

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Bone Cement Embolism with TEE Visualization

An 80 year-old Female with a past medical history of left femoral neck fracture s/p hemiarthroplasty one year ago presented to our institution with a 4 month history of purulent drainage from her left hip wound. The patient was scheduled for an incision and drainage with placement of antibiotic cement spacer. Preoperative workup showed a history of hypertension, Type 2 Diabetes, CHF with ejection fraction of 30%, and severe pulmonary hypertension with RVSP 75mmHg. Physical examination was within normal limits except for a painfully infected left hip with poor range of motion and strengths in the left leg.

In the operating room, awake arterial line access was obtained and a gentle induction of general anesthesia with an endotracheal tube was achieved. The patient was then placed in lateral decubitus position. Due to the patient’s history of CHF, severe pulmonary hypertension, and high risk of cardiovascular decompensation from cement embolism, transesophageal echocardiography (TEE) was used to monitor cardiac function throughout the case. Dobutamine and vasopressin drips were started shortly after the incision due to 300cc of blood loss, despite cc for cc replacement with 5% albumin. During the antibiotic cementing process, large amounts of debris was noticed on the TEE in the RV inflow-outflow tract view. Soon after, the patient went into PEA arrest. 1mg of epinephrine was given and 2 provider lateral chest compressions was performed. Return of spontaneous circulation was achieved within less than 1 minute of CPR. The case was successfully completed and the patient was extubated in the operating room, as arterial blood gas and hemodynamics were within acceptable limits. Patient was discharged from the hospital without further complications on POD#6.

Methylmethacrylate bone cement embolism is a well-documented phenomenon that can occur during various orthopedic procedures. Hip arthroplasty procedures are of particular high risk for embolization. We describe a case where bone cement embolism was visualized with TEE. TEE is not routinely employed during orthopedic procedures requiring bone cementing. However, in our case, TEE allowed for rapid diagnosis of cement embolism in addition to continuous cardiac function monitoring. We speculate that cement embolization occurs fairly commonly during orthopedic procedures involving bone cement. Most cases of cement embolization are likely subclinical, but high risk patients with multiple cardiopulmonary comorbidities are more likely to have negative clinical manifestations. More investigational studies involving TEE and bone cement procedures would be needed in order to confirm our hypothesis.

Poster Presentation

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Can an industrial nitrogen meter be used to detect venous air-embolism?

Introduction: Venous air-embolism can occur during general anesthesia, potentially leading to mortality and morbidity. Various detection methods have been advocated, with varying degrees of sensitivity (1). Observing nitrogen in the expired air has been shown to be a simple and reliable test (1-3). Unfortunately, no dedicated expiratory nitrogen meters are available for use in the operating room at the present time. We attempted to ascertain if a commercially available nitrogen meter (PCT Proline Analyzer 61700-8 Class 85, Ametex, Pittsburg PA 15238), employing mass spectrometry, could be used in an experimental setting using an anesthesia machine and “dummy lung.”

Methods: A Drager Apollo™ anesthesia machine was used to ventilate a dummy lung (2 liter) with a minute ventilation of 6L (Vt 500 mL, RR 12/min). The following conditions were used: 1) 100% oxygen at 1L/min, 2) 1:1 nitrous oxide:oxygen with 1% isoflurane at 2L/min, and 3) 1% isoflurane with 100% oxygen at 1L/min. The nitrogen meter (sampling at 0.0004 atm-cc/sec) was attached to the vapor trap inlet of the Apollo™ gas analyzer, thereby capturing any nitrogen ‘exhaled’ from the dummy lung. A small volume of air (1, 2, 5 or 10 mL) was injected into the distal portion of the dummy lung at different times to assess the detection capabilities of the nitrogen analyzer.

Results: The analyzer detected the presence of nitrogen at every volume when injected in pure oxygen. The amounts of nitrogen detected was proportional to the volume of air injected. Two puffs of albuterol sulfate inhalation aerosol into the dummy lung had no detectable effect on the measured nitrogen levels when the dummy lung was ventilated with 100% oxygen. However, the presence of both isoflurane and nitrous oxide significantly interfered with the measurement of expired nitrogen.

Conclusion: The Proline Nitrogen Analyzer accurately measured nitrogen introduced into a dummy lung ventilated with 100% oxygen. It also worked well if albuterol was present. The analyzer was not useful, however, in accurately detecting nitrogen in the presence of nitrous oxide or isoflurane. Unfortunately, in its present form, this nitrogen analyzer is unsuitable for detection of venous air embolism during anesthesia.

Oral Presentation

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Cannulation of the Subdural Space: A Rare Complication of Continuous Spinal Anesthesia for Total Hip Arthroplasty

Background
While the superiority of general versus regional anesthesia remains open to debate in the healthy population, for patients with severe cardiopulmonary disease neuraxial anesthesia is often considered the first choice in situations where it is feasible and not contraindicated. Here we discuss a rare complication of continuous spinal anesthesia (CSA).

Case Report
A 71-year-old female smoker with severe avascular necrosis of the right hip presented for a total hip arthroplasty. Given a complex pulmonary history notable for severe COPD, oxygen dependence, and a prior right-upper-lobe lung resection for a spontaneous pneumothorax, we favored neuraxial anesthesia, and consented the patient for CSA. Preoperatively, a 17-gauge 3.5in Touhy needle was advance into the L4-L5 interspace, with brisk CSF return noted upon entering the intrathecal space. A 19-gauge epidural catheter was advanced to 11cm and secured, after dependent CSF drainage confirmed correct placement. In the operating room 1mL of 0.75% bupivacaine in dextrose was initially injected. Loss of sensation to pinprick was confirmed to a level of T8, and the surgery team proceeded with positioning. The patient immediately reported severe pain with minimal hip manipulation however, and 1.8mL of additional anesthetic was incrementally administered over the next 15 minutes. Exam at that point revealed sensory loss beyond mid-thoracic dermatomes, and yet there continued to be pain with minimal hip manipulation. This raised suspicion for subdural injection, and the decision was made to delay surgery. There was complete resolution of this patchy sensorimotor blockade after 3 hours, and the case subsequently proceeded under an epidural anesthetic without any complications. Discussion
Subdural placement of a catheter intended for CSA is a very rare occurrence. The first clue suggestive of subdural injection is a delayed sensorimotor blockade onset. Compared with the rapid onset expected with spinal injection, this can be pronounced. The distribution can also be abnormal, with the blockade level extending higher and with less uniformity than other neuraxial techniques. Several case reports have even demonstrated lumbar subdural injections causing numbness and paresthesias in cervical spine dermatomes, with areas serviced by the thoracic spine remaining asymptomatic – thus creating the ‘patchy’ blockade classic for subdural injection. It is theorized these findings result from the mesh-like trabeculae that connect the dura and arachnoid materes. The “honeycomb” appearance of these structures that results, serves to channel injectate to higher levels than typically seen with subarachnoid or epidural injections, while at the same time sparing some, but not all, spinal nerve roots. As this case highlights, subdural catheterization must be considered anytime there is an unexpected onset or distribution of sensorimotor blockade with any route of neuraxial anesthesia. While incidence of unintentional subdural catheter placement may be lower with CSA than epidural techniques, this case should remind that return of CSF doesn’t guarantee the intrathecal space has been completely entered. If a clinical scenario is suggestive of subdural blockade, it’s important to stop and assess if the catheter can be salvaged and used as-is, or aborted in favor of an alternative anesthetic plan.
Poster Presentation

Presenting Author: Dr. Jonathan McGarvey Mayo Clinic Arizona

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Cardiac Dysrhythmia and Arrest After Adductor Canal Block

Introduction  We describe a case of ventricular dysrhythmia and cardiac arrest under general anesthesia after an adductor canal block for knee arthroscopy. Intra-operative trans-esophageal echocardiography showed an ejection fraction of 10% with biventricular failure. The patient was treated with an aortic balloon pump and intralipid, and then regained cardiac function. Case report  A 22 year-old, 70kg male, presented for knee arthroscopy after multi-ligamentous injury in a motorcycle accident. Pre-operative assessment did not reveal any medical history, and patient had previously tolerated a procedure to the hand/wrist under local anesthetic. In the pre operative area an adductor canal saphenous nerve block was performed under ultrasound guidance with patient monitors in place. A 2 inch 21 gauge needle was used with 25 mL of 0.5% ropivacaine. The patient tolerated nerve block well without any neurological or cardiovascular signs or symptoms. He was then taken to the operating room where general anesthesia was induced without incident. Approximately 3 minutes after induction, about 25-30 minutes after regional block the heart rate increased from 80 to 120. The patient then went into ventricular tachycardia and was treated with 70mg lidocaine IV for a total of 100mg including induction. This converted the rhythm to junctional tachycardia and then sinus tachycardia. At this point blood pressure and CO2 began to decrease. He then went into pulseless ventricular tachycardia and was treated with CPR and cardioverted back into NSR. TEE was performed intra-operatively revealing ejection fraction of 10% and biventricular failure with global hypokinesis. This was treated with epinephrine, phenylephrine and milrinone. Cardiology then placed an aortic balloon pump in the operating room. The patient was also treated with an intralipid infusion. After monitoring in the ICU the patient was weaned off pressors and extubated with ejection fraction of 35-40% on repeat echocardiography. Follow up exam with CT angiogram and echocardiography 2 months after discharge showed fully normal cardiac function. Discussion  This case possibly represents an atypical presentation of local anesthetic toxicity. It is unusual that the patient did not show any symptoms pre-operatively after regional anesthesia. Each dose of local anesthetic (ropivacine 125mg, Lidocaine 100mg) was well below the recognized toxic dose. The delayed onset and absence of any neurological symptoms such as numbness and seizures is also atypical. General anesthesia may have masked these symptoms so that ventricular tachycardia was the first visible sign. The treatment of the dysrhythmia with additional lidocaine could have contributed to a reaction to local anesthetics. Movement of the extremity while transferring to the operating table could introduced more local anesthetic into circulation, though any movement was minimal. A pulmonary embolism is also in the differential, but TEE imaging was inconsistent with expected right heart effects. The patient may also have had a genetic predisposition to local anesthetic or general anesthetics that was exposed during the procedure. Fortunately with TEE and cardiology immediately available the patient was able to make a full recovery.

Poster Presentation

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Case Report: Combined Cardiac Autotransplantation and Pneumonectomy, Is it worth the risk?

Introduction: Primary cardiac tumors are rare at 0.001%-0.3% in the general population. Untreated, these tumors (particularly malignant) carry a terrible prognosis via local extension and cardiovascular compromise. Complete surgical resection via autotransplantation has proven to significantly improve outcome when compared to chemotherapy and other conservative management (Putnam). Simultaneous pneumonectomy has previously been linked to increase operative mortality from 11% to 43% and decreased median survival from 378 days to 55 days (Ramwali), who concluded that a need for simultaneous pneumonectomy is a strict contraindication for surgical resection. Another group found 50% operative mortality with simultaneous pneumonectomy as opposed to 0% operative mortality with autotransplantation alone (Blackmon).

Case Presentation: 20F who presented to OSH with atrial fibrillation with RVR found on echo to have myxoid and spindle cell sarcoma of left atrium. At OSH she underwent partial debulking but ultimately transferred to UCSD for higher level of care. She was found to be pregnant at this time and had her pregnancy terminated. Imaging modalities included: CT chest, CT head, Cardiac MRI and PET CT. Imaging revealed multilobulated mass in left atrium that extended to the posterior annulus of the mitral valve as well as into the left pulmonary veins with near-complete occlusion of the left sided pulmonary veins.

Surgical Intervention and Anesthesia Concerns: Induction with Etomidate 0.3mg/kg, Fentanyl 10mcg/kg, Midazolam 3mg, Rocuronium 100mg, Isoflurance for maintenance. Cordis and Swan Ganz catheter placed in Right IJ, TEE placed. Cardiopulmonary bypass time of 290 minutes with aortic clamp time of 153 minutes at 28°C. Cardiectomy performed and all visual signs of sarcoma were removed from left atrium. Left pneumonectomy performed with stapling of left pulmonary artery and main bronchus. Reanastamosis for cardiac autotransplantation performed. Patient received 3 units platelets and 2 units FFP at end of procedure. Required Dopamine 3mcg/kg/min and Phenylephrine 40 mcg/min for transport to ICU, with final Cardiac Index noted to be 2.8 L/min/m2. Patient was cared for in the ICU under CT Surgery, Anesthesia Critical Care and Cardiology. Patient was extubated POD#2. Developed infection of unknown origin requiring 10 days of broad spectrum antibiotics. Developed right heart dysfunction requiring short term milrinone, epoprostenol, sildenafil and diuretics. Left sided vocal cord dysfunction noted as well. Doing well at 1 year follow up, continuing care in Las Vegas.

Discussion: Prior data indicates that 30-day, 1 year and 2 year mortality for cardiac autotransplantation with simultaneous pneumonectomy is 43%, 86%, 86%, respectively (Ramwali). Mortality was primarily from bleeding into the pneumonectomy site with subsequent “coagulopathy, transfusion, volume overload, unilateral pulmonary edema, and ultimately death.” Although the data sets are small (7 combined with 26 total for Ramwali et al and 6 combined with 21 total for Blackmon et al) they have prevented these groups from continuing with performing surgery in patients with disease extending into lung tissue. The
presented case demonstrates a successful combined approach, with no bleeding complications. Future examination of technique differences may allow for treatment options in patients required a combined approach.

Poster Presentation

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CASE REPORT: HYPOXEMIA DURING ONE LUNG VENTILATION (OLV) SECONDARY TO INTRACARDIAC SHUNT. PFO: a potentially underestimated and often overlooked source of hypoxemia during one lung ventilation

Introduction

Hypoxemia has been found to occur in 4-10% of all patients undergoing OLV (1-5). Expert consensus has established many risk factors associated with hypoxemia during OLV; yet, very few mention the presence of a patent foramen ovale (PFO). PFOs are a relatively common anatomic anomaly, occurring in 25-27% of the general population (6,7). They are fairly benign under normal physiologic states; however, under states of elevated PVR and RAP, the development of an intracardiac shunt can be devastating. This case report demonstrates an example of recurrent and prolonged hypoxemia during, and after, OLV secondary to an intracardiac shunt via PFO.

Case

The patient is a 66 year old male who presented for a VATS wedge biopsy of his right lung. During OLV, he developed two successive episodes of hypoxemia. The first episode resolved after re-expansion of the non-ventilated lung; however, the second episode did not respond to right lung re-expansion and required transfer to the ICU for prolonged intubation and further evaluation of hypoxemia. During both of episodes of hypoxemia, escalation of PEEP and recruitment maneuvers only seemed to hasten the desaturation to a SaO2 nadir ~65%. An arterial blood gas sample taken at the time of transport revealed a PaO2 of 66mmHg while receiving an FiO2 1.0. While in the ICU, the patient’s oxygenation gradually improved and he was extubated twelve hours later. A TTE revealed an interatrial passage of agitated saline contrast with valsava maneuver, findings consistent with a PFO.

Discussion

There are numerous sources for poor V/Q matching that can cause hypoxemia during OLV. This presentation will exclusively focus on a source of shunt that is rarely mentioned: an intracardiac shunt via PFO. Intracardiac shunts can occur as a direct consequence of elevated PVR. The following elements result in an excessive PVR during OLV: Hypoxic Pulmonary Vasoconstriction (HPV), Deflation of the operative lung and collapse of its vasculature, Neuromuscular blockade, Positive pressure mechanical ventilation, PEEP and recruitment maneuvers. When hypoxemia occurs in patients with PFOs, there is a dangerous cycle of increased PVR, worsening shunt, and further decline in oxygenation (Figure 1). In such cases, anesthesia providers can actually exacerbate the patient’s hypoxemia via increase in PEEP and recruitment maneuvers. As always, patient safety is paramount in anesthesiology. A review article in Anesthesia and Analgesia, recommended preoperative screening for a PFO “in situations in which its consequences may be devastating and a preventable strategy is feasible” (8). This case illustrates that the presence of a PFO may have devastating consequences in patients undergoing OLV (hypoxemia resulting in prolonged intubation, potential end-organ damage, fatal arrhythmias, even death). If a PFO is identified preoperatively, providers can take extra precaution, such as optimal patient positioning, CPAP to non-ventilated lung, and intermittent two lung ventilation, in attempt to prevent the dangerous cycle of progressive hypoxemia which we experienced during OLV.

As the incidence of thoracic procedures and
indications for OLV continues to rise, further research is needed to help establish and quantify the risk of PFO presence and hypoxemia during OLV.

**Poster Presentation**

**Presenting Author:** Dr. Nick Schiavoni University of Colorado Department of Anesthesiology  

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Case Report: Respiratory Failure, Metabolic Acidosis, and Fluid Overload Caused by Bladder Fluid Irrigation During Holmium Laser Removal of the Prostate

Background  Benign prostatic hypertrophy with lower urinary tract symptoms, which include nocturia, frequency, and bladder outlet obstruction with incomplete voiding, is a common indication for prostatic resection. The gold standard for benign prostatic hypertrophy resection is transurethral resection (TURP), but patients with large prostates are not candidates for TURP and have traditionally undergone open surgical resection. Recently, less invasive transurethral holmium laser resection of the prostate (HoLEP) with normal saline urologic irrigation has been utilized for resection of larger benign prostates. HoLEP has a steep procedural learning curve and is performed at only approximately twenty centers in the United States. We describe complications of a HoLEP procedure due to fluid absorption caused by intraoperative large volume normal saline urologic irrigation. Case Report  Our patient is a 70 year old male with a large (140cc) prostate who underwent HoLEP for BPH causing chronic bladder outlet obstruction. His medical history was complicated by chronic hepatitis C, daily alcohol use, cirrhosis with esophageal varices, hypertension, and multiple myeloma. During the HoLEP, the patient progressively became hypothermic, and 150 minutes after procedure start developed progressive hypoxemia resistant to alveolar recruitment and with unchanged ventilation parameters or end tidal carbon dioxide levels. ABG analysis revealed a hyperchloremic non-gap metabolic acidosis and large A-a gradient. Discussion with the surgical team revealed the use of 40 liters of normal saline bladder irrigation fluid, with an estimated 90 minutes of case time remaining. The procedure was aborted and the patient was transported intubated to intensive care with lactated ringers in place of the standard normal saline bladder irrigation. Spiral CT chest was negative for pulmonary embolism, and cardiac evaluation was unremarkable. The patient returned the following week for completion of the HoLEP procedure and again developed progressive hypothermia, hypoxia and hyperchloremic non-gap metabolic acidosis necessitating post-op intubation. Discussion  HoLEP has a steep learning curve, but provides benefits over traditional open surgical treatment in patients with large benign prostates. This case, only the 8th HoLEP procedure to be performed at UCSF, highlights potential pitfalls in this procedure. The first case report of an identical HOLEP complication presentation was published only 6 days prior to this case. We postulate that this patient’s portal hypertension may have caused a proliferation or engorgement of his prostatic venous sinuses predisposing him to increased absorption of urologic normal saline irrigation fluid. Patients on dialysis or with congestive heart failure may also be predisposed. Such patients should be identified and strategies for reducing or mitigating the effects of volume overload should be included in the HoLEP anesthetic and operative plan.

Poster Presentation

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Cerebral Oxygen Desaturation Associated with Sternal Retraction During Coronary Artery Bypass Grafting

Background:

Near-infrared spectroscopy-based cerebral oximetry is commonly used to monitor brain oxygenation during cardiovascular operations. Decreases in oximetry readings can suggest decreased cortical perfusion and impending ischemia by a variety of mechanisms. A recent study shows that avoiding low intraoperative cerebral oximetry values decrease mortality and major organ morbidity in patients undergoing coronary artery bypass grafting (CABG). We report the case of intraoperative cerebral oxygen desaturation with simultaneous decreased left internal mammary arterial flow in the setting of left sternal retraction.

Case description: A 60-year-old woman, 59 inches tall, with diabetes mellitus, hypertension, and coronary artery disease was scheduled for three-vessel coronary artery bypass grafting, including a graft from the left internal mammary artery (LIMA) to left anterior descending (LAD) artery. Pre-operative workup was notable for 60-79% stenosis of the right carotid artery, from which the patient was asymptomatic. In addition to standard ASA monitors, Fore-Sight Cerebral Oximetry, with bilateral sensors, was applied. A catheter was placed in the left radial artery for invasive blood pressure monitoring. General endotracheal anesthesia was induced uneventfully and maintained with a combination of inhaled sevoflurane and intravenous sufentanil infusion and rocuronium boluses. The chest and sternum were opened, a Rultract skyhook was used for retraction of the left chest, and the surgeon began to dissect the LIMA. Blood pressure was maintained with administration of phenylephrine as needed. Cerebral oximetry readings remained close to their baseline of 75%. The surgeon then reported a lack of arterial blood flow through the LIMA; simultaneously, bilateral cerebral oxygen saturation readings began to drop quickly with a nadir of about 40%. Throughout this time, the arterial blood pressure reading remained steady. The retractor was removed, arterial blood flow returned to the LIMA, and the cerebral oxygen saturation readings returned to their baseline values.

Discussion: In this case, bilateral cerebral oxygen desaturation occurred simultaneously with decreased LIMA flow, suggesting compromised perfusion affecting a number of vessels. Improvement in both cerebral oximetry readings and LIMA flow seemed to improve with removal of the left-sided sternal retractor. In this patient with relatively short height, the retractor may have compressed the left common carotid and subclavian arteries, or the patient may have had an anomalous more proximal origin of the LIMA, decreasing left-sided cerebral and LIMA perfusion. In the setting of right carotid stenosis, the parallel decrease in right-sided cerebral oxygen would suggest a dependency on collateral perfusion via the Circle of Willis. Alternatively, simultaneous systemic hypotension may have led to decreased global cerebral and internal mammary arterial perfusion; treatment with phenylephrine may have been enough to maintain peripheral radial arterial perfusion and thus a pressure waveform, but not sufficient to improve cerebral and internal mammary perfusion. Overall, cerebral oximetry monitoring during cardiac operations can offer valuable information regarding possible insults to end-

Poster Presentation

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**Cesarean delivery of a severely obese parturient with a combined spinal-epidural anesthetic**

Introduction: Obesity is a global epidemic that crosses all demographic and socioeconomic lines. In addition, the incidence of severely obese (BMI > 35 kg/m²) parturients is growing.1,2 These patients have several unique anesthetic, obstetric, and post-operative pain considerations. We present the case of a 25 year old G4P3 at 39 weeks with a BMI of 96.7 kg/m² (height 147cm, weight 209kg), the highest documented in the literature, who successfully underwent repeat cesarean section with a combined spinal-epidural (CSE).

Case: The patient presented to our institution at almost 39 weeks having been turned away from multiple hospitals due to her weight. With scant prenatal care, she underwent transthoracic cardiac echo, general surgery consultation for an untreated breast abscess, ultrasound for asymmetric lower extremity swelling, respiratory therapy consultation for CPAP fitting, and a complete obstetrical evaluation. She had a history three prior cesarean sections, and fundal placenta this pregnancy was noted on prenatal ultrasound. An elective operative delivery by supraumbilical vertical midline incision was planned. Due to poor vascular access and an inability to measure blood pressures non-invasively, a central venous catheter and arterial line were placed prior to surgery. A Styrofoam intubation wedge and video laryngoscopy were available, as were two units of typed and crossed red blood cells. Due to absent anatomical landmarks, midline and distance to the epidural space were identified with ultrasound. Consistent with ultrasound estimation, loss of resistance was found at 15cm with a 6” 17 gauge Tuohy needle. A 190mm 25 gauge Gertie Marx spinal needle was passed into the subarachnoid space, and 12mg of 0.75% hyperbaric bupivacaine and 10mcg of fentanyl were injected. No neuraxial morphine was given due to concerns of respiratory complications. An epidural catheter was uneventfully threaded through the epidural needle and taped at 20cm at the skin. Five epidural boluses of local anesthetic were given throughout the 89 minute surgery. Estimated blood loss was 1500mL. A viable female infant was delivered with APGARs of 3, 7, and 8 at 1, 5, and 10 minutes respectively, and was taken briefly to the NICU following delivery for non-invasive respiratory support and hypoglycemia. The patient’s epidural catheter was left in place, and 0.1% bupivacaine with 2mcg/ml fentanyl was infused for 24 hours until the patient successfully transitioned to oral analgesics. The patient recovered on in the Labor and Delivery unit, although an ICU bed had been made available.

Discussion: A team-based, multidisciplinary approach to this patient’s care assured the safest delivery for this severely obese patient. A CSE allowed for profound anesthesia for a complex operative case, while the epidural catheter provided flexibility and safety for an uncertain surgical course as well as post-operative analgesia to minimize systemic opioid use.


Poster Presentation

**Presenting Author:** Dr. Rachel Clement University of Washington

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Challenges of Perineural Catheter Management in Ambulatory Surgery

Introduction
Regional anesthesia in the form of peripheral nerve blocks has been demonstrated to reduce post-operative pain and improve patient-centered outcomes following orthopedic surgery. Unfortunately, ambulatory patients receiving regional anesthesia may require increased resource utilization due to various issues. Sunderland et al. examined healthcare resource utilization in patients after wrist surgery, comparing subjects who received a single-shot peripheral nerve block (PNB) vs. general anesthesia (GA). Subjects who received a PNB had higher rates of unplanned ED/office visits caused by poorly controlled pain after discharge compared to subjects who underwent general anesthesia. Our institution has noticed a similar trend of increased healthcare utilization, especially in patients receiving ambulatory perineural catheters.

Case Presentation
A 66 year old female admitted for an elective repair of a rotator cuff tear received an interscalene catheter with an initial bolus of 20 cc of 0.5% Ropivacaine preoperatively. In the PACU she was found to have a dense nerve block with no significant pain or complications. She was discharged home on POD-0 with a home pump dispensing 6 mL/hr of 0.2% Ropivacaine. Overnight, the patient called with concerns that her pump was not working, as she reported increased ability to move her fingers, decreased numbness, as well as an increase in pain intensity. The resident determined that the block was still working and the changes she was experiencing were part of the expected transition between the dense surgical block and the post operative block. She was instructed to continue using the pump and supplement with the prescribed pain medicine regimen. A 62 year old male was admitted with an open radial shaft fracture after a motor vehicle crash and underwent an open reduction and internal fixation. He received a supraclavicular perineural catheter for post-operative pain. Prior to his discharge on POD#1, he was given instructions on management and removal of his home pump catheter. The patient called the covering physician on POD#3 with significant stress and anxiety related to discomfort at having to remove the catheter. He had sought care at his primary care physician’s office as well as a local urgent care center. The covering resident guided him through catheter removal by phone and the patient had no additional complications.

Discussion
The ambulatory regional anesthesia challenges encountered in these cases was likely a result of inadequate patient knowledge about homepump and oral analgesic management. Studies have looked at the benefits of patient education on reducing healthcare costs and improving outcomes. Elderly patients who received education on basic pain management and pain communication skills prior to their joint replacement surgery reported less pain on POD0 and POD1 from their surgery. We are currently conducting a prospective cohort study to test the hypothesis that provision of a comprehensive education program directed at patients and their family members will reduce healthcare resource utilization and improve satisfaction in patients undergoing ambulatory surgery combined with a peripheral nerve block. A more extensive and standardized education program could prevent issues such as those experienced by the patients in the cases discussed.

Poster Presentation
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Changes in physician and nursing satisfaction after implementing OR to ICU provider handoff checklist QI project

Background: In medicine, a handoff occurs anytime the care of patient transitions between providers, services or locations in the hospital. One common place handoffs occur is between the anesthesia and ICU care teams. Several variables make handoffs a potentially dangerous time for patients. A large amount of information needs to be conveyed in an efficient manner, including the patient’s medical history, hospital and surgical course and future care plans. During the handoff process, patient care must also be conducted including treatment of any post-operative derangements. Effective communication can be difficult because of providers’ different backgrounds in training and care priorities. The problem of poor handoffs leading to worse outcomes is well documented. A recent study showed an increase in hospital mortality from 1.5% to 1.9% in patient’s exposed to an end of rotation transition between medical residents. The presence of a handoff checklist is known to improve the handoff process.

Methods: This QI project implemented an OR to ICU handoff checklist in a hospital where there was not a standardized process in place. The effect on handoffs was tracked by a satisfaction questionnaire voluntarily filled out by hospital physicians and staff who partake in the handoffs. To develop the handoff checklist, a series of meetings were convened with stakeholder leadership from the Departments of Anesthesiology and Surgery that oversee the SICU. A handoff checklist was developed using best practices and stakeholder input and put into place during the spring of 2016. The checklist focused on four priorities: complete information, efficient delivery, presence and attention of all team members without interruption and compliance with the checklist. An anonymous pre-survey was administered to all resident physicians, CRNAs, ICU RNs and ICU advanced practice practitioners working or rotating at the hospital in December of 2015. The survey consisted of eight Likert scale questions asking about satisfaction with the current hand-off process as well as specific components in the handoff process. A year later the same survey was distributed. Survey results were tallied in Microsoft Excel and a two-tailed T-test was administered with a 0.05 significance. A total of 21 pre-surveys and 23 post-surveys were collected.

Results and Conclusions: One year after the handoff checklist was implemented satisfaction in OR and ICU staff had improved (p=0.003). Specific questions about efficiency (p=0.053) and completeness (p=0.623) did not however show a significant difference. One conclusion is that although satisfaction improved (possibly just by increased attention to the issue) quality of handoffs did not improve significantly. A more optimistic conclusion is that handoff satisfaction improved and specific improvements were made but not captured in the survey. Ideally we would have liked to track which components of the handoffs improved and which did not to guide future improvement efforts. Moving forward the checklist has now become part of the anesthesia record and handoff start and ends times are being collected to track efficiency. Simulator training is also starting to help teach efficient handoffs. These efforts will be tracked with future surveys and metrics for continued improvement.
**Poster Presentation**

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- Dr. Elizabeth Schacht Denver VA Eastern Colorado Health Care System
Clinical Implications and Management of Pulmonary Artery Catheter Thrombosis during Cardiac Surgery

Introduction: The pulmonary artery catheter (PAC) is an excellent real-time hemodynamic monitor that is particularly useful in patients that require careful titration of potent vasoactive or inotropic medications. PAC’s are commonly used in patients with severe cardiogenic shock and during the perioperative period for cardiac surgery patients. Importantly, placement and maintenance of PAC’s are associated with complications, including arrhythmias, vascular perforation, air embolus, and catheter-induced thrombosis. Case Description: In our experience, PAC-induced thrombosis is quite rare. However, we recently noticed a sudden rise in thrombotic events after PA catheter placement for cardiac surgery when we switched from a heparin coated PAC to one without heparin coating. Here we present five cases in which thrombosis occurred after placement of a PAC but prior incision for cardiac surgery. In one case, the thrombus was left in situ. In three cases, the thromboses resolved upon heparin administration prior to initiating cardiopulmonary bypass (CPB). In the final case, the surgical plan for CABG off bypass was altered due to right atrial thrombus formation in the presence of a patent foramen ovale (PFO). Because of increased risk of embolic stroke, it was decided to go on CPB to repair the PFO and evacuate the thrombus. Discussion: PAC-induced thrombosis has important implications for surgical planning. PAC-induced thromboses have been reported with both heparin coated and non-heparin coated PAC’s. Only a few studies support the use of heparin coated catheters for prevention of PAC-induced thrombosis, and none is sufficiently powered to conclusively demonstrate a risk reduction. However, based on these five cases we strongly recommend increased vigilance for this serious complication when using PAC’s without heparin coating.

Poster Presentation

Presenting Author: Dr. Benjamin Illum UCSD

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Coccidioidomycosis ARDS with ECMO support

Pulmonary coccidioidomycosis is a common cause of benign respiratory tract infections in the Southwestern US. C. immitis are dimorphic fungi found in soil as saprophytes producing infectious arthroconidia when airborne. 60% of infections are asymptomatic, and 40% develop self-resolving flu-like symptoms. Cocci can lead to residual morbidity, however mortality is rare at 0.07%.

The literature suggests human rhinovirus (HRV) co-infection exponentially increases rates of severe fungal disease. HRV inhibits antigen specific T cell proliferation/cytotoxicity and processes reliant on ICAM-I/LFA-I binding. Primarily serving to enhance viral replication, T cell dysfunction increases susceptibility to other organisms.

We present a 62 y/o M with no PMHx who recently returned from a trip to TX complaining of fever, cough and discolored sputum. He was a non-smoker and avid gardener in Southern CA. Despite levofloxacin as an outpatient, he was admitted for respiratory failure requiring emergent intubation. Imaging/bronchoscopy revealed RLL pathology presumed to be CAP. With no improvement on broad-spectrum antibiotics, paralysis and proning he was transferred for placement of VV ECMO (day 8) for ARDS and hypercarbic respiratory failure. CocciIgM/IgG, rhino/enterovirus PCR were positive and BAL revealed C. immitus. Amphotericin B was initiated immediately. Oxygenation improved and the patient was maintained on ECMO over a month. Complications included pleural effusions, unstable brady/tachyarrythmias, thrombocytopenia, leukopenia, neutropenia, GI bleeds, AKI and hepatic insufficiency. After ruling out lung transplantation with no signs of meaningful recovery (BAL remained positive/no mountable antibody response), focus was shifted to supportive management and the patient died on ECMO day 32.

Cocci requiring ECMO for ARDS has been described in an immuncompromised patient, however there are no documented cases to our knowledge in immunocompetent patients. It is unclear whether patients with this severity of disease are able to recover with ECMO support.

Poster Presentation

Presenting Author: Dr. Christine No Cedars Sinai Medical Center

Authors:
Dr. Christine No Cedars Sinai Medical Center
Combined Neuraxial and MAC Anesthesia for Urgent Endovascular Aortic Repair (EVAR) Prior to Palliative Laryngeal Cancer Treatment

Endovascular Aortic Aneurysm Repair (EVAR) was introduced in the 1990s as a means to decrease the high morbidity associated with open aneurysm repair. Despite advancements in surgical technology and improved outcomes, little has changed in the anesthetic technique chosen. General anesthesia is still typically used EVAR, particularly when surgical cutdown of the access site is necessary. This case describes use of a neuraxial anesthetic for EVAR in a patient with an added risk of a known difficult airway secondary to symptomatic laryngeal cancer.

The patient was a 73-year-old male scheduled for urgent EVAR of a 10-cm infrarenal abdominal aortic aneurysm found incidentally during work-up of a symptomatic neck mass. Significant past medical history included newly diagnosed laryngeal cancer, peripheral vascular disease with claudication, and a 100-pack-year smoking history. Prior anesthetic records and imaging of the neck mass were unavailable.

Preoperative examination revealed a cachectic male with a quiet, raspy voice; 1x1cm right neck mass; SpO2 91% on room air; and no orthopnea. The patient also stated that over the last two months, he experienced progressive dysphagia and worsening cough. Airway instrumentation was deemed high risk for trauma, but because bilateral groin cutdowns were necessary for surgical exposure, the decision was made to proceed with neuraxial anesthesia. A combined spinal-epidural was performed supplemented by epidural lidocaine, with anxiolysis provided by dexmedetomidine, midazolam and fentanyl. The patient tolerated the procedure well and was discharged two days later.

This case demonstrates a complex case requiring decisions balancing airway management and surgical requirements. A retrospective database analysis demonstrated decreased pulmonary morbidity and length of stay with neuraxial compared to general anesthesia in EVAR patients.1, 2 The case presented adds to the literature supporting neuraxial anesthesia for EVARs requiring surgical anesthetic conditions.


Poster Presentation
Presenting Author: Dr. Chelsea Zur Stanford University

Authors:
Dr. Chelsea Zur Stanford University
Dr. Jessica Brodt Stanford University
**Congenital methemoglobinemia and successful one-lung ventilation: a case report**

Congenital methemoglobinemia occurs when red blood cells contain levels of methemoglobin greater than 1%. This rare condition may result from abnormally formed hemoglobin (MetHb), or impaired or absent reducing enzyme activity. We report a case of uncomplicated CABG with one-lung ventilation in a 60 year-old-man with congenital methemoglobinemia. Proper anesthetic management of patients with this dyscrasia requires an understanding of its pathophysiology, with recognition and preparedness for potential complications of decreased oxygen-carrying capacity.

**Poster Presentation**

**Presenting Author:** Dr. Lindsay Jinkins University of New Mexico Anesthesiology and Critical Care Medicine

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Continuous Spinal Anesthesia With Hypobaric Tetracaine for Hip Surgery in a Patient with Severe Aortic Stenosis

Spinal anesthesia in patients with severe AS is considered by many to be contraindicated due to concerns of decrease in systemic vascular resistant that could lead to severe hypotension. A few case reports in the past have shown successful use of continuous spinal anesthesia in patients undergoing hip surgery with aortic stenosis. In this case, our patient has severe AS w/ AVA 0.8cm\(^2\) along with other co-morbidities and is scheduled to undergo R hip hemiarthroplasty. After discussing with the surgical team the procedure length and complexity, general anesthesia was deemed to carry a higher risk of complications (hypotension, emergence delirium, inability to titrate anesthetic) compared to a carefully administered spinal anesthetic. For the procedure, patient was placed in the lateral position and an intrathecal catheter was placed for gradual administered hypobaric tetracaine. The patient was sedated using a low dose propofol infusion and a low dose phenylephrine infusion was titrated to maintain mean arterial pressure at near pre-spinal levels. No wide fluctuation in blood pressure or pulse was observed. Patient had stable hemodynamics throughout the procedure and recovered in PACU uneventfully.

Poster Presentation

Presenting Author: Dr. Betelehem Asnake University of California, Davis

Authors:

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Dr. Herman Devera University of California Davis
Cooled Radiofrequency Ablation for Pain Associated with Avascular Necrosis of Femoral Head in Children

Background  Avascular necrosis (AVN) of the femoral head is most commonly seen in children 1.5 to 10 years. AVN is caused by a disruption of blood supply to the hip joint leading to micro osteonecrosis and eventual collapse of the femoral head. Two types of AVN occur in childhood. The first is an idiopathic process commonly known as Legg-Calvé-Perthes' disease. The second is an acquired condition. Etiologies include trauma, chemotherapy, synovitis, hypothyroidism, hemoglobinopathy, epiphysial dysplasia, and steroid therapy. In children, AVN commonly presents as a limp and is often associated with hip or referred knee pain. While the hip joint is innervated by the sensory articular branches of the obturator and femoral nerves, referred pain may be from the activation of the obturator nerve which innervates both the hip and the distal thigh or knee. For pediatric patients, chronic hip/knee pain can be debilitating. In adults, there are case reports of pulsed radiofrequency ablation (RFA) as a beneficial alternative pain treatment of last resort. Coolief is a new cooled RFA technique that uses cooled circulating water to create a larger treatment area than conventional RFA. A PubMed search revealed no prior reports of RFA for children, and no prior reports of cooled RFA for children or adults as treatment for hip/knee pain associated with AVN. Case description  Patient LG is a 15 yo female with h/o sickle cell SS disease and alpha thalassemia with chronic bilateral hip pain from AVN. Despite several corrective surgeries, her chronic pain has lead to worsening physical function and increasing opioid use. Patient and parent consented to this procedure. Parent verbal consent was obtained for this case report. This procedure was conducted under GA. After femoral and obturator nerves were identified under fluoroscopy, motor stimulation to 2 V was negative to ensure that there was no motor involvement. Local anesthetics were injected and then 2 minutes of 60 degs Celsius thermal (cooled) radiofrequency ablation were performed on each nerve (Halyard Cooled RF System, Alpharetta, Georgia). This same procedure was carried out on the contralateral side. Two month post procedure, patient’s mother feels that bilateral hip pain is 80% improved. Patient is now able to play tennis again and uses less opioids. Pain relief appears to be sustained. Discussion  Chronic hip pain from AVN can be a debilitating problem for children. Cooled RFA of the obturator and femoral sensory nerves may be a treatment option in this pediatric population. It may help reduce opioid consumption, improve function, and reduce hospitalizations. Further studies are warranted to assess the utility of cooled RFA for hip/knee pain in children with AVN of femoral head. Reference  Divi S, Bielski R. Legg. Legg-Calvé-Perthes' Disease. Pediatric Annals 2016; 45:4:e144-199. Malik A, Simopolous T, Elkersh M, Aner M, Bajwa Z. Percutaneous Radiofrequency Lesioning of Sensory Branches of the Obturator and Femoral Nerves for the Treatment of Non-Operable Hip Pain. Pain Physician. 2003;6:499-502, ISSN 1533-3159

Poster Presentation

Presenting Author: Dr. Esther Lee University of California, San Francisco

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Cross Field Ventilation Strategy in a Transected Trachea

Background: Crossfield ventilation is a rarely used technique for management of tracheobronchial injuries. Traumatic tracheal injuries present emergently and are life threatening, with minimal preoperative evaluation and opportunity to plan. These cases present anesthetic challenges in intubation, maintaining ventilation and oxygenation especially during tracheal reconstruction. We describe a case of tracheal injury requiring emergent repair and the use of crossfield ventilation for anesthetic management. Case Description: A 37 y/o Male with no significant medical history presented after a high speed motorcycle crash with tracheal crush injury after colliding against a barbed wire fence. Additional injuries included bilateral pneumothoraces and pneumomediastinum. He was intubated on scene of the crash by emergency personnel for agonal respirations. A follow up CT scan revealed the distal end of ETT extra-tracheal creating a false lumen. He was re-intubated in the OR at an outside hospital with a bronchoscope and transferred to our hospital. Anesthesia was induced with midazolam and fentanyl, and rocuronium was given for neuromuscular blockade. Intravenous propofol was chosen for maintenance of anesthesia to avoid volatile contamination of surgical field and steady anesthetic depth. Initial rigid bronchoscopy revealed tracheal disruption at 1 tracheal ring level below the cricoid cartilage. Thoracic and otolaryngology surgical teams performed tracheal dissection. A sterile 6.0 ETT was used for cross field ventilation. During tracheal anastomosis ventilation was maintained with SIMV-PSV and manual bag in coordination with surgical team performing intubation and extubation of the trachea. Tracheal anastomosis was performed and at the end of surgery tracheostomy was placed. Discussion: Cross field ventilation is an approach in tracheal reconstruction surgery that requires distal tracheal intubation and intermittent ventilation with positive pressure. Following tracheal exposure the proximal ETT is withdrawn while a new sterile ETT is inserted distally to ventilate. Intermittent apneic periods are permitted to allow insertion of sutures to distal trachea until anastomosed. Alternative methods include jet ventilation with manual high frequency ventilation of distal lung fields. This poses the problem of exposure of a compromised trachea to high airway pressures. Case reports of use of a foley catheter, Shiley have been reported. Sometimes oxygenation may pose a challenge, especially with ARDS, extensive pulmonary injury the patient may not tolerate intermitted ventilation. A case report described the use of veno venous ECMO to maintain oxygenation. Although cardio-pulmonary bypass was popular in the 1960s for carinal surgery, routine use brings its own risks of complications. Spontaneous ventilation has also been described as a strategy in planned tracheal tumor surgeries, often requiring an epidural and sedation. Although this approach may improve surgical field visualization, risks include coughing and blockage of distal airway with debris or blood. The level of injury affects greatly affects ability to ventilate with more inferior or subcarinal injuries requiring one lung ventilation and therefore greater difficulty in maintaining oxygenation. Post operative mortality is related to positive pressure ventilation in cases of tracheal surgeries, so spontaneous ventilation postoperatively is desired. These cases require meticulous communication between the surgical team and anesthesiologist and team based approach.
Presenting Author: Dr. Aamera Thazyeen UC Davis Department of Anesthesiology

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Current Anesthesia and Post-procedure Management Techniques for Transfemoral Aortic Valve Replacement (TAVR) in the United States: A Survey of TAVR Centers

Background: Transcatheter aortic valve replacement (TAVR) is a rapidly developing procedure for patients with aortic stenosis. Initially designed for only those of high risk who were thought to be unable to undergo conventional surgery, recent evidence has expanded its utility for patients of intermediate risk. As the TAVR procedure gains efficacy in the United States both the total number of procedures as well as sites is rapidly increasing. Along with this rapid change in case volume so too is the anesthetic and post-procedure management of these cases across the world. General Anesthesia (GA), Monitored Anesthesia Care (MAC), and Local Anesthesia (LA) have all been demonstrated. This study seeks to evaluate the current state of anesthesia management and monitoring as well as post-procedure management across all TAVR centers in the United States.

Methods: The study is an ongoing nonrandomized survey of all TAVR centers in the United States. TAVR centers were discovered via online searches and use of www.newheartvalve.com. After IRB approval, each center was contacted to identify the contact that could answer questions regarding anesthesia and post-procedure management and the survey was distributed electronically via Qualtrics (Provo, Utah) survey system. Each center was asked the same questions regarding anesthesia and post-procedure management.

Results. Preliminary results show that GA is practiced on average 51 %, MAC is practiced on average 48%, and no center currently has described the use of LA. Medication regimens for MAC seem to vary across centers. Transthoracic echocardiography is used frequently for MAC cases. Current data suggests that patients are sent to the ICU after the procedure and most patients remain in the hospital for less than 72 hours. More centers use peripheral venous access then central or pulmonary arterial catheter and radial artery catheters are most often used without cardiac output monitoring for both MAC and GA techniques. Further details are listed in Table 1,

Conclusions: Preliminary data suggests that GA appears to be the predominant practice in the United States, however the use of MAC has risen from what has previously been reported in the United States. There also appears to be a large degree of variation regarding other management choices for patients undergoing TAVR. Future research should evaluate the potential utility of standardization strategies.

Oral Presentation

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Current Practice Strategies in the Acute Care Setting and the Utilization of Point of Care Ultrasound: A Survey Study Across all Acute Care Specialties

Background: Point-of-care (POC) ultrasonography (US) is the concept of ultrasound brought to the patient’s bedside and performed “real-time” by the provider. The utility of POC US to facilitate the management of the acutely ill patient has been demonstrated for multiple pathologies and across multiple hospital environments. However, the level of training across all acute care specialties, including: Anesthesiology, Anesthesiology–Cardiac, Anesthesiology-Critical Care, Emergency Medicine, Emergency Medicine -Critical Care, Family Medicine, Internal Medicine, Internal Medicine- Critical Care, Pulmonary Critical Care, Pediatrics, Pediatric Emergency Medicine, Pediatric Critical Care, Surgery and Surgery Critical Care, is thought to be quite different. This is despite the fact that each of these specialties may encounter the same acute management situations. To discover some clarity on this topic we designed a survey that was distributed to all program directors of the various specialties listed above in the United States. The survey was designed to evaluate the common examination techniques utilized for common acute care situations as well as evaluate the training and utilization of POC US.

Methods: After IRB approval, a list of all program directors (PD) for the specialties listed above was created from the accreditation council for graduate medical education website (http://www.acgme.org). The survey was distributed electronically via Qualtrics (Provo, Utah) survey system. The survey consisted of 11 questions evaluating the primary bedside assessment tool used for various common acute care situations, as well as to evaluate which topics in POC US the PDs felt comfortable practicing, and which topics they felt were useful for their specialty. In addition, the topics of barriers to POC US use, certification, and documentation were also surveyed utilizing a Likert scale.

Results. Preliminary results show a large degree of variability between the primary assessment tools amongst specialties for the four common acute care situations (Table 1)(Figures Removed). In addition, the level of comfort, education, and usefulness for ones particular specialty, was also variable across various POC US topics and amongst specialties (Table 1)(Figures Removed). Interestingly most specialties demonstrated a large difference between POC US topics PD reported to have received education vs. topics that they identified to be useful for their specialty (Table 2)(Figures Removed). Majority of PD reported a lack of educational opportunities as the barrier to learn POC US (48 %) and the vast majority of PD reported that a POC US exam should be documented (95%). Finally, the majority of PD (42%) reported that departmental certification would be sufficient to perform POC US examinations. Data collection is currently ongoing.

Conclusions: Currently, there is a large variability in the way POC US is utilized in the acute care setting. Further research should evaluate methods to educate and standardize POC US training across all acute care specialties.

Poster Presentation

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Delays in the Operating Room: Analysis of Prevalence, Causes and Implications

Introduction: Delays are operating rooms can be attributable to system deficiencies. Routine delays in perioperative setting can not only negatively impact daily workflow, morale of the perioperative team and patient satisfaction but also increase costs in healthcare system. The study is to address the prevalence, causes and implications of the perioperative delays in Children’s Surgery Center at UC Davis Medical Center, specifically looking at delays in the first cases of the day and delays during the turnover process. By identifying the prevalence and causes of the delays, we aim to improve workflow, promote cost savings to healthcare system and increase patient satisfaction.

Methods: We performed a retrospective study on a total of 76 cases performed on a randomly assigned week (06/13/16 - 06/17/16) at Children’s Surgery Center. We analyzed the prevalence and causes of delays in starting first surgical cases of the day and delays in turnover process, which is defined as longer than 30 minutes from the finish of the last case.

Results: Delays for the first surgical cases were categorized into five major causes (surgery, anesthesia, patients, OR equipments, urgent cases). 66% of total first surgical cases were delayed. The most common cause (56% of delays) was related to surgical teams’ availability and surgical consent issues. Delays for turnover process were categorized into six major causes (surgery, anesthesia, patients, equipments, miscommunications, reasons undocumented). Turnover delays were commonly due to more than one factor; the two most common causes of turnover delays were related to surgical teams (34%) and miscommunication between perioperative teams (19%). A total of 1398 minutes were delayed for electively scheduled cases in one week period.

Discussion: Delays in the operating room are frequent and have a major effect on workflow, resource utilization and system efficiency. By identifying the prevalence and underlying causes of the delays, we can establish better communications between perioperative teams, provide better education to staff members and develop solutions to improve the workflow. Awareness of the frequency of delays, common causes and impacts of such delays hopefully would generate more conscious effort across perioperative teams to take appropriate steps to mitigate delays and hence, improve overall patients and parents’ satisfaction, workflow and cost savings to the healthcare system.

Poster Presentation

Presenting Author: Dr. Yu Yu Shu UC Davis Department of Anesthesiology
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Difficult airway in a patient with prior neck radiation and cervical fusion

Title: Difficult airway in a patient with prior neck radiation and cervical fusion
Primary presenting author: Wenli Ma M.D.
Faculty Mentor: Avner Gereboff M.D.
Institution: Cedars-Sinai Medical Center

Background: This case report details a 54 year old male with a history prior cervical fusion at the C3-C4 level, and a history of pharyngeal squamous cell carcinoma status post chemo and radiation therapy, going for a posterior cervical spinal fusion procedure. Physical exam exposed mallampati II, severely limited neck range-of-motion where neck and jaw are mostly fixed, poor mouth opening, and limited jaw protrusion.

Methods: This is a case report for a surgery that took place in July 2016, at Cedars-Sinai Medical Center. Results: After induction, the resident was unable to ventilate the patient. The attending physician successfully mask ventilated using two hand mask ventilation with an oral airway and the neck in a neutral position. Tidal volumes were up to 400 cc/breath with a peak pressure of 15 cmH2O. Paralysis with rocuronium was then administered. Subsequently, we were unable to ventilate with either two hand mask ventilation with an oral airway or a laryngeal mask airway (LMA). While the patient had not desaturated, the attending called for a knife for cricothyrotomy and the assistance of additional anesthesiologist, who was then able to ventilate with a size four LMA after it was repositioned. This regular LMA was used as an intubating LMA when we advanced an aintree catheter through the hole of the LMA. A fiberoptic intubation was then performed with an aintree catheter placed over the fiberoptic bronchoscope. The area under the epiglottis to the vocal cords was extremely narrow. After insertion of the aintree catheter into the trachea, a 7.5 ETT tube was passed over the device.

Conclusion: My presentation will discuss the special considerations in post-radiation and cervical fusion airways. Radiation causes necrosis and fibrosis of the airway making both mask ventilation and intubation difficult. Prior cervical fusion also makes both mask ventilation and intubation difficult because it greatly reduces the neck range-of-motion, it is therefore difficult to accomplish the sniffing position. Fiberoptic intubation is often the best airway management for these fused patients. Rocuronium is an acceptable choice of paralysis agent in difficult airways now that we have the new drug sugammadex, its fast onset can readily reverse rocuronium’s effect. However, in institutions with no available sugammadex, if one suspects a difficult airway based on the preoperative assessment, one should avoid using rocuronium due to long-lasting effects; and succinylcholine is a better choice in these situations due to its quick-on and quick-off effects.

Poster Presentation

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Difficult Airway Management for Traumatic Tracheal Injury

An 18-year-old female presented s/p MVC with seatbelt injury to the neck. Patient was awake and alert but complained of neck pain, hoarseness, and difficulty breathing. CT C-spine and chest revealed an irregularity of the right anterolateral trachea concerning for tracheal injury versus rupture, extensive retropharyngeal and paravertebral subcutaneous emphysema, and pneumomediatinum. Patient was brought to the OR on 100% non-rebreather mask with 96% O2 saturation. The surgical team prepped the patient’s neck and the difficult airway cart with fiberoptic bronchoscope (FOB) was set up prior to induction of anesthesia. General anesthesia was induced via inhalational of sevoflurane and 100% O2 with maintenance of spontaneous respiration. After induction, endotracheal intubation was performed via video laryngoscopy. No injury was visualized above the vocal cords. However, the endotracheal tube (ETT) met resistance a short distance below the vocal cords preventing further advancement. ETT cuff was inflated and positive pressure ventilation (PPV) attempted without success. FOB was then inserted through the ETT and tissue noted to be occluding the tip of the ETT. The decision was made to withdraw the ETT and resume spontaneous mask ventilation. A surgical airway was obtained via neck incision below the site of tracheal injury, followed by placement of an ETT through the incision. Capnography confirmed tracheal placement of ETT. FOB was then advanced through the oropharynx into the trachea until the surgically placed ETT was visualized. ETT was removed, FOB advanced past the point of tracheal injury, and a new ETT advanced over the FOB to secure the airway past the point of tracheal tear. Trachea was repaired around the ETT and the patient was transferred to ICU, intubated and sedated. She was extubated on postoperative day (POD) 1 and discharged on POD 3. Emergency airway management in the setting of acute airway trauma is a challenge for anesthesiologists. This scenario is infrequently encountered. Previous studies show that up to 78% of patients with tracheal or bronchial injuries are dead on arrival to the hospital1. The American Society of Anesthesiologists (ASA) modified trauma algorithm that pertains to tracheal tears is a great resource2. As recommended by the guideline, we were able to maintain spontaneous respirations during induction and securing the airway. This was important because we were unable to initially provide PPV despite placement of the ETT below the level of vocal cords. We were also able, with surgical team assistance, place the ETT below the level of the tracheal tear as recommended by the algorithm. In hindsight, on our first intubation attempt, we might have considered confirming placement of ETT past the level of the tracheal tear before attempting positive pressure ventilation. This is because there is a concern that PPV, with ETT placed above the level of the tear, could worsen subcutaneous emphysema and pneumomediatinum. This case and others such as described by Barrett3 highlight the importance of coordination with the surgical team and preparation for a variety of possible airway management scenarios by having the difficult airway cart and FOB available.

Poster Presentation

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Difficult Airway Management in an Ethically Complicated Situation

Introduction
This case report details an incident of a difficult airway in a coagulopathic patient with extensive lingual bleeding and hematoma formation who also was DNR, with discussion of subsequent airway management and ethical considerations. A difficult airway is defined as the inability of a conventionally-trained anesthesiologist to either mask ventilate, perform tracheal intubation, or both. An enormous lingual hematoma obstructing the mouth would itself present a significant airway challenge. Ablation of spontaneous respiration can create a situation where intubation and mask ventilation is impossible.

Case report
A 79 year old Tagalog speaking female with end stage renal disease on hemodialysis, atrial fibrillation, hypertension, and diabetes presented with altered mental status from uremia/metabolic disturbances after a missed dialysis run, as well as possible infection. On admission, she was noted to have edema of the lower lip and two ulcerative lesions on her oral mucosa of unclear etiology. The day after admission she was found with copious bleeding from her mouth, with a large lingual mass protruding, and in respiratory distress with desaturations into the 70s on room air. She was placed on supplemental oxygen which improved her hypoxia. Emergent intubation for airway protection was requested. Using an interpreter she consented to intubation. Her coagulopathy was reversed. The difficult airway cart was made available with cricothyrotomy equipment on standby. Then using small boluses of propofol the patient was lightly sedated without ablation of spontaneous ventilation. Using a nasal airway, the fiberoptic bronchoscope was successfully navigated into the trachea. The nasal airway was then removed and a 6.0 mm endotracheal tube was inserted in the right nares. Unfortunately fiberoptic bronchoscopy was unsuccessful and was aborted when her oxygen saturation reached 92%. The patient was transported to the operating room for further airway management and exploration of her bleeding mouth. The patient remained spontaneously ventilating and oxygen saturations remained > 91%. In the operating room, patient was mask induced with preservation of spontaneous ventilation. A third attempt at fiberoptic endotracheal intubation was successful. Subsequently a large clot was cleared from her mouth and the source of bleeding was identified as an anterior tongue ulceration thought to be a venous bleed. The area was cauterized and oversewn with hemostasis achieved.

Discussion
The difficult airway can arise suddenly and progress rapidly to respiratory failure. It requires quick decision making and also thorough preparation. These situations can also be complicated by ethical considerations such as advanced directives in medically complex patients. This case further highlights the value of establishing clear thresholds and team member roles during critical situations, such as tenuous airway management. Lastly maintaining spontaneous ventilation proved key to success for this patient. The case report demonstrates the importance of the skilled airway practitioner in management of the difficult airway.

Poster Presentation
Presenting Author: Dr. Joseph Strunk Virginia Mason Medical Center

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Dr. Eliot Fagley Virginia Mason Medical Center
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Digital Innovation: A new modality to conduct medical residency interviews and virtual hospital tours

Introduction
Interviewing for medical residency encompasses significant economic burden to both applicants and residency institutions. While the current system of in-person interviews is well-validated, technological advances allow for web-based video conference (WBVC) interviews and virtual tours as an alternative at reduced cost to applicants and programs. The Harbor-UCLA Department of Anesthesiology utilized WBVC interviews and a virtual program director’s welcome and a virtual hospital tour this year for a portion of the applicants. It was found there is similar satisfaction between applicants who chose a web based interview and the applicant group who preferred a traditional interview.

Methods
At Harbor-UCLA, WBVC interviews via Skype and FaceTime were conducted for a subset of applicants. Applicants were divided into two groups—traditional face-to-face group and those who were offered a WBVC interview. To keep the experience standardized to a certain extent, a virtual program director’s welcome (https://spark.adobe.com/video/PZKrgY1t9ui9T) and virtual hospital tour (https://spark.adobe.com/video/FrpBebUs2JCQf) was emailed to both the WBVC group and the face-to-face group. Both the virtual information and virtual tour was created utilizing a free web-based application called Adobe Spark Video.

Results
The results demonstrated equal satisfaction with the interview experience between the two groups, and the web based applicants and face-to-face applicants were equally likely to be ranked in the upper or lower half of the program’s rank order list. The WBVC had zero cancellation rate, whereas the face-to-face group a 10% cancellation rate. Two out of the ten ultimately matched as a result of WBVC interviews. All residency spots were filled.

Discussion
Medical students apply to an average of 36 programs, producing an ERAS application cost of $695 per applicant. Based on a survey of medical students, cost of interviewing/travel is averaged at $3,422 per student. With over 35,000 applicants interviewing, the total student financial burden is approximately $125 million. Furthermore, the residency program’s cost is significant. Estimated recruitment cost per resident is $14,000. This total program cost is comprised of opportunity cost, administrative cost, entertainment cost, etc. The total recruitment cost of all programs nationally amounts to $430 million. Based on existing models, this approach has potential to save the department up to $90,000 while collectively saving applicants between $17,000 to $39,000. This model can also be applied to fellowship interviews so residents do not have to sacrifice training time for interview travel.

References

Poster Presentation
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Does a Perioperative Surgical Home for Spine Patients Improve Clinical Outcomes?

Background: There are approximately 30 million major inpatient surgeries annually. The cost of inpatient surgery has increased over the last decade; the average hospitalization for surgery was $13,000 in 2000 and increased to $18,000 in 2010. Policy-makers and hospital administrators have sought to implement interventions that contain and/or lower the costs associated with hospitalizations. The concept of perioperative surgical home (PSH) is becoming increasingly popular. PSH is defined as “an innovative, patient-centered, surgical continuity of care model that incorporates shared decision making.” In the PSH model, anesthesiologists are positioned to coordinate a comprehensive perioperative analgesic plan that begins with the preoperative assessment and continues through discharge. This study will examine the clinical outcomes associated with implementation of a PSH among spine patients at a tertiary hospital. Methods: The perioperative surgical home was implemented by the Department of Anesthesiology and included preoperative, intraoperative, and postoperative care by Anesthesiology team. The care included perioperative risks assessment, pain and PONV management, and other aspects of perioperative care which could be used as a simple tool for reducing the incidences of postoperative complications and shortening hospitalization. The PSH was implemented at Cedars-Sinai Medical Center (CSMC) from 2014 to 2016 among patients undergoing a variety of spine cases including fusions, laminectomies, and decompressions. A control group from CSMC with similar procedures and surgical staff was also included in the study. There were 651 PSH patients included in the analyses; 651 control patients were selected based on gender and date of admission. The sample was 51% female, 85% white, the average age of the sample was 58.4 (SD = 14.7), and 66% of the sample was ASA class I or II; there were no differences between PSH and control patients in regards to age, gender, or ASA class (p > .05). The primary outcomes that will be examined are length of stay, admission to the intensive care unit following surgery, and readmission to the hospital within 30 days. Secondary outcomes include postoperative urinary tract infection, postoperative pneumonia, prolonged mechanical ventilation, unplanned postoperative intubation. Results: There were no differences in length of stay following surgery between the PSH and the control patients (Mean = 3.8 days, SD = 3.2; Mean = 3.9, SD = 5.0; p = .771, respectively). There were also no differences in ICU admission following surgery between the PSH and control group (5.7% among PSH, 7.2% among control group, p = .259). The PSH group had fewer ICU readmission in 30 days as compared to the control group (1.5% in PSH, 3.4 in control group, p = .032). Conclusions: This study did not find differences in length of stay or ICU admission after surgery, however, there was a lower rate of ICU readmission among the PSH patients as compared to the control patients. Implications for the PSH will be discussed.

Oral Presentation

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Does the addition of dexamethasone prolong the effectiveness of regional blocks and improve patient satisfaction in children with special needs undergoing lower extremity orthopedic surgery?

Background: Parental and patient feedback has brought attention to the anxiety and pain pediatric patients experience while undergoing orthopedic surgery. This is particularly important to families and children with chronic musculoskeletal conditions and special needs who require multiple procedures. We wanted a way to safely provide effective pain management in order to improve the experience our patients and their parents encounter. Regional blocks are usually limited by the duration of the local anesthetic. Dexamethasone has been shown to potentiate the duration of blocks in the adult population but has not been reported in the pediatric population. We hypothesize that the addition of dexamethasone can provide safe and effective pain relief overnight with the benefit of decreasing hospital expenses with high patient satisfaction.

Methods: Utilizing an IRB-approved protocol, ultrasound-guided lower extremity single shot blocks were performed after the induction of general anesthesia. In the control group, the block solution consisted of 0.25% bupivacaine (2.5-4.0 mg/kg). In the experimental group, 0.25% bupivacaine (2.5-4.0 mg/kg) plus dexamethasone 2-8 mg was added. The control group is established from a retrospective chart review over a 6 month period of 17 patients who received lower extremity blocks. In the experimental group, 43 children with diverse chronic musculoskeletal conditions and/or special needs undergoing lower extremity orthopedic procedures received lower extremity peripheral nerve blocks with intraneural dexamethasone. They included cerebral palsy (16), spina bifida (9), osteogenesis imperfecta (3), and developmental delay (28). Some with chronic musculoskeletal condition may also have developmental delay. Patients underwent soft tissue, bony, or combination of procedures. The experimental group was asked to complete a blinded survey outlining the patient’s satisfaction with pain control and anxiety over future procedures as well as time to first pain medication.

Results: Of the 43 patients, 21 were female and 22 were male with average of 11.5 years old and average weight of 39.3 kg. Of the 43 surgeries, 9 soft tissue, 19 bony, and 15 combination procedures. 34 out of 43 were discharged from the recovery room while 9 were admitted inpatient. There were no readmissions for pain management or surgical complications. At post-op visit, no complications from nerve block was seen. In the control group, the block lasted an average of 11.4 hours to the first pain medications versus average of 29.9 hours in the experimental group. Patient satisfaction with post-op pain relief was rated at 3.6/4.0 and anxiety over future visit was 1.2/5. Parental satisfaction with overall experience was rated at 3.6/4.0 and anxiety over future visit was 0.8/5.

Conclusions: The addition of dexamethasone ($0.71/4mg vial) to lower extremity peripheral nerve blocks provided a safe, extended and cost-effective pain management with high patient/family satisfaction. This allowed the majority of cases to be done on an outpatient basis, minimizing family disruption which is especially important for families of patients who need multiple surgeries.
Oral Presentation

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Effect of Intraoperative Fluid Replacement on Postoperative Outcomes in Adults Undergoing Elective Non-Cardiac Surgery

Introduction: Intraoperative fluid management is a subject of contention within the field of anesthesiology. If inappropriate, it can lead to increased morbidity and/or mortality. There are numerous proposed fluid management models in the literature1, as well as provider preference influencing intraoperative fluids management.

To better elucidate the effect of intraoperative fluids, this study examined the association between intraoperative fluids with post-operative complications at LAC+USC medical center.

Methods: A retrospective chart review of 599 patients over 18 years of age who had elective non-cardiac surgery during January 1, 2011-March 15, 2016 at LAC+USC medical center was completed. Of those 599 patients, 300 had intra-abdominal surgeries and 299 had extra-abdominal surgeries. The following variables were recorded for each patient within each group: anesthesia type, type of fluids, anesthesia duration, amount of fluids infused, estimated blood loss, urine output, intraoperative vasopressor/inotrope Use, preoperative Hb/Hct and Albumin, pre/intra/postoperative vital signs, mortality. Stepwise logistic regression with backward elimination was performed to investigate the associations between these variables and postoperative complications.

Results: We found that intra-abdominal surgeries were 2.472 times more likely to experience postoperative complications than extra-abdominal surgeries (p<0.001). Also, patients who were infused with >2 liters of fluids were 1.003 times more likely to experience postoperative complications than those receiving <=2 liters (p=0.005) independent of surgery type (intra-abdominal vs extra-abdominal). The most common complication in both intra-abdominal and extra-abdominal surgery were post-operative nausea and vomiting.

Conclusion: The data demonstrates patients receiving greater than 2 liters of intraoperative fluids have a greater likelihood of experiencing postoperative complications after adjusting for intra- or extra-abdominal surgery.


Poster Presentation

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Emergent Cesarean Section under General Anesthesia in Parturient with Abnormal Lumbosacral Neuroanatomy

Background: Cesarean delivery in the United States has reached an all-time high with nearly 32% of all deliveries that take place.(1) In contrast to most other intraperitoneal procedures, neuraxial anesthesia rather than general anesthesia is considered more ideal.(2) Physiologic changes of pregnancy may increase the risk of failed airway securement and aspiration with general anesthesia, while neuraxial anesthesia offers immediate mother-neonate bonding, decreased blood loss, and improved post-operative pain control.(3, 4) In parturients with known abnormal lumbosacral neuroanatomy, however, administering neuraxial anesthesia may pose unique challenges for anesthesiologists, and potentially, risks for patients. Case Description. A 29-year-old G1P0 female with a history significant for sacrococcygeal teratoma repaired as an infant, along with an extensive abdominal surgical history, was admitted at 34-weeks-gestation with hydronephrosis following percutaneous nephrostomy tube placement. Anesthesia was consulted to discuss the possibility of regional anesthesia for labor. Given her history of lumbosacral spine surgery, the patient was advised to undergo imaging to assess for abnormal neuroanatomy and evaluation by neurosurgery to assure minimal risk of a neuraxial procedure. Unfortunately, the patient declined this recommendation. Alternative anesthetic options for labor were discussed including: nitrous oxide analgesia, intravenous narcotics, and if required, general anesthesia. The patient was discharged following improvement of her condition.

The patient presented again at 37-weeks-gestation in labor. Her labor progressed, and after two hours of pushing, the decision was made to proceed with vacuum assisted vaginal delivery. After three unsuccessful attempts, fetal heart rate monitoring began to demonstrate significant fetal distress, so the patient was taken emergently for Cesarean section. Once in the operating room, the patient was moved to the table, standard monitors were applied, and general anesthesia was induced by rapid sequence. The patient was easily intubated using video laryngoscopy without complications. Surgical incision immediately followed airway securement, and entry to the peritoneum demonstrated evidence of dense adhesion formation between the small bowel and both the uterus and retroperitoneum. The neonate was delivered shortly thereafter without issue. The abdominal entry was complicated by small bowel serosal injuries prompting intraoperative emergent general surgery consult and post-partum hemorrhage of two liters requiring transfusion of packed red blood cells and fresh frozen plasma. Following completion of the surgery, the patient was extubated without issue and transferred to the PACU in stable condition.

Discussion. Management of labor analgesia in patients with known abnormal lumbosacral neuroanatomy is not a well-defined topic within anesthesia practice. Neuraxial anesthesia in these patients may be technically challenging because of their abnormal anatomy, increasing the risk of failed attempts, vascular trauma, and even permanent neurological injury (5). Antepartum assessment with spinal imaging and neurosurgical consultation may provide valuable information that will allow minimization of injury and maximally successful analgesia. It is paramount that all anesthesia options for delivery are discussed, including general anesthesia, as was required in this case. If rapid cesarean delivery is required, potential risks associated with surgical entry and general anesthesia need to be anticipated with a goal of improving outcomes for the patient.
Poster Presentation

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Emergent Intubation for Cervical Hematoma following Completion of Carotid Artery Stenting

Introduction
Carotid artery stenting (CAS) is an endovascular procedure for symptomatic or high-grade stenosis in high-risk patients, and is generally safe. We describe a man with a rapidly expanding neck hematoma after CAS - an exceedingly rare complication documented in only two case series of 4 in 1,000 cases and 1 in 132 cases. This emergency requires securement of the airway, perioperative management of a high-risk patient, and is typically seen with open carotid surgery.

Case Description
An 81 year old man with non-ischemic cardiomyopathy (EF 19%), hypertension and moderate COPD experienced amaurosis fugax. 70-80% ipsilateral left carotid artery stenosis was identified, and he underwent CAS under monitored anesthesia care. The patient tolerated the procedure well with no contrast blushing, stable cerebral oximetry, and controlled blood pressure. Prior to leaving the operating room, the patient – with clear voice – noted new onset of moderate nasal and facial pain on the procedural side. Underneath a warming blanket on the patient's left neck was a new, roughly 5x5x3 cm firm mass. The vascular surgery attending and nursing team were immediately called back. The patient’s voice became hoarse and he complained of dysphonia without neurological deficits. By the time the attending surgeon arrived, the patient would not speak due to pain, and his thyroid cartilage deviated rightwards with hematoma expansion. The Anesthesia team discussed the need for intubation and exploration as the Vascular team considered stat CTA. General anesthesia was induced; direct laryngoscopy showed marked laryngeal swelling with rightward displacement. The airway was secured with 6.0 mm endotracheal tube. During open surgical exploration, dexamethasone was administered, epinephrine infusion was required to support the LV, and despite evacuation of 100cc of blood, no perforation was identified. The patient was left intubated, transferred to the intensive care unit, extubated POD#4, and discharged home POD#7.

In debriefing with the Vascular team, possible contributing factors included pre-operative loading dose of clopidogrel, no intravenous protamine reversal, and challenging anatomy (type III aortic arch with L common carotid artery originating from the innominate artery) prompting utilization of a “caterpillar” technique – sheath-over-dilator-over-straight wire (as opposed to coiled tip), requiring deep seating of the wire into the ECA.

Discussion
Despite a successful MAC with tight blood pressure control, this patient experienced the very rarely reported complication of rapidly expanding neck hematoma in the setting of CAS. Only 5 cases have been described in the literature. Vigilance and rapid action rescued the airway prior to obstruction, and preparation for a back-up GA allowed for immediate emergency anesthetic management. Retrospective debrief with OR team identified potential risk factors and systems issues for future patients. Prospective advice for the ICU allowed for a smooth transition of care while anticipating airway and hemodynamic management in a high-risk patient.

References
Poster Presentation

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Emergent lumbar drain placement resulting in reversal of paraplegia after total aortic arch replacement and stent grafting of descending thoracic aorta

Introduction
Open surgery on the aortic arch and thoracic aorta is complex and carries high morbidity and mortality. Indications for open surgery on the thoracic aorta include type A dissection, bicuspid aortic valve and specific ascending aortic diameter/expansion criteria. Integral to these procedures are surgical and anesthetic techniques that minimize ischemia to sensitive CNS tissues. Placement of a lumbar drain can be used preemptively or as a rescue measure in patients that develop cord ischemia. Various studies have demonstrated that lumbar drains can minimize paraplegia. Few authors have demonstrated examples of emergent lumbar drain placement as a rescue measure that reversed paraplegia. Case
This patient is a 52 year old male with a bicuspid aortic valve and 4.9cm aortic arch presenting for total arch replacement. After induction, arterial line, central line and swan ganz catheter were placed. After sternotomy and cannulation the patient went on cardiopulmonary bypass (CPB). He was cooled to 20 C and antegrade cerebral cannulas were placed bilaterally. Intraoperative findings indicated a stent to the descending aorta was necessary. A 3.5x10cm stent graft was deployed in descending thoracic aorta under circulatory arrest. The total circulatory arrest time was 35 minutes and CPB time was 240 min. At the end of the case patient was found to have good biventricular function and transported to ICU. Upon extubation 6 hours after arrival, patient was following commands but unable to move bilateral lower extremities. Emergent lumbar drain was placed at L2-3. Systolic goals were increased to 140-160 and patient was given mannitol. Three hours after lumbar drain placement and drainage ~15cc/hr he was able to flex at the knee bilaterally. After an additional 3 hours he was able to lift lower extremities. Spinal drain was removed on post operative day 3. Remainder of hospital course was uncomplicated. On followup patient denies neurologic deficit.
Discussion
One major complication of aortic surgery is ischemia resulting in paraplegia secondary to compromised distal perfusion pressure, hypoperfusion and thrombosis of segmental arteries. The distal cord near the level of T8-L1, supplied by the artery of adamkiewicz, is susceptible during cross clamping. The rate of paraplegia following this procedure ranges 8-30%. Techniques for preventing ischemia include reducing spinal cord metabolism, increasing distal aortic pressure, or controlling neuraxial outflow pressure via lumbar drain. The risks of lumbar drain placement are nerve injury, hematoma, intracranial hemorrhage and infection. Intracranial hypotension occurs due to excessive drainage &gt;15 ml/hour. Post operative draining should be limited to 48-72 hours to avoid infection. A major randomized study on use of lumbar drain showed 80% reduction of paraplegia in those that received preoperative CSF drain vs those that did not. There is growing evidence for the placement of lumbar drain for spinal cord protection in aortic repair in patients at high risk for ischemic spinal cord. Case studies of prompt post-op placement of lumbar drain with newly developing deficits have shown that this technique can be used to rapidly reverse them.

Poster Presentation
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Endoscopic Evidence of Significant Residual Gastric Content after Prolonged NPO and Despite Gastric Suctioning in a Pediatric Patient with Small Bowel Transplant

BACKGROUND

Microvillus inclusion disease (MVID) is a rare congenital intestinal epithelial cell disorder resulting in intestinal failure. Early small bowel and liver transplantation is the only effective treatment option. Impaired motility is common after bowel transplant, which might present with nausea, vomiting and consecutive aspiration. This, combined with heavy immunosuppression may lead to severe complication of aspiration pneumonia. A high index of suspicion for full stomach should be maintained, even if a patient meets standard fasting guidelines.

CASE DESCRIPTION

The patient was a 4-year old, 13.7 kg male, with past medical history of MVID status post small bowel and liver transplant, splenectomy, hypertension, chronic immunosuppression, and global developmental delay, who presented to emergency department with a 1-day history of persistent emesis. After admission, abdominal x-ray demonstrated a paucity of small bowel gas with no evidence of bowel obstruction. He did have positive viral swab for influenza A and was treated with oseltamivir. The emesis was unresolved in spite of cessation of enteral feeding for 2 days, therefore patient was brought to the operating room (OR) to have peripherally inserted central catheter (PICC) placement for total parenteral nutrition (TPN) and fluid administration. Before induction of general anesthesia, approximately 500ml of dark green liquid was suctioned via the nasogastric tube, in supine, right and left lateral decubitus positions. Modified rapid sequence induction (RSI) was performed with the patient in right lateral decubitus position, followed by uneventful tracheal intubation. Two days later, the patient underwent esophagogastrroduodenoscopy (EGD) for surveillance. 300ml similar liquid was suctioned out before induction. However, the stomach was found full during EGD, and another 200ml was suctioned by endoscope.

DISCUSSION

MVID is an extremely rare genetic disorder, caused by defective intestinal brush border. Early small bowel transplantation is the treatment of choice. Altered intestinal motility is common in transplant recipients, which presents as either hypomotility with persistent nausea and vomiting, or hypermotility with refractory diarrhea. Uncontrolled vomiting imposes significant challenges in airway management. Gastric suctioning via nasogastric or orogastric tube is used to further empty the stomach. In this case we demonstrate that even thorough suctioning in supine, right and left lateral decubitus positions may not guarantee a completely empty stomach. Modified RSI was performed with the patient in right lateral decubitus position. This technique has also been reported by other authors as controlled RSI, during which stable hemodynamics were maintained with minimal patient stress. Induction in lateral position was successfully used by other anesthesiologists for patients at risk of aspiration. The overall risk of aspiration and associated complications has been estimated to be three times more common in children than adults. Appropriate strategies to minimize aspiration should be planned during anesthesia care in high risk pediatric patients.
Poster Presentation

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Epidural Anesthesia in a Parturient with history of Henoch-Schonlein Purpura

Henoch-Schonlein purpura (HSP) is a systemic immunoglobulin A vasculitis that is relatively common in the pediatric population. HSP usually follows an upper respiratory tract infection and causes the “classic triad” of palpable purpura, arthritis, and abdominal pain. Additionally 40-50% of affected patients develop renal disease. However, prognosis is typically favorable with less than 2% of patients suffering long term morbidity. HSP is far less frequently described in adults. In fact, greater than 90% of HSP cases occur in children under ten years of age. Its description in pregnancy is very rare. Under 25 cases have been reported. Of most concern, catastrophic hemorrhages have been described in the pediatric literature and HSP can be associated with Factor XIII deficiency. We present the case of an uncomplicated epidural placement and delivery in a 27-year-old pregnant female with a diagnosis of Henoch-Schonlein purpura but no active symptoms.

Poster Presentation

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Epinephrine as a treatment for hyperkalemia resistant to conventional therapies in the setting of hemorrhage

Introduction: Hyperkalemia is not an uncommon occurrence in complicated anesthetic cases that involve multiple units of blood transfusion. Calcium, insulin and glucose and furosemide have been considered the mainstay of treatment for this condition. This case demonstrates an effective alternative therapy to rapidly lower potassium and support hemodynamics simultaneously.

Case Report: A 29 year old male with a history of testicular cancer and extensive retroperitoneal metastasis status post 4 cycles of bleomycin and radiation presented for radical left nephrectomy and dissection of retroperitoneal lymph nodes and masses via thoracoabdominal incision. Anesthetic considerations included low FiO2, careful titration of IV fluids and maintenance of normal hemodynamics. Induction was uneventful and general anesthesia was maintained with sevoflurane, cis-atricurium and fentanyl. Hemodynamics were initially maintained with lactated ringers. In the fifth hour of surgery, prior to blood transfusion, the patient developed hyperkalemia (6.5 mmol/L) and metabolic acidosis. He subsequently experienced rapid blood loss, with hemoglobin decreasing from 14mg/dl to 7mg/dl, hypotension and anuria. He was resuscitated with 2L of normal saline and several boluses of phenylephrine. Initial treatment of hyperkalemia included insulin, dextrose, 40mg furosemide and 2 ampules of bicarbonate. However, the EKG monitors continued to show peaked T waves and potassium levels remained elevated, limiting resuscitation with blood products. Furthermore, urine output was low and unresponsive to fluid boluses or furosemide. A major transfusion concern in this hyperkalemic patient was further increases in potassium potentially resulting in cardiac arrest. It was decided to treat the patient with seven intermittent doses of epinephrine (25mcg). Within 35 minutes the potassium level dropped to 3.5 mmol/L. Additionally, EKG changes resolved and blood pressure stabilized. The patient was subsequently transfused 4 units of PRBCs further improving blood pressure and increasing urine output. Post transfusion potassium levels showed 4.5 mmol/L. The total operative time was 11 hours. Patient was successful extubated in the operating room without negative sequelae. Total blood loss was 2.5 L and total urine output was 3L. Discussion: In cases of hyperkalemia resistant to conventional therapy, epinephrine is effective in shifting potassium intracellularly. Massive blood transfusion can cause hyperkalemia. In this case, small doses of epinephrine served a dual purpose: to support unstable hemodynamics and minimize the risk of cardiac arrest from hyperkalemia.

Poster Presentation

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Evaluating the effectiveness of a self-guided online course for Crisis Resource Management (CRM) knowledge and skills

Introduction:

CRM knowledge and skills are an important part of anesthesiology training and are specifically identified as competency milestones by the American Board of Anesthesiology and Anesthesiology Residency Review committee. In most institutions the primary method of teaching CRM skills and behavior is through didactics and simulation-based training. Unfortunately, simulation-based training is time and resource intensive. An effective on-line training module covering CRM principles might allow a reduction in the amount of time spent in the simulation center on formal didactic training of CRM skills and knowledge, and increase the amount of time spent on actual simulation exercises. The purpose of this study is to test the hypothesis that a one-hour self-guided online crisis resource management (CRM) course is as effective at improving trainee CRM knowledge and skills as a one-hour lecture session taught by a faculty instructor.

Methods:

All consented participants will receive a 30-question CRM knowledge pre-test and take part in a standardized 10 minute simulated crisis scenario. Feedback will not be given during this initial session. Video recordings of each participant’s performance during the simulated crisis will be scored by trained raters using a standardized crisis resource management non-technical skills rating tool. Following the pre-test and simulation assessment, participants will be randomly placed into one of two groups: experimental and control. The experimental group will be given one hour to complete the online CRM training module. The control group will receive a standardized one-hour didactic session on CRM. We will use the same simulation faculty member for each didactic session; the lecturer will not be involved in rating the participants. After the one hour CRM training is complete, all participants will then retake the same knowledge test administered as a pre-test, and undergo another standardized simulation. A video-recording of the simulation will be scored by trained faculty raters using the same CRM assessment tool as in the pretest. Raters will be blinded to participant group. The scores from both groups will be evaluated to compare any performance improvements from the pre-test to the post-test. The content of the lecture was developed by the authors in conjunction with SIM faculty experts at 5 other academic institutions. A review of the SIM literature, CRM training courses, and CRM assessments was used to determine the content covered in the lecture.

Results, Conclusions, Discussion: Pending. The education materials (lecture series and modules) are almost complete. IRB approval was obtained and we are awaiting the new cycle of resident trainees to recruit participants.

Poster Presentation

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Evaluating the Hemodynamic Effects of Acute Methamphetamine Use during General Anesthesia, a Retrospective Cohort Study

Background: The clinical effects of chronic amphetamine use in patients undergoing general anesthesia have been evaluated in various case studies dating back more than 40 years. However, most of these studies involved prescription stimulants for narcolepsy, ADHD, and depression with only scant case reports regarding illicit IV methamphetamine use. The goal of this retrospective cohort study was to evaluate the hemodynamic effects and vasopressor requirements within the first hour of general anesthesia in patients testing positive for methamphetamine use.

Methods: After obtaining IRB approval, medical records from Jan 1, 2014 to Dec 31, 2015 were examined and patients testing positive for methamphetamine within 10 days of surgery were identified and placed into an acute (positive within 48 hours of surgery) vs subacute group (positive within 10 days but negative prior to surgery). Exclusion criteria included age ≥ 65 years old, age ≤ 15 years old, polytraumas, ICU patients, and patients with medical history including HTN, IDDM, ESRD, CVAs, CAD, CHF, and ASA III-V patients if they would remain ASA III without the methamphetamine use. A control group was created using patients of statistically similar age, sex, ASA status, and surgical category.

Hemodynamic instability, defined in our study as a MAP drop > 40% for at least five minutes or requiring phenylephrine > 300 µg or ephedrine > 15 mg or any amount of epinephrine or vasopressin within the first hour of anesthesia. Chi-square analysis was conducted to identify the proportions of Hemodynamic instability among the three groups. P-value < 0.05 was considered to be statistically significant.

Results: Among the 363 patients included in the final analysis, 139 (38.3%) were found to be methamphetamine acutely positive, 74 (20.4%) were methamphetamine subacutely positive, compared to 150 (41.3%) control patients. Almost half (62 or 44.6%) of methamphetamine acutely positive patients were found to meet the hemodynamic instability criteria compared to 9 (6%) of control patients and 21 (28.4%) for methamphetamine subacutely positive (p < 0.001). Furthermore, acutely positive patients had higher phenylephrine requirements; the acutely positive, subacutely positive, and control groups required 357.6, 292.2, and 58.7 µg phenylephrine on average. Conclusions: Patients undergoing general anesthesia who tested positive for methamphetamine within 10 days of surgery were found to experience hypotension during the first hour of general anesthesia more frequently and severely than a negative control group. Furthermore, methamphetamine users experienced higher phenylephrine requirements than the control group, particularly if they were positive within 48 hours of surgery compared to positive within 10 days of surgery. Awareness of the increased incidence of intraoperative hypotension is beneficial to anesthesiologists and allows for adequate preparation of the frequent hypotension. Further studies evaluating the effects of methamphetamine on postoperative outcomes including acute kidney injury, cardiac ischemia, ICU admissions, and length of stay are recommended.

Oral Presentation
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Evaluation of an Online Training Website for Perioperative Point of Care Ultrasound:
www.foresightultrasound.com

Background: Point-of-care (POC) ultrasonography (US) is defined as portable ultrasonography brought to the patient that is performed and interpreted “real-time” by the provider. Recently, POCUS for the perioperative setting has demonstrated a high degree of utility for the acute assessment of: cardiovascular, airway, pulmonary, gastric, abdominal, and neurologic pathology. [1, 2] This rapid growth of this emerging bedside examination tool has lead to “a call to action” for incorporation of perioperative POCUS education and training for current and future trainees. [3] In 2015, successful implementation of comprehensive perioperative POCUS curriculum, abbreviated FORESIGHT (Focused periOperative Risk Evaluation Sonography Involving Gastro-abdominal, Hemodynamic, and Trans-thoracic ultrasound) was demonstrated at a single academic center. [2] Since that time the developer of the curriculum has transitioned the learning modules to an online platform, www.foresightultrasound.com. This project highlights the implementation of this e-learning platform at another academic center (Loma Linda University Medical Center) with hopes of future implementation of this system across multiple academic programs.

Methods: A task-force was developed to transition the education lectures and evaluation tools used for the original FORESIGHT curriculum to an online platform. The mission statement for this initiative was to develop the material to be completely open access, be available under a Creative Commons license [4], and distribute all education materials for free. Once developed all previously validated model/simulation focused lectures and resident evaluation tools (Kirkpatrick Level 1 and 2) were performed utilizing the website. Evaluation of the website and its content was performed by weekly resident evaluations during the hands-on training sessions for each of the FORESIGHT curriculum topics using a 5 point Likert scale. In addition, website functionally benchmarks were also captured. Finally, evaluation of the online testing system and resident performance database was also evaluated.

Results: The online site has been implemented for a period of 9 months for a total of 45 residents. All requested residents were able to perform satisfaction surveys (Kirkpatrick Level 1) and content assessment tests (Kirkpatrick Level 2) without difficulty. The site exhibited no events of downtime or data loss. Aggregate data of the resident evaluations of the website demonstrated: a score of 4.8/5 on effectiveness of the presentation, 5/5 on content relevance, and 4.8/5 quality of learning material. Conclusion: This project demonstrates one effective avenue to provide perioperative POCUS education. It is the hope of the authors of this project that this site may serve as a resource to facilitate collaboration across many academic anesthesiology programs, with the ultimate mission of incorporating POCUS training as a core competency of anesthesiology training.

Poster Presentation

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Evaluation of Clinical Impact of Non-Invasive Hemodynamic Monitoring to Optimize Preventative Care of Heart Failure Patients

Background: Nearly five million Americans experience heart failure (HF) with greater than 250,000 dying annually. The prevalence has continued to increase with HF now being the leading cause of hospitalization among adults ≥65 in the United States. Despite remarkable improvements in medical therapy, the prognosis of patients with HF remains poor. This project seeks to assess if the use of non-invasive hemodynamic (HD) monitoring technologies (ClearSight/Nexfin, Edwards Lifesciences, Irvine CA), which are currently used in the perioperative and critical care settings, can provide additional patient benefit when used longitudinally for outpatient management. This HD monitor provides information on cardiac output, stroke volume, dp/dt, mean arterial pressure and systemic vascular resistance.

The aim of this multi-phase study is to assess if using this HD monitor longitudinally to patients with NYHA classification 3 or greater during their HF clinic visits will result in less patient hospitalizations and complications. Currently, this study is in its first phase designed to evaluate patient and provider satisfaction with the use of the HD monitor as well as begin evaluating associations of the HD parameters to the patients’ electronic medical record (EMR) data.

Methods: After IRB approval and collaborative agreement with the heart failure group, patients with classification of NYHA classification 3 or greater were approached to be involved in the study. Patients were consented and had the HD device placed for 2 minutes. The patient was then surveyed regarding level of discomfort during data capture. Averaged data was then displayed to the HF expert who were subsequently surveyed regarding the utility of the device and its data. The patients’ EMR were also reviewed to evaluate for overall improvement or decline in the patients’ cardiovascular status. All HD data was recorded (values captured every second) for analytics and patient EMR comparisons.

Results: To date, 42 patients have been enrolled. Recent results suggest that none of the participants had discomfort while wearing the device. Provider surveys indicate a high level of interest in the device data and its correlation to the patients’ clinical picture (Table 1). Comparisons of patients (n=9) who reported to have worsened in cardiovascular status since last clinic visit demonstrated a statistically significant reduction in dp/dt values vs. those who reported stability or an improvement (n=33), p = 0.03. Similarly for patients (n=5) who have been evaluated for multiple clinic visits, alterations of HD data correlated to alterations in the patients cardiovascular status captured in the EMR, R=0.73.

Conclusions: Use of flow guided cardiovascular function technologies have not been evaluated for its potential impact on outpatient management of patients with HF. This study highlights the promising first phase of a project seeking to evaluate the impact of implementing these technologies for the outpatient management of heart failure patients.
Oral Presentation

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Evaluation of Pre-operative Non-Invasive Hemodynamic Monitoring for Patients Undergoing Moderate to High Risk Surgery

Background: Physicians have relied on “static” vital signs (heart rate, blood pressure, etc.) to evaluate patients despite knowing that adequate assessment of oxygen delivery depends on both the perfusion pressure (blood pressure) and flow (cardiac output). Numerous studies have proven that the “vital” signs of heart rate and blood pressure do a very poor job of identifying patients’ cardiac function. Currently, consultant diagnostic studies are frequently obtained to provide this information, despite not always being available in urgent settings. Recently, new technology (ClearSight/Nexfin) has been developed and validated to provide cardiac output non-invasively, along with other flow-guided parameters (stroke volume, dp/dt, systemic vascular resistance, and stroke volume variation). This multi-phase study seeks to assess if use of this technology can facilitate preoperative assessment with an ultimate target of helping risk-stratify patients undergoing emergent/urgent procedures.

Methods: The current phase of the study is designed to evaluate the utility of the HD device in identifying patients with cardiovascular dysfunction. After IRB approval, patients seen in the preoperative clinic (either by an anesthesiology resident or a nurse practitioner) who were scheduled to undergo major surgery (defined as surgical time greater than two hours and having the potential of ≥ 20% shifts in blood volume) were consented. After consent the patient had the HD device placed for 2 minutes for data capture and then they were surveyed regarding the level of discomfort during the study (Likert scale). The perioperative provider then performed the clinic visit and reviewed the patients medical record. The provider was then asked to quantify the patient’s cardiac dysfunction status as normal, mild, moderate, or severe. Results from the HD monitor were compared between the patients who were scored as normal/mild vs. moderate/severe. Comparisons of these multiple variables between groups were performed with one-way ANOVA with series of Scheffe’s. A p-value of < 0.05 was significant.

Results: Currently, 57 patients have been enrolled for the first phase of this project. Current results suggest that no subjects experienced discomfort while wearing the device during data capture. A total of 42 patients were identified by the preoperative provider as having normal or mild cardiac dysfunction and 15 patients were identified as having moderate to severe cardiac dysfunction. Comparisons of HD data showed that the normal/mild group had statistically significant: 1) higher average values of cardiac index (2.8 ± 0.86, 2.4 ± 0.76, p=0.003), stroke volume index (34.2 ± 7.5 vs. 32.3 ± 9.2, p=0.02), and lower average values for systemic vascular resistance index (2935 ± 859 vs. 3503 ± 847, p=0.02).

Conclusions: Preliminary data from this ongoing study demonstrated an association between HD data derived from a non-invasive device to a patient’s degree of cardiac dysfunction, as determined during their perioperative assessment. Continuing efforts on this project will ultimately evaluate the utility of this device to risk stratify patients undergoing urgent surgery.

Poster Presentation
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Exchanging a King Laryngeal Tube for an Endotracheal Tube Using a Fiberoptic Bronchoscope-Aintree Catheter Combination in a Known Difficult Airway

Purpose: To present the first case where a King Laryngeal Tube (LT) was exchanged for an endotracheal tube (ETT) using a fiberoptic bronchoscope-Aintree intubating catheter (FOB-AIC) combination in a patient with a proven difficult airway. Clinical features: A 24-yr-old male was admitted to trauma service with multiple facial injuries including extensive oral and perioral edema. A King LT was placed in the field after difficulty with tracheal intubation. Anesthesiology service was consulted for definitive airway management. After advancing an FOB through the ventilation port of the King LT for evaluation of the tracheobronchial tree, the decision was made to exchange the King LT for an ETT utilizing a FOB-AIC combination. The FOB-AIC combination was advanced through a bronchoscopy elbow allowing maintenance of positive pressure ventilation (PPV) on FiO2 1.0 throughout the airway exchange.

Conclusion: The King LT is a supraglottic airway often employed as an airway management alternative for patients in which endotracheal intubation is difficult. It is important for providers to have a safe and effective method for exchanging a King LT for an ETT in these patients. Currently there is no consensus on the preferred method to accomplish this exchange. Our case demonstrates that the FOB-AIC exchange can be done safely and effectively in an unstable trauma patient. In addition, and opposed to other methods of King LT exchange, the FOB-AIC technique offers the advantages of maneuverability when loaded onto a FOB, minimal ID-OD discrepancy, and the ability to fit through a bronchoscopy elbow and thus maintain PPV.

Poster Presentation

Presenting Author: Dr. Jessica Hollingsworth UCSD

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Eye tracking technology differentiates novice and expert image interpretation for ultrasound-guided regional anesthesia.

Eye tracking technology differentiates novice and expert image interpretation for ultrasound-guided regional anesthesia. Borg L, Harrison TK, Kou A, Mariano ER, Udani AD, Kim TE, Shum C, Howard SK. Department of Anesthesiology, Perioperative and Pain Medicine, Stanford University School of Medicine; Anesthesiology and Perioperative Care Service, Veterans Affairs Palo Alto Health Care System; Department of Anesthesiology, Duke University

Introduction Historically, educational research has relied on test-retest and self-assessment methods to infer learning. Similarly, training programs use subjective evaluations from instructors to determine trainees’ milestone achievement and competence. Objective measures of learning are needed to guide the individual learner’s pathway from novice to expert. Eye tracking has been used in surgery, radiology, nursing, and athletics for both training and assessment. Based on a recent feasibility study in the field of ultrasound-guided regional anesthesia (UGRA), we designed this study to test the hypothesis that eye tracking may differentiate novices from experts in image interpretation for UGRA.

Materials and Methods With IRB and VA research committee approval, we recruited 6 first-year anesthesiology residents and 6 experts in regional anesthesiology to participate. Novices completed a survey describing their previous experience with ultrasound-guided techniques. Participants were seated in front of a 50-inch screen and fitted with eye tracking glasses (Tobii, Karlsrovägen, Sweden). Glasses were calibrated to each individual participant. Room lighting and set-up were the same for each participant. A slideshow of 5 UGRA sonograms were serially projected onto the screen. Participants were asked a series of standardized anatomy-based questions related to each image while their eye movements were recorded. The answer to each question was a location on the ultrasound image defined as the “area of interest” (AOI; Figure 1). Gaze data was analyzed using Tobii Pro Lab Analyzer (Karlsrovägen, Sweden). The primary outcome was total gaze time in the AOI (sec). Secondary outcomes were total gaze time outside the AOI (sec), total time to answer questions (sec), and time to first fixation on the AOI (sec).

Results One novice and one expert were excluded from the study due to prescription eyewear preventing successful calibration of the eye tracking glasses. All novices had performed ultrasound-guided line placement and observed UGRA; only one novice had performed any ultrasound-guided peripheral nerve blocks. While the gaze time (mean+/−SD) in the AOI was not different between groups (7+/−4 sec for Novice and 7+/−3 sec for Expert; p=0.150), gaze time in non-AOI was greater for Novice (75+/−18 sec) vs. 44+/−4 sec for Expert (p=0.005). Total time to answer standardized questions and total time to first fixation in the AOI were both shorter for Expert (Figures 2 and 3).

Discussion Experts in UGRA take less time to identify sonoanatomy of interest and spend less time gazing away from a target compared to novices. Eye tracking is a potentially useful tool to differentiate novices from experts in the domain of ultrasound image interpretation, a key skill in field of UGRA, and may represent an objective measure to benchmark a trainee’s progress towards expertise.
Oral Presentation

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**Frail Individuals Have Higher Risk of Poor Outcomes & Increased Length of Stay in Moderate to High Risk Elective Surgical Procedures**

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**BACKGROUND**

In 2012 the American Geriatric Society alongside the American College of Surgeons released best practice guidelines for the preoperative assessment of geriatric surgical patients. Concurrently, the World Health Organization estimates there are currently 700 million people over the age of 65 with expectations of this number to increase dramatically over the coming years. These guidelines help direct appropriate care for the this population that is at significant risk of adverse postoperative outcomes. However, to our knowledge little evidence based data exist to delineate which geriatric patients pose the greatest risk.

**METHODS**

Patients >60 years old undergoing elective moderate to high risk noncardiac surgery were sequentially recruited in our pre-anesthesia clinic. Multiple ACS/AGS assessments were performed, most notably the Fried Frailty Index. 90 day post-operative outcomes were tracked.

**RESULTS**

116 patients (71 non frail, 29 pre-frail, 16 frail) were included in the final analysis. Frail and pre-frail were more likely to have high risk of post-operative complications including poor discharge disposition (18.8% of frail patient discharged home; 85.7% of non frail, p<.001) and increased length of stay (11.9 days in frail; 4.7 days in non frail, p<.001).

**CONCLUSION**

There was a clear association between the level of frailty and poor post operative outcomes. Those determined as frail (as indicated by the Fried Frailty Index) had a statistically significant increased risk of post-operative hospital and surgical complications including readmission, delirium and death. Geriatric patients have been known to be at risk for poor surgical outcomes but based on these results it appears that those determined as frail or pre-frail pose the highest risk. Opportunity exists for implication of "pre-hab" protocols to improve frailty scores thus reducing post operative complications.

**Oral Presentation**

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**Functional Continuous Nerve Block – Motor Sparing Analgesia in the Upper Extremity**

Background: Peripheral nerve blocks allow avoidance of multiple anesthetics in the OR for burn patients. One disadvantage of extremity blocks is loss of functionality due to motor blockade. We present a patient with an upper extremity burn injury requiring multiple dressing changes managed with dual continuous median and radial peripheral nerve block catheters placed under ultrasound. No such combination of distal nerve block catheters placed under ultrasound has been reported. Here, we hope to illustrate a novel continuous nerve block technique that preserves motor function and is almost purely sensory—a functional block. Case Description: A 51 year old male with a past medical history of COPD was admitted with a 0.25% total body surface area burn to the left index finger. His pain at baseline and during dressing changes was not controlled with IV and PO narcotics. Regional anesthesia was consulted for placement of a nerve block catheter. An infraclavicular block was placed, but the patient complained of loss of function in his left upper extremity. To avoid motor blockade, we used ultrasound guidance to place continuous nerve block catheters of the distal radial and median nerves. The patient had immediate pain relief; his baseline pain score decreased from 9 to 1/10, he tolerated dressing changes with minimal pain, and he was able to use the extremity, including intrinsic hand muscles, during the duration of the block. The infusion rates were decreased on both catheters on day 2 due to leakage from catheter sites causing dislodgement of clear dressings. Catheters were removed on catheter day 4 as patient noted tenderness and the regional team noted slight erythema on rounds. The patient was placed on antibiotics for treatment of presumed bacterial infection. The erythema and tenderness at catheter sites improved and he was discharged on oral antibiotics when his burn was adequately healed. Discussion: This is the first report of continuous distal motor sparing blocks of the median and superficial radial nerves. In distal continuous nerve blocks, the rate of infusion of continuous distal nerve blocks needs to be low, as leakage from the site makes adhesion of dressings difficult and may increase the risk of infection. Despite superficial location of the nerves, there were no issues with catheter dislodgement. Continuous nerve blocks placed after hand surgery in the ulnar and median nerves and a case of a superficial radial continuous nerve block in a complex regional pain syndrome patient has been reported. Here, we demonstrate further that distal continuous nerve blocks that are motor sparing, which we call a functional block, provides excellent and prolonged analgesia while preserving motor function in the upper extremity, including in both flexor digitorum and the extensors of the fingers. By allowing for early movement, functional blocks may decrease scarring, increase range of motion and improve functional outcomes.

**Poster Presentation**

**Presenting Author:** Dr. YingQiu Zhou UCSD  

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General Anesthesia for Unrepaired Cyanotic Congenital Heart Disease and Decompensated Heart Failure

Background The congenital heart disease population presents a medically complex population for non-cardiac surgery and represents a rapidly growing segment of the adult population as more afflicted children live to adulthood. We present a case of a 53 y/o female with unrepaired tetralogy of Fallot with rapidly progressing cardio-renal syndrome undergoing general anesthesia for a laparoscopic peritoneal dialysis catheter placement. Our challenge was to induce and maintain general anesthesia in a patient with decompensated congenital heart disease for laparoscopy. Case Description Patient is a 53 y/o female with past medical history significant for thalidomide embryopathy, phocomelia, and tetralogy of fallot with pulmonary atresia. In addition, she also had discontinuous pulmonary arteries, history of MAPCA, a PDA to her left pulmonary artery, and an increasingly stenotic Blalock-Taussig shunt to her right pulmonary artery. The patient presented to the hospital with progressive cardio-renal syndrome, significant hepatic congestion and ascites refractory to diuresis and was scheduled for a peritoneal dialysis catheter placement. She underwent the procedure under general anesthesia with standard ASA monitors, a dorsalis pedis arterial line, and access in her pre-existing central line. She required vasopressin boluses and a vasopressin drip to maintain her systemic vascular resistance and avoid “stealing” from pulmonary blood supply and avoid an increase in pulmonary vascular resistance. The patient was extubated successfully after the procedure, and is still using her peritoneal dialysis catheter today. DISCUSSION Only case reports exist of this population of patients surviving to this advanced age, with our patient’s particular pathology of complete pulmonary atresia being even more remarkable. To our knowledge, this is the first anesthetic to be reported in this specific patient population. Our case represents congenital heart disease pathology at its finest and provides a fascinating lesson in cardiac physiology.

Poster Presentation

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Has the Introduction of Sugammadex Changed Anesthesiologists’ Choice of Neuromuscular Blocking Agents?

Background: With the introduction of any new medication or technology, there is a chance that it will significantly affect the way a physician chooses to practice. Sugammadex, approved in the US in December 2015, has been introduced as a new agent capable of reversing neuromuscular blockade by rocuronium and vecuronium. With its ability to cause rapid reversal of neuromuscular blockade following varying durations of time following administration of a steroidal non-depolarizing agent based on the dosage used, it is even more so inclined to truly affect the manner in which an anesthesiologist may practice. It potentially may alter the choice of nondepolarizing agent, doses administered, as well as timing of administration. Under an IRB approved protocol, we are interested in finding out if sugammadex has changed practice habits in the operating rooms of our hospital since its introduction to our formulary in December 2016. We hypothesize that the introduction of sugammadex will significantly alter the choice of neuromuscular agents used at our institution, increasing the amount and number of times rocuronium and vecuronium are used, compared to cisatracurium.

Methods: The study utilized retrospective data as was collected by the pharmacy department from June 2016 to February 2017. Data was collected from anesthesia intra-operative orders, excluding any orders from other areas in the hospital. The data collected the number of orders per drug and did not take into account the dose used. We compared the number of times rocuronium, cisatracurium, and vecuronium were used with one another as percentages. Additionally, we collected data looking at the percentage of times neostigmine versus sugammadex was selected when a reversal agent was used.

Results: Rocuronium usage went from 39.4%, 41.1%, 42.8%, 41.7%, 34.7%, 40.7%, and 48.3% from June 2016 to November 2016 to 48.3%, 55.6%, and 57.4% from December 2016 to February 2017. Cisatracurium usage went from 39.6%, 34.5%, 34%, 37.4%, 34.5%, and 36.5% from June 2016 to November 2016 to 30.6%, 27.8%, and 25.5% from December 2016 to February 2017. Vecuronium usage went from 20.9%, 24.34%, 23.2%, 20.8%, 30.8%, and 22.8% from June 2016 to November 2016 to 21.1%, 16.6%, and 17.1% from December 2016 to February 2017. Additionally, neostigmine usage since the introduction of sugammadex became 91.3%, 80.8%, and 95.3% from December 2016 to February 2017. Sugammadex usage during the same months was 8.7%, 19.2%, and 4.6%, respectively.

Conclusion: The introduction of sugammadex has, in fact, altered anesthesiologists’ choice of non-depolarizing agent intraoperatively. Rocuronium has been used more often since the introduction of sugammadex. Interestingly, the use of cisatracurium only decreased slightly, while vecuronium usage decreased as well though it also can be reversed by sugammadex. Another point to note was that there was a significant decline in usage of sugammadex in February 2017, possibly explained by a couple of reasons. In February, a review of proper indications and usage of sugammadex was presented to the anesthesia. Additionally,
it is possible that practitioners were using sugammadex more in the first months of introduction to help familiarize themselves with the drug.

Poster Presentation

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HEMODYNAMIC MANAGEMENT IN CESAREAN SECTION: CONTINUOUS VS INTERMITTENT NON-INVASIVE ARTERIAL PRESSURE MEASUREMENTS

BACKGROUND: An inconsistency of hypotension detection in women undergoing cesarean section with use of standard intermittent blood pressure monitoring versus with use of a continuous non-invasive arterial pressure device post spinal anesthetic has been previously noted (1). Although hypotension was significantly more often detected while utilizing continuous non-invasive monitoring, no associated study has evaluated the potential clinical implications regarding the total hemodynamic management between these two modalities.

OBJECTIVE: Evaluate the clinical management of patients undergoing cesarean section with regard to fluid and pressor administration in the setting of intermittent vs continuous non-invasive blood pressure monitoring.

METHODS: A total of 56 singleton parturients undergoing cesarean section under a spinal anesthetic were included in the study analysis. Blood pressure of one group of 28 subjects were assessed via a standard intermittent blood pressure cuff, while the other 28 subjects were assessed via a continuous non-invasive blood pressure device. No specific protocol for fluid management was utilized. Fluid administration (crystalloid and colloid), fluid equivalence administration based upon a conventional 3:1 colloid to crystalloid ratio, estimated blood loss (EBL), urine output (UOP), and vasoactive medication use (phenylephrine and ephedrine) were compared between the two groups.

RESULTS: Total volume loss were non-significant between groups. No significant differences were identified between total fluid administration, fluid equivalence administration, and total vasoactive medication use.

CONCLUSIONS: Although continuous arterial pressure monitoring may detect hypotensive episodes more often than a traditional blood pressure cuff, our study suggests that no total hemodynamic management changes are demonstrated throughout an entire cesarean delivery when comparing the two.


Poster Presentation

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High-Dose Methadone Therapy in Pregnancy

Background: The incidence of both prescription opioid and heroin abuse among pregnant women has risen dramatically in recent years, currently affecting 5.6 per 1000 live births. In fact, drug overdose now represents the leading cause of maternal death in Colorado. In addition to overdose, other serious risks associated with opioid use during pregnancy include infectious complications from intravenous use, as well as socioeconomic sequelae, such as inadequate prenatal care, poor nutrition, and increased rates of maternal mental illness and interpersonal violence. For the newborn, Neonatal Opioid Withdrawal Syndrome (NOWS) can lead to significant morbidity from a combination of central nervous system, autonomic, and gastrointestinal disturbances. This syndrome is associated with poor developmental outcomes and significantly higher healthcare costs. Despite the above risks for both the mother and baby, maternal “detoxification” is discouraged, as the stress of acute withdrawal can lead to intrauterine growth restriction, preterm labor, and fetal demise. Instead, opioid agonist treatment remains the standard of care during pregnancy, as discussed below.

Case description: We report a 30-year-old G1P0 female presenting for cesarean section for breech presentation. The patient’s history was notable for heavy heroine abuse extending into her first trimester, at which time she was transitioned to remarkably high-dose Methadone maintenance (190mg BID). Surgical delivery under combined spinal-epidural anesthesia was performed without issues. The neonate did well after delivery (APGARS of 7 and 8), and never developed signs of NOWS. However, postoperatively, the patient’s pain proved difficult to control despite patient-controlled epidural analgesia, an incisional pain catheter, high-dose oral oxycodone, scheduled Acetaminophen and Ketorolac, as well as continuation of her home Methadone. Eventually, remarkable improvements were achieved after simply dividing the Methadone dosage from 190mg BID to 95mg QID. She was discharged home on postoperative day 4, along with her healthy baby boy.

Discussion: In review, this patient was successfully managed on Methadone therapy during pregnancy to mitigate the risks associated with both heroine abuse and withdrawal. Consistent with available literature, this patient demonstrated relatively unremarkable intraoperative anesthetic requirements, but had very difficult to control postoperative pain. Indeed, Meyer et al. showed that mothers on Methadone maintenance during pregnancy have no significant increases in intrapartum pain scores or opioid requirements compared to controls, but significantly higher pain scores and opioid requirements after cesarean delivery. There remains ongoing debate regarding the efficacy of Methadone versus Buprenorphine in this setting. Methadone has historically remained the gold standard with decades of proven safety and efficacy. Furthermore, it does not carry the same risk of precipitating acute withdrawal during initiation of therapy, and is clearly more effective for mothers with particularly high opioid requirements. Meanwhile, Buprenorphine offers decreased risks of drug interactions and overdose, and results in less severe NOWS. Regardless of the regimen, it is important to continue the patient’s home medication perioperatively, as part of a multimodal analgesia approach which may require atypical dosing as described above.
Poster Presentation

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**Hitting the Nail on the Head: The Importance of a Multidisciplinary Approach to an Unusual Penetrating Intracranial Injury**

**Background**

Nail gun related injuries are becoming more common. Intracranial injuries remain a rare subset, accounting for less than 0.1% of nail gun injuries. To date, there have been approximately 45 reported cases in the literature concerning penetrating nail gun injuries to the head. Overall, these patients have favorable outcomes, although there have been reports describing devastating neurologic deficits and death.

These patients pose unique challenges to anesthesia providers, highlighting the importance of a multidisciplinary approach and strategic planning.

**Case Description**

A 28-year-old man was accidentally struck in the head with a nail from a pneumatic nail gun at close range. On outside imaging, the nail appeared to lacerate the lateral aspect of the superior sagittal sinus. Based on this, the patient was transferred to Zuckerberg San Francisco General Hospital (ZSFGH) for higher level of care.

On arrival to ZSFGH, the patient was hemodynamically stable, and alert and oriented. Exam was significant for left homonymous hemianopsia with intact CN III-XII. CT head revealed an 8 cm nail penetrating his occipital bone, traversing the right occipital and parietal lobes with mild multi-compartmental hemorrhage. CT angiogram and venogram revealed the tip of the nail abutting the posterior superior sagittal sinus without evidence of active extravasation.

Given the potential for massive blood loss and neurologic injury, a multidisciplinary team consisting of neurosurgery, anesthesia, and radiology was gathered to devise a detailed management plan.

A CT scanner was reserved for immediate scanning of our patient. The patient was brought to the operating room (OR) and standard ASA monitors were applied. A rapid infusion device and blood products were in the room. He underwent rapid sequence induction and was intubated with a 7.5 endotracheal tube. A radial arterial line was placed for hemodynamic monitoring. A large-bore central catheter was inserted into the left subclavian vein. Given the proximity of the nail to vital draining veins, the patient was prepped and draped for possible craniotomy.

The surgical team carefully extracted the nail with a vice grip. There was a small amount of venous bleeding which ceased spontaneously. The patient was hemodynamically stable throughout. He remained intubated and was transported to the CT scanner for repeat imaging, which revealed unchanged mild multi-compartmental intracranial hemorrhage and no active extravasation. The patient was transported to the ICU. He was extubated the following day with persistent left homonymous hemianopsia, but otherwise neurologically intact.
Discussion

This case emphasizes the responsibility of anesthesiologists to maintain close communication with multi-disciplinary teams in anticipation of all possible clinical outcomes, a quality that contributed greatly to this patient’s positive outcome. Given the complexity of this case, we anticipated the need to have in place a step-wise approach to management. In discussion with colleagues in neurosurgery, nursing, and radiology, we devised a detailed plan for each critical step and downstream consequence. This multidisciplinary approach to patient care lends its benefit to numerous clinical scenarios and should be applied to urgent traumatic events whenever feasible.

Poster Presentation

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How Common is Airflow Limitation in Patients with Emphysema on CT Scan of the Chest?

Background: COPD has traditionally been defined by the presence of irreversible airflow limitation on spirometry using either the GOLD (Global Initiative for Chronic Obstructive lung Disease) or American Thoracic Society/European Respiratory Society criteria (lower limit of normal [LLN]). We have observed that some patients with clinical COPD and emphysema on chest CT scan have no obstruction on spirometry. The purpose of this study was to assess the prevalence of obstruction by GOLD and LLN criteria in patients with emphysema on CT scan and determine which radiographic criteria were associated with a clinical diagnosis of COPD.

Methods: We retrospectively analyzed the clinical records and spirometry of all patients who had radiographically defined emphysema on chest CT scans completed at the University of Vermont in 2011. We compared spirometric criteria and CT scan factors with the presence of clinical COPD based on chart review.

Results: We identified 274 patients with CT scan defined emphysema. GOLD criteria detected obstruction in 228 patients (83%) and LLN detected obstruction in 206 patients (75%). However, GOLD failed to correctly identify 19 patients (6.9%) and LLN failed to identify 38 patients (13.9%) (average 10.4%) who had radiographic emphysema and a clinical diagnosis of COPD. Obese patients had a lower prevalence of obstruction whether classified by GOLD or LLN. Among patients with spirometric obstruction, there were greater degrees of emphysema and more severely increased airway wall thickness. Factors that were independently associated with clinical COPD were lower FVC % predicted, lower FEV1/FVC ratio and increasing airway wall thickness.

Conclusions: Spirometry missed 10.4% of patients with clinical COPD who have significant emphysema on chest CT scan.

Oral Presentation

Presenting Author: Dr. Whitney Creed University of Utah

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Huntington's Disease and Perioperative Management

Huntington's Disease (HD) was first described by Paracelsus in the 16th century, when he created the term “chorea” to describe the characteristic choreiform movements associated with the disease. The word originates from the Greek term “khoreia” meaning “to dance in unison.” The disease was definitively described by George Huntington in his paper “On Chorea” in 1872, which helped to establish its role as a heritable illness. In North America and Europe, HD is thought to occur between 5-7 per 100,000 people, but is not unlikely to be encountered by anesthesiologists. There are important implications for perioperative management that the anesthesiologists should be aware of and be prepared to manage, particularly with motor function, esophageal dysmotility, dystonia, muscle rigidity, inability to cooperate, and case reports of adverse drug reactions.

This case report presents the successful general anesthetic of a 57 year old, 50 kg female with diagnosed HD, presenting for hip hemiarthroplasty following a fall. Her manifestations of the disease are dementia, well controlled chorea, poorly coordinated oropharyngeal movements and poor motor response to commands. She is induced with 70mg propofol, 50mg lidocaine and 100mcg of fentanyl, and maintained on TIVA of propofol and remifentanil 20mcg/mL. She is extubated at the end of the case and has no further complications from anesthesia. Case reports exist citing use of succinylcholine and thiopental as cause for prolonged emergence, however there have been larger studies conducted that find no increased incidence of prolonged emergence with these drugs. It is hypothesized that populations with HD may have low levels of atypical pseudocholinesterases, however this remains controversial. Additionally, there have been recent studies citing maintenance of GA with isoflurane in rat models with disease progression. Overall, general anesthesia appears to be largely safe for those with HD, as long as the anesthesiologist is aware of the risks associated with the manifestations of the disease, drug interactions and can guide the patient and family through safe decision making.

Poster Presentation

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Hydrogen peroxide-induced air embolism and cardiovascular collapse in a pediatric patient; a case report.

A 6-month old male patient with a history of recurrent scrotal abscess presented for cystoscopy, incision and debridement at Children’s Hospital of Orange County in August 2016. Past medical history includes premature delivery at 31 weeks, with 6-week NICU stay for feeding and 1 week CPAP for apneic episodes with uneventful discharge. Past surgical history includes drainage of scrotal abscess one month prior with uneventful perioperative hospital stay. The patient underwent smooth mask induction with sevoflurane. LMA was placed easily and patient was then turned 90 degrees for procedure. No caudal block was attempted. Shortly after incision, patient developed wheezing and high peak airway pressure despite appropriate anesthetic depth with sevoflurane and fentanyl. CPAP and propofol given with respiratory improvement. Patient was electively intubated uneventfully on first attempt. Albuterol given and wheezing resolved. Procedure continued to be well tolerated until scrotal abscess was irrigated with non-diluted 3% hydrogen peroxide. Subsequently, the patient desaturated to 70-80% and briefly became cyanotic. End-tidal CO2 suddenly decreased to nadir of 8. Additional anesthesia help was called immediately. Breath sounds were confirmed as clear bilaterally with normal peak pressures and appropriate tidal volumes. Total of 20 mcg epinephrine was given and titrated in 5 mcg increments. ETCO2 slowly returned to baseline while HR and BP remained stable throughout. Patient’s color soon returned and saturations improved to mid-90s. Drapes were immediately removed and scrotum was noted to be severely swollen, distended, and discolored. Exam was significant for crepitus. STAT chest and abdominal films were taken in OR and demonstrated extensive soft tissue gas dissecting into the left inguinal canal and left lower quadrant of the pelvis. Hydrogen peroxide induced oxygen vs air embolism suspected. Patient was observed in the OR for an additional 30 mins after procedure stop time and remained hemodynamically stable with return to baseline ETCO2 waveform. Decision was made in discussion with urology team to keep patient intubated and transfer to ICU. Transport was uneventful and transfer of care was completed to PICU team. Postoperative echocardiogram was obtained and showed patent foramen ovale versus small secundum atrial septal defect with left to right shunting with normal right and left ventricular size and function. Postoperative course was uneventful. Patient was extubated on postoperative day one and was stable for discharged home.

Discussion: Hydrogen peroxide induced air embolism mechanism

Review of case reports

Poster Presentation

Presenting Author: Dr. Charles Li UC Irvine Medical Center

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Hypotension, outcomes, and opportunities for quality improvement in patients with mesothelioma undergoing pleurectomy/decortication

INTRODUCTION

As a center for malignant pleural mesothelioma (MPM), UCLA has one of the largest American cohorts of patients undergoing thoracotomy for complete visceral and parietal pleurectomy/decortication (P/D). In the anesthesiology literature, evidence supports the association of intraoperative hypotension with increased operative morbidity and mortality. Our aim is to determine the incidence and impact of significant perioperative hypotension in patients undergoing complete P/D, along with other factors contributing to ICU admission, 30-day readmission, and mortality.

METHODS:

We reviewed the electronic records of 71 patients with mesothelioma who underwent complete P/D between April 2013 and November 2016. We collected data regarding survival, complications, and factors leading to ICU admission and 30-day readmission.

RESULTS:

Overall surgical mortality, defined as death within 30 days or before discharge, occurred in two patients (2.8%). Follow-up information was not available for all patients because some obtained primary care outside the UCLA system. An additional 20 patients expired at intervals ranging from one month to 17 months after surgery, with 13 of these patients surviving less than six months.

ICU Admission:

17 patients (24%) were admitted to ICU:

* Six patients were extubated in the OR, transferred to PACU, and subsequently sent to the ICU because of hypotension.

* Five were transferred directly from OR to ICU for intraoperative hypotension, respiratory insufficiency, or aborted procedures.

* Six were transferred from ward care to ICU because of adverse events that necessitated emergency transfer, with length of stay from 14 to 58 days. Five experienced either cardiac arrest or near-arrest cardiorespiratory events following prolonged hypotension during the first few postoperative days.

30-day Readmission:

Only patients readmitted to UCLA had records available for review. Of the 15 patients who survived to hospital discharge after ICU admission, two (13%) were readmitted within 30 days of discharge. Of the 54 patients who did not receive ICU care, 21 (38.8%) presented again within
30 days. Four of these were Emergency Department visits only, while 17 patients required admission (31.5%). The most common symptom was shortness of breath; two readmitted patients expired.

DISCUSSION

The short-term mortality rate of 2.8% is comparable to that reported in other large series. The incidence of postoperative hypotension as a precursor to more severe adverse events is of concern. Though numbers are small, patients transferred to ICU from the ward experienced worse outcomes including prolonged length of stay and increased mortality.

We intend to continue this study to analyze duration and severity of hypotension, to look for other risk factors and associations that could predict a need for ICU care, and to identify possible modifications to our care pathway. As a quality improvement initiative, this work has the potential to lead to better outcomes and fewer complications for this high-risk patient cohort.

Poster Presentation

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**Impella 5.0 (Abiomed) as bridge to combined orthotopic combined heart-liver transplant.**

**Background**

First combined orthotopic heart and liver transplant (CHLT) performed in San Diego and the first time an Impella 5.0 (Abiomed) micro-axial cardiac assist device has been used as a bridge to transplant.

**Case Description**

58 year old male with non ischemic cardiomyopathy (LVEF 16%) from both alcohol abuse and mismatched bicuspid aortic bio-prosthetic valve, automatic implantable cardioverter defibrillator (AICD), treated Hepatitis C virus infection, hypothyroidism, hypertension, ex-heavy drinker and smoker admitted for progressively worsening congestive heart failure refractory to maximal medical management. Hospital course complicated by acute kidney injury and atrioventricular node ablation for atrial fibrillation; eventually needing placement of Impella 5.0 cardiac assist device via his right axillary artery while awaiting work up for heart transplant which revealed liver cirrhosis (MELD 10). Listed 1A status for a combined heart and liver transplant (CHLT) with suitable organs procured after 155 days with 50 days of Impella 5.0 cardiac support as a bridge to transplant.

Anesthesia setup included balanced anesthetic with focus on large bore access lines (9Fr right internal jugular introducer catheter x2), hemodynamic monitoring with transesophageal echocardiogram (TEE), right radial arterial line, left femoral arterial line as well as cell saver and cardiopulmonary bypass (CPB) machine. CPB was initiated with Impella 5.0 device explanted before orthotopic heart transplant performed. Dobutamine 5mcg/kg/min was utilized to attenuate transplanted right heart dysfunction with norepiphrine 5mcg/kg/min infusions to maintain right sided coronary perfusion pressures. Serial thromboelastograms (TEGs) after coming off bypass were used to ensure adequate coagulation parameters before liver transplant could be contemplated. The preferred surgical liver transplant technique was the "piggy back" method without veno-veno bypass which involves partial clamping of the inferior vena cava preserving flow. Chest left open during the orthoptic liver transplant to monitor bleeding. Transfusion totals included 12 units packed red blood cells, 11 units of fresh frozen plasma, 4 pooled units of platelets, cell saver 675ml and albumin 900ml. Majority of blood loss occurred during liver transplant an-hepatic stage with right heart strain on TEE noted during the reperfusion stage. Patient was transferred intubated, ventilated, supported with dobutamine infusions along with inhaled nitric oxide to the dedicated transplant/ICU team after a prolonged but uncomplicated 11 hour surgical course with CPB time 150mins and donor ischemia time 116mins.

Postoperative course complicated by acute on chronic right subdural hematoma managed conservatively before discharge home a month after his CHLT.

**Discussion**
Only 18 combined orthoptic heart-liver transplants were performed in the United States in 2016 including this case. This case however is the first to use an Impella 5.0 (Abiomed) as a bridge to combined heart-liver transplant. The Impella’s placement is markedly less invasive than the current FDA approved ventricular assist devices (VAD) which need surgery with cardiac bypass support but do necessitate inpatient status. The major anesthetic challenges in this case relate to preparation for massive transfusion requirements, assessing coagulation status, managing multiple surgical teams and optimizing transplanted right heart function coming off bypass and especially during reperfusion of the newly transplanted liver.

**Poster Presentation**

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Implementation and Indicator Outcomes Using Clinical Decision Support in Pediatric Traumatic Brain Injury Anesthesia Care

BACKGROUND: Traumatic brain injury (TBI) is a leading cause of pediatric morbidity and mortality. Evidence-based guidelines for management of pediatric TBI were last updated in 2012. TBI outcomes may depend not just on injury severity but also on the timeliness and quality of care provided and on prevention of second insults. A recent retrospective multi-center study found a 1% increase in guideline adherence to be associated with a 6% decrease in inpatient mortality. We previously developed a novel, real-time algorithmic clinical decision support (CDS) system to guide pediatric TBI anesthesia care. In this study, we evaluate the impact of CDS on anesthesia provider adherence with best practice process measures and on key performance indicator (KPI) outcomes during neurosurgeries at a level I trauma center.

METHODS: CDS was activated in patients who were under 19 years with diagnosis of acute TBI undergoing urgent or emergent craniotomy. Eligible cases were automatically detected from a surgery scheduling system. The anesthesia information management system (AIMS) database was sampled every minute for KPIs of interest. Messages were generated for unwanted KPIs and displayed on the AIMS computer screen. Providers were also prompted to follow best practice TBI anesthesia care processes. Data was collected prospectively for cases with CDS activated and also in those that CDS failed to activate. Patients meeting our inclusion criteria who underwent craniotomy prior to CDS implementation were sampled retrospectively.

RESULTS: Data from 39 patient cases was included for analysis: 20 with CDS and 19 without CDS. Median ages were 8.9±5.7 years (CDS) and 9.9±5.6 years (no CDS). Both groups were approximately 75% male and epidural hematoma was the most common diagnosis. Median arrival GCS was 8 (IQR 3-14; CDS) and 8 (IQR 4-15; no CDS). CDS was associated with improvement in 5/11 TBI process measures: arterial blood gas sampled, neuromuscular blocker use, coagulopathy treated, hyperglycemia treated, and ICP transduced. Median KPI event duration was lower in the CDS group for 4/7 KPIs: Duration of hypocarbia, by 44%; hypotension, 29%; hypothermia, 12%; and hyperthermia, 15%. The CDS was highly sensitive, detecting 89% of monitor KPIs and 100% of lab KPIs, and 100% specificity was achieved.

CONCLUSIONS: CDS implementation for pediatric TBI anesthesia care is feasible and reliable, with high rates of case capture and event detection. CDS was associated with improved adherence to some TBI process measures, and a reduction in duration in the majority of unwanted KPI events. This is the first demonstration of improvement in guideline adherence attributed to CDS, and these preliminary results suggest CDS as a potential strategy to reduce second insults and improve TBI guideline adherence during anesthesia care.

Oral Presentation

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Implementation of a multimodal analgesic protocol to enhance recovery after minimally invasive general surgery: comparison of postoperative opioid use and perioperative outcomes.

Introduction
General surgery is commonly performed with minimally invasive techniques utilizing laparoscopic or robotic assistance. However, despite advances in surgical procedures, patients report postoperative pain that requires high dose opioids. Enhanced recovery after surgery (ERAS) protocols have been described for minimally invasive surgeries and include interventions to optimize postoperative pain control. We implemented an intraoperative multimodal analgesic protocol for minimally invasive general surgery (MIGS) to minimize opioid use and enhance postsurgical recovery. We hypothesized that a standardized protocol will reduce use of postoperative intravenous (IV) opioid patient-controlled analgesia (PCA).

Materials and Methods
With IRB approval, we retrospectively reviewed the electronic medical records of consecutive MIGS performed six months before and after implementation of a multimodal analgesic protocol (Table 1). Initially all patients who underwent MIGS were included. Exclusion criteria include: emergent surgery, admission to an intensive care unit, or conversion to an “open” approach. Patients were divided into Pre- and Post-protocol groups. For subsequent analysis, Pre- and Post-patients were categorized according to surgery duration (low, mid, and high tertiles – Subgroups 1, 2, and 3, respectively). The primary outcome was proportion of patients requiring IV opioid PCA use in the Pre- and Post-protocol groups. Secondary outcomes included post-anesthesia care unit (PACU) length of stay (min), time to IV opioid cessation (hours), lowest and highest pain scores using a numeric rating scale (NRS, 0-10) and total opioid consumption in IV morphine equivalents (mg) on POD 1 and 2, and hospital length of stay (days).

Results
Between May 2014 and May 2015, 139 MIGS cases were performed and 118 patients were included in the analysis (57 Pre-protocol and 61 Post-protocol; Table 2). For the primary outcome, 24/57 (42%) patients in the Pre- and 19/61 (31%) in the Post-protocol group received IV opioid PCA after surgery (P=0.217). PACU length of stay [median (10th-90th percentiles)] for the Pre-group was 130 (67-194) min compared to 110 (60-168) min in the Post-group (p=0.034). Highest pain score on POD1 in the Pre- and Post-groups was 4 (0-8) and 7 (1-10), respectively (p=0.001) and lowest pain score on POD2 was 0 (0-0) and 0 (0-4) for Pre- and Post-groups, respectively (p=0.009). There was no difference in other outcomes. In the Pre- and Post-protocol groups categorized by surgery duration, PACU length of stay was different in Subgroup 1 [Pre- 143 (66-226) min versus Post- 97 (59-128) min, p=0.007] but not in Subgroups 2 or 3 (Figure 1). For hospital length of stay, there was no difference except in Subgroup 3 [Pre- 5 (3-8) days versus Post- 3.5 (3-8) days, p=0.026].

Discussion
Implementation of an intraoperative multimodal analgesic protocol reduced PACU length of stay, especially among patients undergoing surgeries of short duration. These results may have implications for workflow and allocation of resources at high volume surgery centers. To enhance recovery, numerous perioperative interventions are required; our protocol only addressed intraoperative analgesia without standardizing pre- or postoperative pain.
management. Although comparison of pain scores reached statistical significance, these secondary outcomes are suggestive, but not conclusive, and warrant further study.

**Poster Presentation**

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Implementing a Novel Triage Questionnaire using Time-driven Activity-based Costing (TDABC) to Drive Process Change and Improve Preoperative Efficiency

Introduction: With the shift towards value-based healthcare delivery, institutions must evaluate ways to decrease the cost of care while maintaining the quality of care provided. Traditional hospital costing methodologies do little to elucidate the true cost of care delivery. Time-driven activity-based costing (TDABC), a methodology developed by Kaplan and Anderson which utilizes a combination of time and resource cost per minute, can be used to more accurately assess overall cost of care and efficiency. In a previous study, we undertook to apply TDABC to the preoperative evaluation process of patients undergoing cataract surgery at the Jules Stein Eye Institute at UCLA. Based on our analysis, we identified opportunities for process improvement and cost reduction. One of these was the implementation of a novel triage questionnaire addressing medical conditions that would warrant further screening. By implementing this questionnaire, our aim is to increase efficiency and decrease overall costs without impacting turnover times, operating room delays, or clinical adverse events.

Methods: A screening questionnaire was developed based on validated surveys and is in the process of being independently validated. The questions are designed to identify patients with systemic disease significant enough to provide a functional limitation that would impact their ability to undergo cataract surgery. In the pilot phase of the study, the questionnaire was administered to 20 patients. Those answering all “no” (considered a negative screen) did not undergo any further preoperative screening. Patients answering “yes” to any question then proceeded to have the standard full interview and review of records. After these patients underwent surgery, we compared findings on the preoperative evaluation with answers to our questionnaire. Case delays, cancellation rates, and unanticipated adverse events were recorded as part of the new process design along with assessment of the cost. We performed a TDABC analysis of the new screening process including the questionnaire, and compared the time and cost to that of the original process. Data on personnel, space, and equipment cost were obtained from the operations department.

Results: Fifty percent of patients had a negative screen and had no further evaluation prior to surgery. There was no impact on turnover time and delays as compared to patients not part of the pilot study over the same time frame. [AR1] From the previous TDABC analysis, the average process time for the original preoperative evaluation process was 128 minutes at a cost of $186. With the triage questionnaire, the average process time was 64 minutes at a cost of $90. The use of the questionnaire demonstrated a 50% reduction in time and a 52% reduction in cost. There were no unanticipated adverse outcomes.

Conclusion: We were able to demonstrate a reduction in average cost and time of the preoperative screening process using this questionnaire in place of the full interview in patients undergoing low risk surgery, without negatively impacting operating room turnover or outcomes. TDABC is a useful tool in identifying process inefficiencies and provides a basis for continued process improvements.

Poster Presentation
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Improving compliance to evidence-based anti-emetic prophylaxis for patients at high risk for post-operative nausea and vomiting

Background  Post-operative nausea and vomiting (PONV) results in patient dissatisfaction, longer post-anesthesia care unit (PACU) stays, and unanticipated hospital admissions (1,2,3). A patient’s Apfel score correlates with their risk of PONV and anti-emetics from different classes are additive in reducing PONV risk (1,2). Current guidelines recommend that patients at high risk for PONV (Apfel score of 3 or higher) receive at least 2 anti-emetic agents as PONV prophylaxis (3,4). Based on a random chart audit of our institution’s cases over a 2-month period, only 47.9% of patients at high risk for PONV received at least 2 anti-emetics. We implemented a resident quality improvement initiative to improve the preoperative PONV risk assessment process and the preoperative and intraoperative administration of at least 2 prophylactic anti-emetics for patients at high risk for PONV. Methods  To improve preoperative PONV risk assessment, documentation of Apfel risk factors was incorporated into the preoperative evaluation and electronic medical record (EMR). The inclusion criteria were: adult (at least 18 years old), extubated prior to leaving the OR, Apfel score of 3 or higher, general inhalational anesthesia by an anesthesiology resident. Residents were educated on PONV-focused preoperative documentation, indications, contraindications, and dosing regimens for anti-emetic prophylaxis using department-wide presentations and reference cards. Weekly reminder pages were used to reinforce documenting Apfel risk factors and providing anti-emetic prophylaxis as part of routine anesthetic practice. Anti-emetic medications were added to the anesthesia cart to improve accessibility in the intraoperative period. Monthly audits were performed on all cases meeting inclusion criteria to analyze the number of prophylactic anti-emetics as well as the number of rescue anti-emetics given during the first 24 hours postoperatively. Quarterly emails provided data on overall performance to the department and constructive feedback to individual providers. Results  In the first academic quarter, 568 resident cases met inclusion criteria and residents treated 77% of patients at high risk for PONV with at least 2 prophylactic anti-emetics. In the second academic quarter, 608 resident cases met inclusion criteria and residents treated 80% of patients at high risk for PONV with at least 2 prophylactic anti-emetics. Of the patients at high risk for PONV who received at least 2 prophylactic anti-emetics, 48% received rescue anti-emetics in first 24 hours postoperatively. Conclusions  An increased awareness of PONV risk factor assessment, improved documentation in the EMR, repeated education, and frequent feedback on performance led to a sustained improvement in evidence-based anti-emetic prophylaxis for patients at high risk for PONV. Our data suggests that despite the administration of at least 2 anti-emetics for patients at high risk for PONV, there is still significant rescue anti-emetic administration in the first 24 hours postoperatively. References1) Apfel, CC, et al. (1999). Anesthesiology 91(3): 693-700.2) Apfel, CC, et al. (2004). N Engl J Med 350(24): 2441-2451.3) Gan, TJ, et al. (2014). Anesth Analg 118(1): 85-113.4) “ASA PQRS Overview.” Anesthesia Quality Institute. 2016. www.aqihq.org/files//PQRS at a Glance_final.pdf
Poster Presentation

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Improving prophylaxis of postoperative nausea and vomiting

Background
Postoperative nausea and vomiting (PONV) is a common side effect of general anesthesia that reduces patient satisfaction, increases costs, and can result in serious complications. The current Society for Ambulatory Anesthesia (SAMBA) guidelines recommend administering at least 2 prophylactic antiemetics to high risk patients, and can be interpreted as administering the same number of prophylactic antiemetics as PONV risk factors[1]. The SAMBA guidelines inspired a quality improvement project by the anesthesia residents at UCSF. Given this setting of increased attention to PONV prophylaxis, we investigated how often residents administered at least as many antiemetics as PONV risk factors, and examined what barriers providers face when trying to do so.

Methods
We retrospectively reviewed all general anesthesia cases involving adult patients at UCSF hospitals between July 1, 2016 and February 28, 2017. Inclusion criteria included administration of inhaled anesthetic or nitrous oxide >30 minutes, and having resident involvement in the case. We defined compliance as the percentage of cases in a time period for which the number of prophylactic antiemetic medications given was greater than or equal to the patient’s Apfel score. PONV was defined as the administration of an antiemetic in the PACU. We subsequently created a survey to identify barriers to providing 2 or more antiemetic interventions to high risk patients and ways to overcome those barriers. This survey was administered to all 71 anesthesia residents at UCSF.

Results
We evaluated 5485 PACU stays corresponding to 5040 unique patients. 2849 of 3209 (11.2%) PACU stays with a compliant number of anti-emetics had PONV, while 1942 of 2276 (14.7%) PACU stays with a noncompliant number of antiemetics had PONV (p<0.001). In the survey, with a 60% response rate, residents reported the following barriers to providing antiemetics to high risk patients: cumbersome charting (51%), difficulty administering antiemetics preoperatively (37%), few antiemetic options in the OR cart (33%), contraindications (30%), difficulty identifying high risk patients (16%), and insufficient time due to other responsibilities (12%). Residents identified several interventions that would facilitate providing at least 2 antiemetics to high risk patients: 61% suggested more streamlined charting, 61% suggested more medication options in the OR cart, 29% suggested more antiemetic choices in the intra-op macros, and 22% suggested education sessions regarding antiemetic choices.

Conclusions
When providers are able to administer the same number of prophylactic antiemetics as PONV risk factors, there is a lower incidence of PONV. From a survey of anesthesia residents, the main barriers to providers in achieving this goal are: cumbersome charting, difficulty administering antiemetics pre-op, lack of antiemetic options in the OR cart, and contraindications. While our current study focuses on reducing incidence of PONV, further work is needed to identify low-value administration of antiemetics (e.g. giving more antiemetics than necessary to low-risk patients).

References

Poster Presentation

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Improving the Accuracy of Anesthesiology Resident Case Logs Using an Anesthesia Information Management System Database

Background: Anesthesiology residents in the United States are required to fulfill graduation requirements outlined by the Accreditation Council for Graduate Medical Education (ACGME) and manually log cases corresponding to these requirements. Published studies have shown that these case logs are inaccurate, so we expected less than 50% of residents at our institution to have accurate logs as defined by having a case total greater than or equal to the number of cases they had performed according to our Anesthesia Information Management System (AIMS) database. We hypothesized that residents who received AIMS case data via email would have more accurate case logs than those who did not receive emails, with a persistent effect beyond the period of intervention.

Methods: We conducted systematic reviews of the ACGME graduation requirements and the information within our AIMS database to create an algorithm that suggests a category for a given case. We collected data over four weeks to establish a baseline accuracy of case logs. We randomized 64 anesthesiology residents at our institution into intervention and control arms, with 31 residents receiving emails containing AIMS case data every two weeks and 33 residents receiving no emails for a total of eight weeks. We collected data for an additional four weeks to assess persistence of any intervention effect.

Results: During the baseline, intervention, and post-intervention study periods, a higher percentage of residents in the intervention arm than the control arm had accurate case logs (69% vs. 52% during baseline, 74% vs. 58% during intervention, and 68% vs. 48% post-intervention). However, this difference was not statistically significant during any of these periods (p = 0.16 during baseline, p = 0.16 during intervention, and p = 0.07 post-intervention). Residents in the intervention arm were surveyed following the study, and the majority (83%) wanted to continue receiving emails.

Conclusion: Although no significant difference in case log accuracy was found between the intervention and control arms, accuracy in both arms exceeded our expectation, and a greater percentage of residents in the intervention arm had accurate logs throughout the study. A survey of residents in the intervention arm found that the majority wanted to continue receiving emails.

Poster Presentation

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Improving Timing of Epidural Placement to Maximize Patient Pain Relief Prior to Delivery

Abstract: It has been noted that on Labor and Delivery unit, there are patients who deliver their baby within 90 minutes of epidural placement. Having a neuraxial block placed later in labor not only decreases the amount of pain relief time a laboring patient has, since an epidural can take 20-30 minutes to attain its full effect, it also significantly increases the risks of an epidural placement. Patients in a later stage of labor are often less able to hold still, which can possibly increase the number of attempts as well as risk of a “wet tap” or dural puncture. They may also be at higher risk of having “block failure” due to malpositioning of the epidural catheter once it is threaded. The purpose of this quality improvement study is to determine the causes for delayed epidural placement in laboring patients to identify areas for process improvement.

Methods: Data was collected from medical records retrospectively. We looked at all of the epidurals from April 2016 through Jan 2017 and included the epidurals that were placed within 90 minutes of delivery. Epidural placement was determined by the time of test dose from the anesthesia chart. We then evaluated patients for their original documented preference to receive an epidural or not. We also looked at possible causes of delay which included; time of labs drawn, documentation of HTN/pre-eclampsia/eclampsia, delay in anesthesia availability, late admission to the hospital (defined as arriving within 2 hours before the epidural placement), and possible fetal issues.

Results: We found that about 1 in 25 patients (59 out of total 1376 patients) received an epidural within 90 minutes of delivering. Of those 59 patients only 11 of them were delayed because of arriving to the hospital late. Of the remaining 48 patients 40% of them did not have a preference documented in the chart (Process Improvement Area #1). For those in this group who stated no to initial epidural screening 33 % received pain medication prior to questioning (Process Improvement Area #2). Finally, for those who reported an interest in epidural placement, 22 % may have had a delay in provider availability (Process Improvement Area #3). Full details of these patients are shown in the process map, with the highlighted areas indicating topics of future process improvement (Figure 1).

Conclusion: This quality improvement initiative has identified several target areas for improvement to reduce the number of delayed epidural placements. Currently, implementation strategies are being developed to improve patient epidural screening during admission. Similarly strategies are being developed to improve communication with the Obstetrics department (nurses, attendings, and residents) as well as develop anesthesia support teams to facilitate availability. Figure 1: Quality Improvement Process Map: Factors Impacting Delayed Labor Epidural Placement
Poster Presentation

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In vitro study of pressure generated via automated bolus injection through peripheral nerve catheter

Background

Automated intermittent or patient-controlled analgesia bolus doses are an increasingly popular method to deliver local anesthetic via continuous peripheral nerve catheters (CPNCs). Many experts believe that bolus injection improves perineural fluid spread compared to slower conventional continuous infusion. Perineural injection pressure generated from a bolus (typically administered at 10 mL/min) is approximately 8 to 10 psi (or 400 to 500 mmHg) via a short needle. Additional pressure is expected to be introduced into the system when using a long, small-bore CPNC. Such high overall pressure can potentially exceed the delivery pressure limit and activate occlusion alarms of modern ambulatory infusion pumps. This can result in unwanted cessation of medication administration. We performed an in vitro study of the relationship between pressure and flow rate assessed using a range of catheter lengths.

Methods

For this in vitro study, IRB review was not applicable. Five 19G (1.1mm) x 60 cm catheters (FlexBlock; Teleflex, Research Triangle Park, NC, USA) were used for testing. Injections with normal saline were administered via catheter with an automated syringe pump (Asena; Alaris Medical Systems, Basingstoke, UK) with built-in pressure monitoring. An injection rate starting at 1 mL/min was used for each catheter, and increased in 1mL/min increments until generated pressure reached the maximum 1000 mmHg pump pressure limit (or up to the maximum 20 mL/min pump delivery rate). The length of each catheter was shortened by 10 cm and retested through the range of injection rates. This was repeated until pressures for five samples were measured at each flow rate for each length (20, 30, 40, 50, 60 cm). All tests were conducted at room temperature.

For analysis purposes, an occlusion pressure limit of 900mmHg (common among ambulatory infusion pumps e.g. Curlin Medical 4000 Series Pumps, Huntington Beach, CA, USA) and perineural bolus injection pressure of 400 mmHg were used as reference pressures.

Results

Average pressures computed from five samples of each catheter length are plotted against flow rate in Figure 1. Table 1 summarizes the average pressures at a flow rate of 10 mL/min (typical bolus injection rate) for each catheter length.

Conclusions

To our knowledge, this is the first in vitro study to evaluate the relationship between injection rate and pressure generated from CPNCs. Subtracting the 400 mmHg perineural bolus injection pressure results in a theoretical allowable pressure of 500 mmHg from catheter contribution alone before alarm activation (if the pump’s occlusion pressure limit is 900 mmHg). The implications of our results suggest that commercially available 19G x 60 cm CPNCs generate
high pressures that can potentially exceed occlusion alarm limits when attempting to bolus at 10 mL/min or greater. Clinicians should be familiar with occlusion pressure limits of their infusion pumps and management techniques to address alarm triggers. Options include programming infusions at slower rates for longer catheters or possibly shortening catheter length to improve flow characteristics.

**Poster Presentation**

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Incidence of Post-operative Nausea and Vomiting in Non-cardiac Post-operative Adult Patients and Correlation with Risk Factors: A Retrospective Study

Introduction: Post-operative nausea and vomiting (PONV) is a common problem that is prevalent in over one-third of post-surgical patients. Patient surveys have indicated that patients consider emesis even more undesirable than pain. The purpose of this study was to evaluate the incidence of PONV and to identify risk factors and treatment strategies in non-cardiac adult post-operative patients in the post-anesthesia care unit (PACU). Methods: The electronic medical records of 356 adult post-operative patients undergoing non-cardiac surgery from 5/1/2016 to 2/28/2017 at LAC+USC Medical Center were reviewed retrospectively looking at incidence of PONV. Risk factors recorded included 1) baseline patient risk factors such as inpatient vs. outpatient surgery, age, gender, ASA physical status, BMI, smoking history, 2) intra-operative risk factors such as types of surgery, modes of anesthesia, anesthesia duration, and intra-operative blood loss, and 3) PACU risk factors such as pain score on arrival, administration of post-operative opioids, and administration of anti-emetics. Results: The overall incidence of post-operative nausea in the PACU at LAC+USC medical center was 5.6%. Risk factors such as female gender, age > 50, types of surgery (e.g. gynecological, oral maxillofacial), and prior history of PONV or motion sickness were predictive of PONV. In addition, in-patient surgeries, utilization of general anesthesia, longer anesthesia duration, and opioid administration in PACU were also associated with higher PONV rates. ASA physical status, estimated blood loss, type of intra-operative opioid administration, and PACU pain score on arrival showed no correlation with incidence of PONV. Conclusion: Incidence of PACU PONV categorized according to peri-operative risk factors largely confirmed many of the PONV risk factors as defined by Gan et al. The overall incidence of PACU post-operative nausea at LAC+USC was 5.6% and vomiting 0% compared to the incidence reported by Gan et al. in meta-analysis studies of 50% for nausea and 30% for vomiting for various post-operative periods. This may be due to factors such as the use of intra-operative prophylactic anti-emetic agents, utilization of alternative modes of anesthesia to reduce PONV, and under-reporting of PONV. Future research may look into risk-benefit and cost analysis of prophylactic anti-emetic agents, uncovering methods of better characterizing and reporting PONV, and correlation with aforementioned predisposing risk factors for PONV in randomized prospective controlled trials. References: 1. Gan, Tong et al. “Consensus Guidelines for the Management of Postoperative Nausea and Vomiting.” Anesthesia and Analgesia, Volume 118, Issue 1, 2014, 85-113. 2. Macario A, Weinger M, Carney S, Kim A. Which clinical anesthesia outcomes are important to avoid? The perspective of patients. Anesth Analg 1999;89:652-8. 3. Apfel CC, Läärä E, Koivuranta M, Greim CA, Roewer N. A simplified risk score for predicting postoperative nausea and vomiting: conclusions from cross-validations between two centers. Anesthesiology 1999;91:693-700

Poster Presentation
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Incorporating Smoking Cessation into a Preoperative Clinic

Background:

Smoking in the perioperative period increases postoperative morbidity and mortality, while abstinence just 24 hours before surgery is associated with significantly improved outcomes, including decreased rates of ST depression and increased oxygen availability. While most patients are aware of the importance of smoking cessation, especially in the perioperative period, there are many obstacles to quitting for patients who identify as current smokers. There is evidence that patients are more receptive to smoking cessation counseling if it is provided by a physician. The UCSF Prepare Clinic, which sees a majority of patients prior to surgery, is poised in a unique position to provide formal smoking cessation interventions. Unfortunately, there is no formal smoking cessation intervention protocol in place. This project was designed to investigate provider practices and barriers to providing smoking cessation interventions in the Prepare Clinic, as well as to develop a feasible smoking cessation program for the Prepare Clinic.

Methods:

Prepare Clinic providers were surveyed anonymously using Qualtrics survey software to assess current smoking cessation practices and perceived barriers to providing smoking cessation interventions. Based on the survey results, we will design and implement a smoking cessation program for the Prepare Clinic.

Results:

Out of the 15 providers who responded, 8 reported that they “always” or “often” have smoking cessation conversations with patients who identify as current smokers, while 7 reported that they do so “sometimes,” “rarely,” or “never.” When asked what intervention they most often suggest, notable findings included that 33.3% reported nicotine replacement therapy, 14.3% reported in-person classes, and 4.8% reported telephone counseling. Among perceived barriers, providers reported that patients’ other health issues were more pressing, that there was not enough time during patients’ visits, and that there was uncertainty about which interventions to suggest. An analysis of the patients seen in Prepare Clinic revealed that a majority of patients are seen in the clinic within a week of surgery, many on the day before surgery. Based on the barriers found in our gap analysis, and that reaching patients as early as possible will have the greatest benefit for smoking cessation, we are targeting our intervention to occur prior to patients’ Prepare Clinic visits. Medical students working in coordination with the Prepare Clinic will call pre-surgical patients who are identified as active smokers and initiate brief smoking cessation conversations using motivational interview skills. If desired, they will make referrals to the UCSF Fontana Tobacco Treatment Center and the 1-800-NO-BUTTS hotline.

Conclusions: Given the benefits of smoking cessation in the perioperative period and that surgery can be a powerful motivator for smoking cessation, smoking cessation counseling should occur preoperatively. There are multiple barriers for providers to consistently provide
smoking cessation counseling, including the limited time they have with patients with which they must cover many health issues. Calling patients in advance of their surgeries has the benefit of giving patients more time to quit, while simultaneously overcoming the barriers identified in our provider survey. A future area of research will be evaluating the effectiveness of this intervention.

Poster Presentation

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Informing pediatric surgeons about anesthesia-related neurotoxicity: an educational intervention's effect on elective surgeries in children under one year of age

Background: Millions of children each year require general anesthesia (GA), however, the safety of these medications on neurodevelopment is largely unknown. There is now a large body of evidence regarding anesthesia-related neurotoxicity established in animal models, raising concerns regarding translation into humans. Clinical investigations into the potential neurotoxic effects of anesthesia in young children are growing. Recently, federal organizations like the FDA have weighed in on the debate, releasing public warnings about anesthetics and sedatives in young children. Despite these warnings, at our institution, we have noticed a continued large number of infants undergoing elective surgical procedures. We sought to develop an educational curriculum for pediatric surgeons and proceduralists to better inform them about the potential neurotoxic effects of anesthesia.

Methods: We followed Kern’s six-step approach to curriculum development in implementing our educational initiative. A needs assessment in the form of an electronic survey was sent to all pediatric surgeons and proceduralists who regularly request GA, as well as nurse practitioners in the pre-surgical preparation clinic (Prepare). Goals and objectives for the educational intervention were then developed. We created an educational presentation summarizing current neurotoxicity evidence for distribution amongst these pediatric providers; it was presented at a multidisciplinary pediatric conference and distributed electronically as a video, accompanied by a brief written summary. Additionally, an informational pamphlet for parents was produced for dispersal in the providers’ offices and in Prepare. A post-educational intervention survey is pending. Electronic medical record review will be used to quantify the number of elective surgical cases performed in children under age one, over a six-month period, before and after the educational intervention.

Results: All 29 of the electronic survey respondents reported anesthetic neurotoxicity was concerning. Nearly all (93%) identified this topic as a knowledge gap, and only 18% knew of resources available for parents. Medical record review six months prior to intervention revealed 35 elective cases performed in children less than one year of age; the majority (22) were urological procedures such as circumcisions. Post-intervention data will be available starting late March 2017. We hypothesize there will be fewer elective cases performed for children under the age of one, post-educational intervention.

Conclusions: Written and video presentations summarizing current data on anesthetic neurotoxicity may be useful in educating pediatric providers requesting GA for elective surgeries in young children. We hope the materials from this study provide an organized framework for perioperative providers to approach discussions with patients and families about potential risks of anesthesia on the developing brain.

References:

**Poster Presentation**

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**Injury as a Risk Factor for Persistent Pain: Preliminary Results**

There are no prospective studies on persistent pain after trauma. One retrospective study reports an 80% prevalence of pain one year after trauma, but pre-existing pain was not considered (1). We examined the relationship between pre-existing pain and persistent pain three months after traumatic injury and present preliminary results of an ongoing prospective study on patients &gt; 18 years at a level-one trauma center. Patients were interviewed during hospitalization and three months after discharge via phone or internet-based survey. The presence of pain at three months was the primary outcome. We also examined widespread pain index (WPI) as the measure of widespread pain. Data are presented descriptively as mean ± SD, percent and odds ratios (95% CI), adjusted for gender and pre-existing pain. One hundred and fifty-six patients, age 47±17 years, were enrolled; 45 (28%) were eligible for 3-month follow-up; 34% reported pre-existing pain and 78% reported pain at 3 months. Patients with pre-existing pain had a 30% higher prevalence of persistent pain than patients without pre-existing pain (aOR 1.30; CI: 0.2-8.0). In the overall cohort (N=45), the WPI was higher at three months than at baseline (1.75 ± 1.5 vs. 1.09 ± 1.7 respectively). In patients with pre-existing pain (N=14) the WPI was also higher at three months than at baseline (2.5 ± 2.4 vs. 2.0 ± 1.93). The same was observed in patients without pre-existing pain (N=31) (1.6 ± 1.3 vs. 0.45 ± 0.72). These preliminary results suggest that pre-existing pain is a risk factor for persistent pain. Widespread pain index increases at 3-months post injury. Injury is a risk factor for development of persistent pain, regardless of pre-existing pain.

**References**

**Poster Presentation**

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**Insidious Rise in CO2 in Pediatric Patient**

Background Hypercapnia while under general anesthesia can be due to many causes including hypoventilation, rebreathing, increased CO2 production, and increased dead space. Increased CO2 production is frequently encountered in hypermetabolic states such as malignant hyperthermia, isolated hyperthermia, thyroid storm, and pheochromocytoma. In an otherwise healthy patient with no prior exposure to anesthesia, the concern for malignant hyperthermia and its associated rapid deterioration is of increased concern, with the incidence of MH in pediatric patients 1:30,000. Case Description A 6 year old, otherwise healthy, 17kg male, presented for emergent lower extremity open reduction and internal fixation. After an uneventful induction and oral endotracheal tube placement, he was managed with volume control ventilation using an adult circuit. As the case went on, there was a noticeable uptrend of EtCO2 as seen in the graph below refractory to all basic ventilation changes. The patient otherwise remained hemodynamically stable, normothermic, normotensive, with expected heart rate fluctuations based on sympathetic stimulation. Inhalational anesthetics were discontinued for fear of early malignant hyperthermia, and manual ventilation was begun using an Ambubag. ABG was consistent with respiratory acidosis, with no signs of metabolic or electrolyte abnormalities. The remaining portion of the case was managed with manual ventilation and total IV anesthesia during which the patient remained hemodynamically stable and resolution of hypercarbia. Given the patient remained hemodynamically stable, and the combination of anesthetic management alterations led to the resolution of hypercarbia, the treatment for malignant hyperthermia was not begun. At the end of the case, patient was transported to PICU, intubated, for close monitoring given hypercarbia. The MH hotline was contacted and per their recommendations, CK’s were drawn for 24 hours postoperatively and the patient was closely monitored in the ICU. Later that evening, the patient was extubated by the PICU team and remained hemodynamically stable thereafter until discharge. Discussion In an otherwise healthy patient, increased dead space from obstructive processes were deemed unlikely. While hypermetabolic causes were of grave concern, normal vital signs combined with intraoperative blood gas monitoring decreased our concern for malignant hyperthermia. Based on patient's age and weight and normal airway pressures, hypercarbia was unlikely caused by adult circuit use. Lastly, given improvement in hypercarbia with manual ambubag ventilation, machine induced ventilator insufficiency was deemed most likely the cause of hypercapnea in this patient.

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**Poster Presentation**

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Dr. Hanna Schittek University of Southern California
Intraoperative Generalized Tonic-clonic Seizure While Undergoing General Anesthesia for a Left Temporo-occipital Craniotomy

BACKGROUND: While undergoing general anesthesia for a temporo-occipital craniotomy for primary tumor resection a 38 year-old gentleman had a generalized tonic-clonic seizure. Intraoperative seizures under general anesthesia are extremely rare and this event occurred despite the patient receiving both oral and intraoperative intravenous levetiracetam. This event was especially concerning given the patient’s head was being held into place with a Mayfield 3-point fixation head holder and surgery was actively being performed. Upon recognition of tonic-clonic type movement propofol and remifentanil boluses were administered with resultant cessation of the seizure that was followed by significant hemodynamic and physiologic variability.

CASE DESCRIPTION: 38 year old man with history of mild asthma and seizures was found to have a left temporal occipital junction lesion and underwent general anesthesia for left temporo-occipital craniotomy. Patient experienced a seizure at work one month prior to surgery, resulting in an inability to read and visual distortion (“flickering TV effect”). Seen at an outside hospital for syncope, visual auras, and inability to read - referred to neurologist office, during visit experienced a seizure and was sent to the emergency department 2.5 weeks prior to surgery. MRI Brain – left 15mm temporal occipital junction lesion with irregular margins. Pre-operative laboratory values and vitals signs unremarkable. Normal levetiracetam (Keppra) dose (1000mg BID) taken at 3am on morning of surgery with sip of water. Patient induced, intubated, positioned in Mayfield 3-point fixation head holder without incident. Twenty minutes after surgical incision patient experienced a generalized tonic-clonic seizure, remifentanil and levetiracetam were running, and expired sevoflurane was 1.8%. Upon recognition of tonic-clonic type movement, boluses of propofol and remifentanil were administered with resultant cessation of the seizure. The remainder of the operative case, postoperative evaluation including neurological exam, and follow up were unremarkable. Surgical pathology was consistent with glioblastoma and the patient later underwent concomitant radiation and chemotherapy. Recurrent glioblastoma was detected approximately 6 months after initial surgery for which patient underwent subsequent craniotomy.

DISCUSSION: Previous studies have reported intraoperative incidence as low as 3.1 cases per 10,000 and as high as 3.4% among those with a preexisting seizure disorder. Up to 68% of intraoperative seizures were related to surgery, 55% were attributed to patient-related factors, and 30% were directly associated with anesthesia. Multidisciplinary approach to effectively manage patients at risk for perioperative seizures. Determine baseline AED blood levels to ensure perioperative drug compliance and prevent sub-therapeutic levels. Once a seizure takes place, measures must be taken to prevent progression into convulsive status epilepticus (CSE). Benzodiazepines are considered first line drugs for termination of CSE. In the operating room propofol is considered a reasonable first choice. If a grand mal seizure occurs, consider rapid onset neuromuscular blocking agents to reduce the risk of injury due to convulsion if the patient is in a Mayfield (i.e. herniation).
**Poster Presentation**

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Intraoperative Management of Hypoglycemia in a Patient with Nesidioblastosis: A Case Report

Background: Nesidioblastosis, also known as noninsulinoma pancreatogenous hypoglycemia syndrome (NIPHS), is a rare functional disorder of pancreatic beta cells characterized by inappropriate insulin secretion in the presence of hypoglycemia. Although idiopathic nesidioblastosis is diagnosed in infancy, there is now considerable interest in an acquired form in adults, especially after bariatric surgery1,2. Anesthesia providers must take special precautions in caring for these patients in the perioperative setting.

Case Description: A 42-year-old man with cervical spinal stenosis, cerebral palsy, nesidioblastosis, myasthenia gravis, and narcolepsy with cataplexy presented for an elective anterior cervical discectomy and fusion.

Preoperatively: The patient was diagnosed with nesidioblastosis after frequent episodes of random hyperinsulinemia and hypoglycemia which were complicated by hypoglycemic infarcts seen on brain MRI. He reported occasional nighttime hypoglycemic episodes so he is now taking glucagon 1 mg subcutaneously at bedtime. He is followed by his endocrinologist, who recommended continuous glucose monitoring and strict avoidance of insulin during surgery.

Intraoperatively: After induction, an arterial line was placed for close hemodynamic and glucose monitoring, and general anesthesia was maintained using propofol, remifentanil, and sevoflurane. A blood glucose level measured 35 minutes after induction was 88 mg/dL; however, 10 minutes later it was 55 mg/dL so 10 g of 50% dextrose and 1 mg of IV glucagon were given. It improved to 82 mg/dL in 3 minutes and levels were subsequently measured every 10 minutes. Although a continuous dextrose infusion was considered, it was never initiated since levels remained stable between 93-180 mg/dL for the remainder of the case.

Postoperatively: The patient was successfully extubated and transferred to the ICU for close glycemic and respiratory monitoring. Glucose levels remained between 105-133 mg/dL over the next 24 hours and the patient was discharged home the next day.

Discussion: Intraoperative glycemic control in the setting of hyperinsulinemic hypoglycemia presents a unique challenge for the anesthesia provider; surgical stress causes perturbations in metabolism, and most neuroglycopenic symptoms of hypoglycemia are undetectable under general anesthesia. To the author’s knowledge, this is the first case report of intraoperative management of hypoglycemia in a patient with nesidioblastosis, outside of patients undergoing pancreatectomy3. Mainstays of management include using a continuous infusion of glucose-containing solutions, frequent blood glucose monitoring, and emergent treatment of hypoglycemia with dextrose and glucagon. This case highlights successful intraoperative management techniques that can be utilized by anesthesiologists who may encounter an adult patient with nesidioblastosis.

Poster Presentation

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Intraoperative Point-of-Care Ultrasound for Identification of Endotracheal Tube Position in the Pediatric Population

Background Anesthesiologists rely on auscultation and clinical exam to determine correct endotracheal tube (ETT) placement since CXR or fluoroscopy are only rarely available. Several studies have shown that 18-19% of all the intubations result in inappropriate endotracheal tube placement and as high as 11% of malpositioned endotracheal tubes are not recognized after standard auscultation and clinical exam. [1,2] Recently the utility of point of care ultrasound (POCUS) to identify appropriate placement of the endotracheal tube in adults has been demonstrated. This is assessed by identifying the trachea motion secondary to adjustment of the ETT cuff. [3] Importantly, similar utility has yet to be determined in pediatrics. This study sought to evaluate the utility of a POCUS exam to identify appropriate ETT position in a pediatric population by examining measurements of the ultrasound examination to those from routine fluoroscopy.

Methods Pediatric patients (from birth to 10 years old) requiring general anesthesia for cardiac cath procedures involving chest fluoroscopy were consented for the study. The patient underwent induction with verification of appropriate ETT position via standard practice (auscultation and clinical exam). After ETT was deemed to be in appropriate position, an ultrasound linear probe was placed in a midline longitudinal tracheal view and the ETT cuff was identified by assessing for tracheal shape alteration during palpation of pilot balloon (occlude and release test). Once identified, the cuff location was marked on the US image and measurements were obtained to the sternal notch, cricoid cartilage, and thyroid cartilage’s. Transverse trachea view was also obtained to identify the location of the esophagus. Finally, bilateral pleural lung sliding was also evaluated. The patient then underwent chest fluoroscopy that was later reviewed to assess the location of ETT in relationship to the carina. Primary comparison was correlation assessment between the ultrasound measurements to the fluoroscopy measurements. Specifically, the fluoroscopy measurement of the carina to the ETT tip plus the measured distance of the balloon cuff to the tip of the ETT was compared to the ultrasound measurement of the thyroid cartilage to the cuff of the ETT. In addition, the incidence of inappropriate ETT location was also compared between the auscultation/clinical exam and both the ultrasound and fluoroscopy examinations. Finally time to perform the POCUS exam was also recorded.

Results Preliminary results indicate 100% detection/visualization of the ETT cuff with the POCUS exam. Average time to perform the exam was 163 secs (stdev = 67sec). A strong correlation (R=0.98) was demonstrated between the fluoroscopy measurements to the ultrasound measurements (p=0.024). Currently, all exams (auscultation, fluoroscopy, and ultrasound) have demonstrated appropriate ETT placement. Additionally, the POCUS exams have demonstrated 100% visualization of the esophagus, with 80% demonstrating the esophagus to be to the left of the trachea.

Conclusion Preliminary data suggests that airway POCUS is a fast and reliable modality to verify adequate depth of the ETT in the pediatric population.

Poster Presentation
Intraoperative Real-time Three-Dimensional Transesophageal Echocardiography (RT3DE) to Objectively Assess Improvement in Synchronization and Regional Wall Motion after Coronary Reperfusion

Background: Quantitative evaluation of Regional Wall Motion Abnormalities (RWMAs) induced by myocardial ischemia can be performed using Transesophageal Echocardiography (TEE). However, this relies on a subjective visual assessment of wall segments. A key advantage of RT3DE is a fast and automated analysis of Left Ventricle (LV) function while accounting for errors in geometric assumptions. We present a case report which illustrates the intraoperative use of RT3DE during coronary artery bypass surgery to objectively assess LV volumes, LV systolic function, RWMAs, and cardiac synchronization following coronary reperfusion.

Case Report: A 50-year-old female presented to Harbor-UCLA Medical Center (Torrance, California, USA) with unstable angina. Cardiac catheterization revealed an occlusion of the proximal Left Anterior Descending (LAD) Artery with collateral filling of the distal LAD. Preoperative Transthoracic Echocardiography (TTE) showed a mildly reduced Left Ventricular Ejection Fraction (LVEF) of 40-45% and RWMAs involving basal to mid-anterior and anteroseptal walls. She underwent an uneventful single vessel off-pump Left Internal Mammary Artery (LIMA) to LAD bypass. An intraoperative TEE was performed after induction and 30 minutes after coronary reperfusion. A multiplane phased array TEE probe (X7-2t transducer) was used and images were acquired using a Phillips iE33 xMatrix Ultrasound Imaging System (Phillips Medical Systems, Bothell, Washington). Digital RT3DE images were analyzed using prototype software (QLAB, 3DQ-Advance, Philips Medical Systems). Two-chamber and four-chamber views were selected and 5 individual points were placed along endocardial border and the automate software traced the endocardial border inside the LV cavity during end diastole and determined the voxel count inside the LV cast to derive the End-Diastolic Volume (EDV). The same process was repeated for the end-systolic frame deriving the End-Systolic Volume (ESV). The software generated baseline ejection fraction was calculated at 41.8% based on these measurements. Pre-reperfusion parametrics also revealed dyssynchrony of the anterior wall segments in the LAD territory (segments 1, 7, and 13). Similar LV data was performed post-reperfusion and analysis was carried out in a similar fashion using the software. Improvement in anterior wall motion, synchronization, and LVEF (49%) was seen post-reperfusion in the LAD territory.

Discussion: RT3DE can a beneficial and objective intraoperative tool for quantitative assessments of LV volumes, LV systolic function, and RWMAs before and after coronary reperfusion. Parametric imaging also revealed abnormal timing and the extent of segmental contraction in the anterior wall. Evaluation of LV systolic function and LVEF is more reproducible and accurate with RT3DE as compared with two-dimensional and M-mode techniques. Therefore, RT3DE may provide a useful standard for quantification. Further studies
are needed to validate the utility of intraoperative RT3D TEE to directly and objectively assess the effects of coronary reperfusion on LV dynamics.

**Poster Presentation**

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Intraoperative Surveillance with Transesophageal Echocardiography during Cesarean Section

Background: Transesophageal echocardiography (TEE) was developed in the 1960s with its potential applications that found its way into cardiac anesthesiology for intraoperative surveillance during cardiopulmonary bypass, heart valve management, and other cardiac procedures. To our knowledge, TEE is uncommonly used in obstetric anesthesia, and has never been used for surveillance of a tumor thrombus that was at risk of embolizing during cesarean section. We present a parturient whose intraoperative management benefitted from the use of transesophageal echocardiography.

Case Description: A 16 year old G1P0 parturient at 37 weeks of pregnancy presented to us from an outside hospital for higher level of care due a recently diagnosed renal mass. She endorsed a five month history of left upper quadrant discomfort that was routinely dismissed as pregnancy-related problem. Eventually, an MRI from an outside hospital performed at 27 weeks of gestation revealed a large mass arising from her left kidney. Further imaging with ultrasound measured it to be 21cm by 15cm in size. Her management was further complicated by the discovery of a large IVC thrombus in the suprahepatic region that was not amenable to IVC filter placement. Given the concern for potential embolization of this thrombus during labor, a multidisciplinary meeting deemed a cesarean section was a safer option given the better control of hemodynamics. However, the autotransfusion that normally follows delivery presented a concerning complication given this additional volume may allow for the thrombus to migrate towards the heart and cause a catastrophic cardiovascular collapse. Additionally, the team agreed it would be safer to manage the renal mass several weeks after delivery when her cardiovascular status had returned to the baseline of a nonparturient.

General anesthesia with invasive blood pressure monitoring was performed in anticipation of possible cardiopulmonary bypass in the event of thrombus migration. We performed a spinal anesthetic prior to induction for postoperative analgesia. A baseline TEE revealed the thrombus size to be 33mm by 37mm which occupied over 95% of the IVC. It extended proximally 2.5cm distal to the IVC/hepatic vein junction. We visualized small slit-like blood flow on color Doppler flowing around the tumor thrombus and up towards the IVC. Her vitals were kept stable with the goal of avoiding wide hemodynamic changes. She quickly delivered a neonate with APGAR scores of 2, 5, and 8 at 1 minute, 5 minutes, and 10 minutes respectively. A second evaluation with TEE at the end of the surgery noted the tumor thrombus to be unchanged in position and morphology.

Discussion: This particular case provided a challenge to the anesthesiology team because of the anticipated hemodynamic shifts that could potentially allow the tumor thrombus to embolize to the heart. We focused on an anesthetic technique with minimal hemodynamic perturbation, and with judicious use of intravenous medications to maintain her vitals within 20% of her baseline. Intraoperative TEE surveillance was also a powerful tool to assess the status of the thrombus and to predict the need for the vascular surgery team in the patient’s management.
Poster Presentation

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Intubated, Cannot Ventilate: A Proposed Addition to the ASA Difficult Airway Algorithm

Presenter: Debbie Fretwell, MD, Resident University of California San Diego Authors: Debbie Fretwell, MD, Resident Dan Lee, MD, PhD (Faculty Mentor) Background The Difficult Airway and its management remains challenging at times even for a well-trained and skilled anesthesiologist. First published in 1993, the ASA’s “Difficult Airway Algorithm” proposes interventions for unsuccessful intubation attempts. What about a successfully intubated patient who cannot be ventilated? Aside from a little known flow diagram published by Hosking et al in 1989 for forward military hospitals, we know of no existing established guidelines for the recommended sequence of airway interventions for “intubated, cannot ventilate” situations. Case Description We will present a discussion of the challenges and successes of three unique cases in which a patient was successfully intubated, but could not be adequately ventilated. Case one involves a 4 month-old burn ICU pediatric code that presented a diagnostic dilemma and took 20 minutes to resolve. Case two involves a 9 year-old patient in with Tetralogy of Fallot, post-thoracotomy hemorrhage, and progressive difficulty ventilating ultimately requiring ETT exchange. Case three explores the added difficulties of troubleshooting in a prone-positioned patient during lumbar laminectomy with acute onset of inability to ventilate that eventually required exchange to an armored endotracheal tube. Discussion Every anesthesiologist is likely to experience a situation in which a patient has an endotracheal tube (ETT) verified between the vocal cords, or tip visualized within tracheal rings, but who cannot be effectively ventilated. Diagnosing difficult ventilation in an intubated patient should be systematic and include mechanical versus pathological etiologies. The stakes are high and the consequences of not resolving such a situation in a timely manner are potentially devastating. We propose a novel algorithm, that could serve as an additional arm of the ASA’s Difficult Airway Algorithm, that offers guidelines to organize an efficient clinical approach to the management of the “intubated, cannot ventilate” scenario.

Poster Presentation

Presenting Author: Dr. Deborah Fretwell University of California, San Diego

Authors:

Dr. Deborah Fretwell University of California, San Diego
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Investigating Bupivacaine-induced Cardiotoxicity and Intralipid Rescue in Pregnant Rats

Background: Pregnant patients routinely get neuraxial anesthesia for labor and delivery. Bupivacaine is one of the most commonly used local anesthetics in obstetric anesthesia. Some laboratory studies have suggested that pregnancy increases the cardiotoxicity of Bupivacaine. We have previously shown that Intralipid (ILP) rescues the heart from Bupivacaine-induced cardiotoxicity in male rats. However, Bupivacaine cardiotoxicity and ILP rescue have not been extensively studied in pregnant rats. We aimed to investigate the cardiotoxicity of Bupivacaine and the potential of ILP’s rescue in pregnant rats.

Methods: Pregnant female rats (200-350g, n=5) were used for the study. Rats were anesthetized intraperitoneally with a mixture of Ketamine (80 mg/kg) and Xylazine (8 mg/kg). Tracheostomy was performed using a 16-gauge angiocatheter and rats were ventilated with a ventilator. Femoral vein was accessed through a 24-gauge intravenous catheter. Body temperature was maintained at 37°C. Rats received Bupivacaine bolus (10 mg/kg, IV over ~20 seconds) to induce asystole. Resuscitation with ILP 20% (5 ml/kg bolus, and 0.5 ml/kg/min maintenance) and chest compressions were initiated. Serial B-Mode and M-Mode transthoracic echocardiography was continuously performed using a VisualSonics Vevo 2100 system equipped with a 30-MHz linear transducer. Standard Lead II Electrocardiograms were acquired under anesthesia continuously throughout the experiment. The ejection-fraction (EF%), fractional shortening (FS%), and heart rate (HR, beats per min) were calculated at baseline and at 1, 5, and 10 minutes after ILP treatment.

Results: All five rats developed cardiac arrest within a few seconds after a toxic dose of Bupivacaine. Interestingly, only 2 out of the 5 rats were rescued with ILP using the usual rescue dose typically used in male rats. Baseline EF and HR were 66.30±2.99% and 310±34 bpm respectively. One minute after ILP, EF and HR were 38.24% and 143 bpm. Five minutes after ILP, EF and HR were 57.62% and 227 bpm. Ten minutes after ILP, EF and HR were 59.49% and 270 bpm. In the no recovery with intralipid group of rats (n=3) the average baseline EF and HR were 69.28±0.57% and 331±65 bpm. Ten minutes after ILP, EF and HR were 0. Conclusions: ILP unreliably rescued Bupivacaine-induced cardiac arrest in pregnant rats. More experiments are needed to find out the optimal rescue dosage regimen of ILP for Bupivacaine-induced cardiac arrest in pregnant rats. Physiologic changes associated with pregnancy, sensitivity to Bupivacaine, pregnancy-induced heart hypertrophy and changes in cardioprotective signaling cascades may be responsible for the unreliable rescue of Bupivacaine cardiotoxicity by ILP in pregnancy.

Oral Presentation

Presenting Author: Dr. Caitlin Sherman UCLA Department of Anesthesiology and Perioperative Medicine

Authors:

Dr. Caitlin Sherman UCLA Department of Anesthesiology and Perioperative Medicine
Dr. Catherine Cha UCLA Department of Anesthesiology and Perioperative Medicine
Investigating the Cardiotoxicity of Liposomal Bupivacain (Exparel) in Rats: The Role of Intralipid Rescue

Background
Liposomal bupivacaine has been studied and applied in clinical practice in order to provide long-lasting pain relief after a single dose. Exparel is a formulation of bupivacaine encapsulated in multi-vesicular liposomes, developed for surgical wound infiltration for postsurgical anesthesia. The liposomes have been shown to increase the drug’s stability and extend its duration of action, with recent studies showing bimodal kinetics and rapid uptake during the first few hours and prolonged release over 96 hours. Exparel may prevent accumulation of bupivacaine in blood and/or tissues; thus, it may decrease the risk of central nervous or cardiovascular toxicities. Administration of Exparel has its risks. There is concern that non-bupivacaine based local anesthetics may cause immediate release of bupivacaine from Exparel when administered concomitantly. The cross-reactivity may potentially place the patient at risk for local anesthetic toxicity especially when total local anesthetic use is unclear. Because Exparel is a white solution, another concern is inadvertent intravenous injection of the local anesthetic if mistaken for propofol leading to systemic toxicity. The maximum dosage of Exparel for adults is ~266 mg; however, the maximum mg/kg dosing limit is not known. There have been no formal studies conducted on Exparel’s actual toxic dose in mg/kg and if use of Intralipid 20% can reverse its toxicity. The study’s aim is to determine Exparel’s toxic dose in mg/kg and if Intralipid 20% can reverse its cardiotoxic effects.

Methods
Female rats (200-300 gm) were used for the study. Asystole was attempted with different IV dosages of Exparel (25 mg/kg, 15 mg/kg, 7.5 mg/kg over 10 seconds). For the second part of the experiment, asystole was induced with Exparel (15 mg/kg over 10 seconds, IV), and resuscitation with Intralipid 20% (5 ml/kg bolus and 0.5 ml/kg/min maintenance) was started immediately along with chest compressions. Heart rates and ejection fractions (EF) were measured using continuous transthoracic echocardiography at 1, 5, and 10 minutes after cardiac arrest. Results
We found that a dose of 25 mg/kg of Exparel caused cardiac arrest immediately. Next we decreased the dose of Exparel to 15 mg/kg, that was still enough to cause immediate cardiovascular collapse. Exparel 7.5 mg/kg did not induce cardiovascular collapse; instead, it caused wide complex tachycardia which resolved in 5 minutes with no intervention. Intralipid rescue of Exparel cardiotoxicity was found to be unpredictable. EF, HR, EKG were improved from cardiac arrest the most at 1 min after Intralipid rescue and continued to deteriorate when measured at 5 min and 10 min after the initial bolus dose. Conclusion
We found a dose of Exparel that reliably induced cardiotoxicity in rats. More experiments are needed to determine Intralipid’s dosage that can reliably reverse Exparel toxicity. Based on our results, Intralipid is unreliable in rescuing Exparel induced cardiotoxicity at the dosage regimen used.

Oral Presentation

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Is Local Anesthetic Injection through the Needle Associated with Interscalene Catheter Failure?

Background:

The interscalene continuous peripheral nerve block (CPNB) is an effective regional anesthesia technique for prolonged analgesia after various painful shoulder and proximal arm surgeries. Secondary block failure, defined as failure of the block catheter to provide postoperative analgesia, is a frequent known complication.1 We hypothesize that injection of local anesthetic (LA) through the needle (TTN) prior to the insertion of a catheter can lead to undiagnosed improper catheter placement potentially resulting in a higher catheter failure rate compared to LA injected through the catheter only (TTC).

Methods:

Our Institutional Review Board approved this retrospective chart review study. All patients receiving an interscalene CPNB catheter at a single institution for postoperative analgesia and admitted for at least 24 hours were identified from July 2015 to June 30, 2016. We excluded patients on &gt;30 mg morphine equivalents daily and those in whom injection technique could not be confirmed from charting. All blocks were performed by trainees (residents or fellows) supervised by an experienced regional anesthesia attending physician. Injection technique was determined by the procedure note charted in our electronic medical record. A secondary survey of the attending physicians was performed to confirm injection technique and practices. Primary outcome was visual analogue scale (VAS) pain scores at 7am on postoperative day 1, with secondary outcomes of opioid requirements in the postanesthesia care unit (PACU) and 24 hours after discharge from PACU. Data were analyzed for normality using the Shapiro-Wilk test and nonparametric data compared with the Mann-Whitney U test using R Studio open source software.

Results:

During the study period, 306 patients received an interscalene CPNB catheter and 205 met inclusion criteria. 24 patients had LA injected TTN and 181 injected TTC. Mean (SD) VAS at 7 am was 3.44 (2.78) TTC vs. 2.32 (2.41) TTN; p=0.0418. Opioid requirements (mg morphine equivalents) in the PACU was 17.2 (26.5) TTC vs. 31.33mg (34.82) TTN; p=0.0445. Opioid requirements at 24 hour was 64.4mg (68.64) TTC vs. 131.35mg (121.02) TTN; p=0.0003.

Conclusion:

Our study shows that patients in the TTC group reported better pain scores at 24 hours and required less opioid both in the PACU and at 24 hours compare to the TTN group suggesting better analgesia in the TTC group. Only 1 prior study has compared the 2 injection modalities but only to assess the effect on primary failure and not on secondary failure.2 Our study is
limited by its retrospective nature. It is also possible that the difference is linked to other factors such as technical variations within each supervising attendings’ practice.

References

Poster Presentation

Presenting Author: Dr. Dan Moy Stanford University

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Dr. Dan Moy Stanford University
Dr. Jean-Louis Horn Stanford University
It's a Pheo...Baby! Perioperative Management of a Catecholamine Secreting Tumor in an Infant with Heart Failure

Neuroblastoma (NB) is one of the most common solid tumors of infancy. It can present with a variety of symptoms related to size and/or metabolic activity of the tumor. While affected children almost invariably have elevated circulating catecholamine (CCM) levels, it is rare for stigmata of CCM excess to be the hallmark of the clinical presentation. We present a novel approach to periop preparation of a 16-day old full-term neonate who presented in cardiogenic shock in the setting of a 5x5 cm CCM secreting NB. While previously published cases of NB causing sympathetic surge have described using phenoxybenzamine for pre-op alpha blockade, we successfully managed this patient’s pre-op state with a labetalol infusion alone. To our knowledge this is the first case reported in which the CCM secretion caused overt heart failure in an infant. The patient initially presented to an OSH ER with several days of lethargy and anorexia. In the ER, she was found to be hypothermic, hypogylemic, bradycardic, and subsequently went into full cardiac arrest. She was successfully resuscitated and transferred to our institution. An echocardiogram revealed biventricular hypertrophy and biventricular cardiomyopathy with reduced systolic function. An abdominal ultrasound, followed by MRI suggested the diagnosis of NB, which was confirmed with a Urine VMA assay. In the PICU she remained intubated, receiving inodilator support with milrinone. She developed ectopic atrial tachycardia with ventricular response rates as high as 210 bpm. A labetalol infusion was started in order to prepare her for surgical excision of her tumor. She remained on the infusion for several days. Once her response to alpha and beta blockade with labetalol was deemed adequate, she presented to the OR for surgical excision. Anesthesia was induced with sufentanil, sevoflurane and vecuronium. Anesthesia was maintained with Precedex and sufentanil infusions. We discontinued labetalol infusion as we were achieving hemodynamic stability within our goals from our anesthetic agents, and milrinone was maintained for inotropy. The patient remained stable throughout the resection, with minimal blood loss and without evidence of CCM surges or withdrawal during tumor manipulation and resection. The patient did well in the postop period. She was discharged on POD13. On 6 month follow-up, patient had improvement in her tachycardia induced cardiomyopathy. At 1 year follow-up, she was transitioned off all meds, remained asymptomatic and was demonstrating normal growth and developmental milestones.

Poster Presentation

Presenting Author: Dr. Matt Careskey UCSF Medical Center

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Dr. Matt Careskey UCSF Medical Center
Dr. Scott Schulman UCSF Medical Center
Ketamine Anesthesia for Improvement of Depression in Electroconvulsive Therapy: Outcomes from an Ongoing Prospective Clinical Trial

Background: Alteration of brain derived neurotrophic factor (BDNF) has been suggested as a mechanism of ketamine’s anti-depressant effects. Although ketamine use during electroconvulsive therapy (ECT) has gained support, studies have been equivocal regarding its efficacy. The aim of this prospective dual-arm randomized clinical trial is to evaluate ketamine’s anti-depressive effects and plasma BDNF changes when used as a primary anesthetic for ECT.

Methods: Subjects undergoing ECT index course were randomized and blinded to receive either methohexital (1.0mg/kg) or ketamine (1.0mg/kg) anesthesia. Demographics, periprocedural hemodynamics, seizure data, depression severity using self-reported and clinician-assessed questionnaires were gathered before and after ECT. Cognitive scoring and plasma BDNF concentrations were also obtained before and after ECT.

Results: There were no differences in demographics, hemodynamics, seizure lengths or cognitive scores between the ketamine (n=11, 72 ECTs) and methohexital (n=11, 59 ECTs) groups. Ketamine caused more significant improvement in depression after final ECT (clinician-assessed questionnaire; p=0.02) and 72 hours later (self-reported questionnaire; p=0.01) compared with methohexital. Higher pre-ECT plasma BDNF were correlated with better pre-ECT PHQ-9 scores (p=0.01). Though pre-ECT plasma BDNF serum levels were similar in both groups (p=0.71), BDNF increased after ECT only in the ketamine arm (p=0.01).

Conclusions: Our data suggest that ketamine may be beneficial as an anesthetic for ECT and that plasma BDNF correlates with the severity of depression supporting the neurotrophic hypothesis of depression. Further studies are warranted to evaluate sustainability of ketamine’s anti-depressant effects in ECT and role of BDNF as a marker of depression.

Oral Presentation

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Ketamine Reduces Post-Traumatic Brain Injury Neurogenesis and Improves Outcomes in Mice

Introduction: Traumatic brain injury (TBI) is a potentially devastating condition affecting millions of people each year, which can burden survivors with memory deficits, depression, emotional lability and loss of independence. TBI induces a dramatic neurogenic response in the hippocampus with unknown longer-term consequences: new neurons may compensate by assuming the functions of disrupted circuits, or interfere with hippocampal function, as injury-generated neurons have aberrant positioning and branching phenotypes. As anesthetic and sedative drugs are known to modulate neurogenesis, here we evaluate how ketamine-induced modulation of NMDA receptors, which are known to affect neurogenesis, impact the production of adult-born neurons and behavioral outcomes after TBI in mice.

Methods: In accordance with IACUC-approved protocols, wild-type mice underwent controlled cortical impact (CCI) model of TBI vs. sham (non-injury), followed by immediate initiation of ketamine or vehicle infusion via osmotic drug pump. Pumps were removed after 1 week. Neurogenesis and other cellular responses were assessed using immunohistochemistry at 2 and 6 weeks post-injury, to evaluate mitotic activity (BrdU) and the production of new neurons (doublecortin & NeuN), astrocytes (GFAP) and microglia (Iba1) in the granule cell layer of the hippocampal dentate gyrus. Behavioral testing of hippocampal dependent tasks was accomplished via Morris Water Maze (MWM) Reversal test at 4 weeks after injury.

Results: CCI induced dramatic cellular proliferation in vehicle-treated animals. Injury-induced neurogenesis was not apparent at the 2-week time point but was significantly increased by 6 weeks, suggesting increased survival of injury-born neurons; ketamine exposure abolished this effect on neurogenesis but not the effect on overall cell proliferation. CCI increased the production of new astrocytes in vehicle-exposed mice and increased new microglia in the ketamine exposed group. Behavioral testing revealed impaired spatial learning and memory after CCI; ketamine exposure prevented this deficit.

Conclusions: CCI triggers a robust proliferative response in the dentate of the hippocampus characterized by increased neuron and astrocyte creation. However, behavioral testing revealed impaired hippocampal learning and memory in these mice. Ketamine administered in the immediate post-injury period reduced this neurogenic and astrogenic response; but surprisingly, these mice performed equivalently to non-injured mice in MWM Reversal. These results suggest that, rather than improving function, injury induced neurogenesis could impair performance in certain hippocampus-dependent tasks, possibly by preventing the generation of aberrantly projected new granule cells.

Oral Presentation

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Labetalol Reduces Mortality and Improves Neurologic Outcome Compared to Nicardipine in Intracerebral Hemorrhage

Background: Intracerebral hemorrhage (ICH) increases sympathetic tone and leads to hypertension. Acute blood pressure reduction after ICH has been studied as a way to decrease hemorrhage growth and improve outcomes, with optimal blood pressure goals remaining unclear. The INTERACT2 trial randomized patients to systolic blood pressure (SBP) &lt;180 mmHg or &lt;140 mmHg, and it predominantly utilized α/β-blockers that modulate sympathetic tone. This trial found improved modified Rankin Scores (mRS) among those randomized to lower SBP goals. Conversely, another major trial, the ATACH-2 trial, which used nicardipine only, found no benefit to intensive blood pressure control. Given these disparate trial findings and prior basic research supporting a benefit from β-blockers in ICH, it is conceivable that the discrepancy between the two large clinical trials is related to the specific antihypertensives utilized. To further examine this possibility, this study compares outcomes between patients receiving labetalol or nicardipine to control hypertension in ICH.

Methods: Prospective data from ICH admissions at a single center from July 2010 to June 2015 were reviewed. Patients receiving labetalol, nicardipine, or both during their first week of hospitalization were included. Patients receiving nicardipine were propensity matched with those receiving labetalol or both medications using demographic covariates, comorbidities, and measures of ICH severity. Outcomes included in-hospital death, mRS at discharge, and infection during hospitalization (urinary tract infection, pneumonia, or bacteremia). Death and infection were analyzed with Kaplan-Meier curves, and mRS values were compared with ordinal logistic regression.

Results: Of the 1,066 ICH admissions, 261 (24.5%) patients were treated with labetalol, 68 (6.4%) were treated with nicardipine, and 252 (23.6%) received both. Mortality and infection rates were 27.8% and 13.2% respectively. There was an association between reduced mortality and receiving labetalol (OR: 0.49, 95% CI: 0.27 - 0.88, p = 0.016) or both medications (OR: 0.42, 95% CI: 0.23 - 0.77, p = 0.005). Labetalol was also associated with lower mRS values at discharge (OR: 0.48, 95% CI: 0.25 - 0.94, p = 0.033). Patients receiving both medications, however, had similar mRS values to those receiving only nicardipine (OR: 0.86, 95% CI: 0.43 - 1.70, p = 0.665). Compared to patients receiving nicardipine, infection rates were similar in patients receiving labetalol (OR: 1.11, 95% CI: 0.34 - 3.65, p = 0.864) or both medications (OR: 1.58, 95% CI: 0.54 - 4.66, p = 0.407). Conclusions: This study found significantly reduced odds of death and lower mRS values at discharge for patients who received labetalol instead of nicardipine for management of hypertension after ICH. Patients who received both medications had similar mortality rates and mRS values as those who received only labetalol, suggesting a benefit from labetalol as opposed to harm from nicardipine. These improved outcomes did not seem to be driven by reductions in infection, as there was no difference in overall infection rates between the study groups.

Oral Presentation
Presenting Author: Dr. Jordan Starr University of Washington

Authors:

Dr. Jordan Starr University of Washington
Dr. David Tirschwell University of Washington
Dr. Kyra Becker University of Washington
Laparoscopic Adrenalectomy (2017) s/p Neoadjuvent Chemotherapy, Left Pneumonectomy and Pulmonary Artery Angioplasty/Mobilization of Tumor Off Aorta on Cardiopulmonary Bypass for Stage 3 (pT4N2) Left Lung Adenocarcinoma

Locally Advanced T4N2 non-small cell lung were noted to have a median progression-free survival of 13 months, median overall survival of 20 months and 71%, 40.3% and 28.2% of patients survived 1, 2 and 3 years after diagnosis, respectively, in a study performed by Arsian et al (1). A study by Varela et al in Journal of Thoracic Disease deemed operative resection of T4N2 non-small cell cancer “anecdotal and debated considering such categories as unresectable disease with a dismal prognosis of about 7%” (2). After one tertiary referral center in Los Angeles concluded our patient with stage IIIB (T4N2) lung adenocarcinoma not to be a candidate for treatment, Dr. Robert McKenna performed a left pneumonectomy, pulmonary artery angioplasty and mobilization of tumor off aorta on cardiopulmonary after the tumor responded to neoadjuvent chemotherapy in 2013. Patient did not have evidence of recurrence on chest PET scans every 6 months and prior to conversion to annual surveillance chest, abdomen and pelvis PET scan revealed an adrenal mass that was noted to not to have endocrine activity on subsequent testing. In 2017, a laparoscopic adrenalectomy was performed with a double lumen tube and one lung ventilation. In this presentation, will discuss cardio-pulmonary bypass, one-lung ventilation and anesthetic consideration for thoracic pneumonectomy and laparoscopic abdominal surgeries.

Poster Presentation

Presenting Author: Dr. Ali Qaderi Cedars Sinai Medical Center

Authors:

Dr. Ali Qaderi Cedars Sinai Medical Center
Lighting up while on oxygen: An emergent intubation in the setting of self induced airway fire

Background: Airway fires can result in respiratory compromise and have fatal consequences if quick evaluation and appropriate interventions are delayed. We report a case of an acute airway fire in the setting of oxygen and tobacco use requiring emergent intubation.

Case Description: A 54-year-old male with a past medical history of asthma, hypertension, hyperlipidemia and tobacco use presented to the emergency room complaining of shortness of breath. He was found to be saturating in the low 90s, heart rate of 89 beats per min, and blood pressure of 143/87 mmHg. He was placed on oxygen via nasal cannula with improvement of his oxygen saturation to 98%. While awaiting the remainder of his evaluation, the patient decided to light up a cigarette. This resulted in an immediate combustion reaction and significant facial burns. The emergency room team quickly removed the patient’s oxygen and extinguished the fire with saline. The patient was noted to have facial, nasal, and oropharyngeal burns as well as edema. He was brought to the operating room for emergent intubation. An awake fiberoptic intubation was performed and a 7.5 oral endotracheal tube was placed. The otolaryngology team was also present for emergent invasive airway placement if intubation was not successful.

Discussion: Airway fires require rapid identification and termination while ensuring establishment of adequate ventilation. Evidence of airway or inhalation injury after a burn incident include singed facial or nasal hair, carbonaceous deposits, blisters, or edema in the oropharynx, burns on the face or neck, hoarseness, or stridor. These clinical signs indicate the possibility of impending airway obstruction and a secure airway should be considered. Anesthesiologists encounter airway fires in the setting of inhalation injuries from smoke, heat, or chemical exposure as well as in the operating room, particularly when use of electro cautery or lasers are near the airway.

In order for a fire to occur, three elements, commonly known as the “fire triad,” must converge simultaneously: 1) an oxidizing agent, 2) a fuel source, and 3) an ignition source. Once an airway fire has been identified, immediate efforts should be made to curtail further damage by removing elements of the triad. The American Society of Anesthesiologists have designed an algorithm for fires that occur in the operating room, which include measures to prevent fires, identify high risk situations, and execute actions necessary to manage operating room fires. If a fire occurs, all gas flows should be discontinued, flammable materials removed, fire extinguished with saline, and if an endotracheal tube is in place at the time of the fire, it should be immediately removed. Ventilation should be reestablished as soon as safely possible with room air. Not every burn patient requires intubation, however if airway patency is of concern, intubation should not be delayed.

Poster Presentation
Presenting Author: Dr. Nicole Yin Department of Anesthesiology & Perioperative Medicine, David Geffen School of Medicine, UCLA

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Dr. Reza Borna Department of Anesthesiology & Perioperative Medicine, David Geffen School of Medicine, UCLA
Limb Amputation and Postoperative Epineural Catheter Infusion for Treatment of End Stage CRPS

CASE: We present a 49 year old male with Complex Regional Pain Syndrome type I that resulted from arthroscopic knee surgery. Symptoms became progressively more severe over 18 years, refractory to multiple therapies including high dose opiates, antiepileptics, sympathetic and spinal blocks, nerve ablations, epidural infusions, neurostimulation trials and ketamine infusions. He ultimately elected to undergo a controversial above knee amputation. However, to minimize CRPS spread and phantom limb pain, he received 4 weeks of postoperative local anesthetic infusions through a sciatic nerve epineural catheter. He is now pain free and no longer wheelchair bound with the aid of a prosthetic limb.

DISCUSSION: Amputation for treatment resistant CRPS-1 remains controversial. There are a number of associated risks: (a) CRPS recurrence in stump, (b) spread to other limbs, and (c) phantom limb pain. However, select patients have resolution of symptoms and improved quality of life after amputation. Because potential complications can be severe, we suggest a strategy to decrease risk of amputation-associated morbidity. We propose a postoperative local anesthetic infusion to a target nerve. In this particular patient, we discovered success with the aid of a dense, continuous peripheral nerve block of extended duration (lasting weeks rather than days). This strategy may permanently help reorganize spinal and cortical pain mapping, thereby helping prevent complications associated with amputation of a limb affected by CRPS.

Poster Presentation

Presenting Author: Dr. Ajit Rai Department of Anesthesiology & Perioperative Medicine, David Geffen School of Medicine, UCLA

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**Lipomatosis presenting as stridor in a newborn**

Introduction: A lipoma is a tumor of soft tissue that occurs very rarely in the oral cavity. We present a case of an infant presenting with stridor who was found to have two soft palate masses consistent with introral lipomas causing airway obstruction.

Case Report: The patient is a 9 day old infant who was born at full term with dysmorphic features. He was noted to have stridor and increased work of breathing since birth, but it improved within the first few days of life. He was transferred to our institution from an outside hospital for neurological and genetic workup, and he subsequently underwent an MRI brain under GA with an LMA. Afterwards, he developed worsening stridor that improved with CPAP. OHNS was consulted, and upon examination under flexible nasolaryngoscopy, a soft palate mass that extended into the oropharynx was seen. Then patient was taken to the OR for excision and biopsy. At this point, the patient was tachypneic and had an increase work of breathing. Given concern for a difficult intubation as well as airway obstruction with positive pressure ventilation, we decided to perform an awake nasal fiberoptic intubation. Initial attempts by the anesthesiologist were not successful due to secretions and grimacing. The OHNS fellow attempted afterward, and after suctioning was able to secure a 3.5mm ETT in the left nare. Examination revealed two 3cm pedunculated soft tissue masses emanating from the superior tonsillar fossa bilaterally, as well as a bifid uvula and ankyloglossia. Patient underwent resection of the masses, partial tonsillectomy, and frenulectomy. He was stable on pressure support and was extubated POD#2. Patient afterward was noted to have mild intermittent stridor but was stable on room air with no desaturations or increased work of breathing. Biopsy from resected masses revealed lipomatosis.

Discussion: This case illustrates a rare presentation of a lipoma that resulted in an unusual cause of stridor. Oral lipomas have an incidence of 1-5%, with no cases reported earlier than 6 weeks of age.1,2 Although rare, it is a diagnosis to consider when evaluating a patient with stridor. If there is a need to intubate, it is best to involve OHNS colleagues and perform flexible awake fiberoptic intubation if possible.

References:


**Poster Presentation**

**Presenting Author:** Dr. Elaine Nguyen UCSF Medical Center

**Authors:**

Dr. Elaine Nguyen UCSF Medical Center
Dr. Marla Ferschl University of Cal
Local Anesthesia Toxicity: managing anesthesia emergencies outside of the operating room

Background: The FDA estimates at least one death occurs everyday and over one million injuries occur each year, in the United States, because of medication error. The causes include poor communication, ambiguity in orders, patient misuse due to misunderstanding and lack of training. Local anesthesia systemic toxicity (LAST) most commonly occurs in the perioperative setting, but a recent review of LAST cases in literature found that 31% of cases occurred outside of the OR. Education focusing on LAST is limited outside of anesthesiologists and perioperative nurses leaving room for error.

Case Report: A 74-year-old female with a history of asthma, congestive heart failure, an implantable cardioverter-defibrillator (ICD) for intermittent ventricular arrhythmias and chronic kidney disease had been admitted for an upper respiratory infection. She had an uneventful hospital course and was being prepared for discharge when a code blue was called for sudden onset and persistent tonic clonic seizures. When the code team arrived, the patient was exhibiting rhythmic movements of upper and lower extremities, was incontinent of urine, and had blood in the oropharynx from a fresh tongue laceration. Intravenous lorazepam was effective in terminating the seizure. She was intubated for airway protection. Her electrocardiogram evolved from sinus tachycardia to ventricular tachycardia. Her ICD discharged and restored her to sinus tachycardia. No etiology of the new onset seizure was immediately clear: the most recent labs were within normal limits and no changes had been made in her medications. A stat head computerized tomography (CT) scan was unremarkable. Shortly after arrival to the ICU, the floor team contacted the ICU team to report a medication error. Immediately prior to the code, the patient received IV potassium supplementation for mild hypokalemia. Lidocaine is routinely ordered for infusion pain with IV potassium (2ml of 1% lidocaine). The physician order was unclear and 20ml of 2% lidocaine was given as an IV bolus. A lidocaine level was drawn at the time of error identification and was 2.8, so fat emulsion (Intralipid) was considered, but not administered. Within a few hours, she was alert, following commands and was able to be extubated. The medication error was then disclosed to the patient and her family.

Discussion: Importance of local anesthetic toxicity training and education for medical professionals: Local anesthetics are commonly used outside of the operating room environment. Nurses, non-anesthesiologist physicians, and pharmacists should be educated on the dangers, signs and symptoms, and appropriate treatment of local anesthetic toxicity. Additionally, anesthesiologists need to keep this diagnosis in mind in unexpected locations. Systems issues: In this case, the medical order was ambiguous and the medication dispensing system released a toxic dose of medication. Changes could be made in the computer ordering system and medication dispensing system to prevent these types of errors from occurring at a systems level. Disclosure of medical error to patient and family: Formal education on disclosing medical errors is limited. This case provides an opportunity to discuss best practices from risk management.

Poster Presentation

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Management of an Embolized ASD Occlusion Device

Background: Although surgical correction is the gold standard for ASD closure, transcatheter approach to correct this congenital defect has increased in popularity since the first successful use of a percutaneous closure device in the 1970s. Percutaneous ASD closure is known to be safe and adds the benefit of avoiding open heart surgery, shorter hospital stay, and lower rates of mortality/morbidity. However, several potential complications are known, including device embolization.

Case Description: A 40-yr-old asymptomatic male was noted to have a significant murmur on physical exam. TEE and cardiac MRI revealed a large secundum ASD measuring 2.7 cm x 1.1 cm, with flow through the defect of 8 L/min, a Qp/Qs 3:1, moderate/severe RV dysfunction, and moderate TR. The MRI also demonstrated a poor inferior/caudal rim tissue with the defect relatively close to the coronary sinus/RA junction. Using TEE and fluoroscopic guidance, 34 mm Amplatzer septal occluder was placed through the ASD. Following deployment, there was some concern for prolapse of the left atrial disc of the device. The device was removed from the ASD using a gooseneck snare and while attempting to pull the device into a 14F sheath, the device broke free from the snare and embolized to the RVOT. Several attempts were then made to retrieve the device using a snare and biopsy tools, but this was unsuccessful. The device was removed from the RVOT and stabilized in the right atrium using a biopsy tool. The patient was transferred to the operating room and underwent removal of the embolized ASD occluder, closure of the large ASD with bovine pericardial patch, and tricuspid valve repair via a minimally invasive right thoracotomy approach. After this successful operation, the patient was transferred to the ICU and ultimately discharged from the hospital on post op day 5.

Discussion: As percutaneous closure of ASDs has increased, several device related safety issues have been described in the literature including embolization, atrial perforation, thrombus formation, and erosion with hemopericardium. The incidence of device embolization is rare, with a recent study describing a 0.55% rate of embolization (3). Device embolizations usually occur during the procedure or in the periprocedural period, as in this case. Several mechanisms for device embolization have been proposed in the literature, include limited operator experience (learning curve), inadequate defect rim to hold the device, and inaccurate deployment (4). Damage to the tricuspid valve due to embolized occlusion devices has also been described in the literature. In this case, the patient had existing tricuspid insufficiency due to a dilated RV, and this pathology necessitated the surgical repair of the tricuspid valve. Fortunately during this case we did not see any hemodynamically significant arrhythmias, severe RVOT obstruction or tamponade secondary to hemopericardium. Having a cardiothoracic surgery team available on standby was of benefit in this particular situation. Additionally, heparinization of the patient following device embolization and TEE guidance to track the position of the device as the patient is transitioned from a percutaneous to open surgical procedure was essential for proper management of this rare complication.

Poster Presentation

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Markedly Delayed-Onset Malignant Hyperthermia in One Lung Ventilation and Sepsis: Case Report

Background: Malignant hyperthermia (MH) is a rare and potentially life-threatening condition of hypermetabolism. Delayed onset in the setting of a complex medical picture can result in a fulminant malignant hyperthermia crisis that can be more difficult to diagnose and treat. Case report: A 40-year-old man (BMI 33) with history of hypertension, congestive heart failure, obstructive sleep apnea, and type 2 diabetes suffered an acute intraparenchymal hemorrhage with ventricular extension. On admission, he arrived intubated, hypertensive, and hyperthermic (Tmax 38.7°C) requiring multiple doses of acetaminophen. His pCO2 on arterial blood gas was 86. The fever defervesced after 24 hours and was attributed to his intracranial hemorrhage. On hospital day 17, he complained of stridor, chest pain, and supraglottic edema. Chest CT showed cervical and mediastinal subcutaneous emphysema. He was taken to the operating room (OR) for airway management and neck exploration. General anesthesia was induced with etomidate and rocuronium and maintained with sevoflurane for 3.5 hours without incident. He was found to have a retropharyngeal necrotizing soft tissue infection (NSTI). Despite ongoing antibiotics for 9 subsequent days, the retropharyngeal NSTI developed into an abscess with extension along the right posterolateral mediastinum with persistent leukocytosis. He was taken to the OR for thoracotomy. General anesthesia was induced with fentanyl and sevoflurane through his tracheostomy with vecuronium as the paralytic. He remained stable for 6 hours on sevoflurane maintenance before suddenly experiencing dramatic increases in temperature (0.7-0.9°C every 15 minutes) and end tidal CO2 levels (20-30 points every 15 minutes) without tachycardia. Despite maximal efforts to treat with 51 vials (1020 mg) of IV dantrolene, external and internal cooling methods, total intravenous anesthesia with thorough flushing of the anesthesia machine, and symptomatic treatment for hyperkalemia and acidosis, the patient’s temperature reached a maximum of 41.4°C. The end tidal CO2 was so elevated it was not measurable and hyperkalemia continued to increase to 9.2 mEq/L despite ongoing treatment. Within 30 minutes the patient succumbed to death. The patient’s family declined genetic testing for malignant hyperthermia. Discussion: Malignant hyperthermia is rare and can be misdiagnosed in the setting of other more likely diagnoses such as septic shock and one-lung ventilation. Appropriate diagnosis and treatment can be further delayed in delayed onset malignant hyperthermia due to its a rare presentation. However, the incidence of delayed onset MH is increasing with increased use of non-halothane inhalational anesthetics. Therefore, a high degree of suspicion is necessary to promptly diagnose delayed onset fulminant malignant hyperthermia.

Poster Presentation

Presenting Author: Dr. Stephanie Pan University of Washington

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Massive aspiration during anesthesia due to gastric outlet obstruction and partial volvulus

Background: Aspiration is defined as either passive or active entrance of either oropharyngeal or gastric contents through the glottic opening and into the distal airways of the lung. Predisposing conditions and risk factors of aspiration include reduced consciousness (resulting in compromised cough reflex and glottic closure), dysphagia or neurological deficits, mechanical disruption of glottic closure and/or lower esophageal sphincter closure (e.g. endotracheal tube, nasogastric tube), and existence of a large reservoir of gastric contents with active emesis. The following case presentation explores these predisposing factors, and offers options to both the prevention and treatment of massive aspiration. Case Presentation: A 75 year-old Caucasian male with Parkinson's Disease presented with chest pain, nausea, and minimal emesis was found by CT to have a large incarcerated type IV paraesophageal hernia with organoaxial rotation/volvulus and gastric outlet obstruction at the level of the gastroduodenal junction. The patient was brought to the OR for emergent endoscopic decompression. An airway exam revealed narrow mouth opening and a Mallampati class IV airway. Given the small amount of emesis reported, and last oral intake reportedly 2 days prior to surgery, a rapid sequence fiberoptic intubation was chosen. During induction, intubation was complicated by inability to visualize the glottic opening, followed immediately by a large volume of emesis that required suctioning before an endotracheal tube could be secured. After establishing an airway, aspirated gastric contents were noted in copious amounts, and suctioned from the endotracheal tube. 700 mL of regurgitant volume was suctioned from the oropharynx and the trachea together, and an additional 2 liters of gastric contents were suctioned from the stomach during the procedure. Post operatively, the patient's massive aspiration resulted in acute hypoxic respiratory failure, evident by the initial ABG pH 7.32, pCO2 43, pO2 <55, and bicarbonate 22.3 on 100% FiO2 while intubated. CXR revealed patchy bilateral airspace opacities consistent with aspiration pneumonia and developing ARDS. In the Critical Care Unit, the patient was started on methylprednisolone and cisatricurium on post-operative day 1 for ARDS. On post-operative day 2 he was proned in 16 hour increments until his shunt fraction decreased to less than 25%, which lasted approximately 5 days. The patient was discharged on POD 19, and received surgery 2 months later for more definitive hernia repair.

Discussion: Prevention of massive aspiration during anesthesia starts with proper choice of induction technique, in this case awake vs asleep rapid sequence fiberoptic intubation. Prior suctioning via an NG tube may be considered but can be complicated by potential perforation, particularly in the case of existing volvulus and ischemia. For this case, intervention through early pronation and ARDS protocol before clinical deterioration resulted in a positive outcome. Calculation of shunt fractions for guidance of pronation in addition to ARDS protocol may also provide morbidity/mortality benefit. Primary avoidance and prevention of massive aspiration in the setting of anesthetic use is obtained through careful selection of induction technique. Treatment of a massive aspiration with early pronation and vigilant lung protective ventilation appear to be vital for improved outcomes.
Poster Presentation

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Massive subcutaneous emphysema and impending tension pneumothorax status post robotic nephrectomy

64-year-old female with a history of depression on escitalopram and quetiapine initially presented from outside provider with right-sided abdominal and flank pain who was later diagnosed with hydronephrosis with ureteral dilation secondary to high grade mid-ureteral transitional cell carcinoma. The patient was scheduled for right sided robotic nephroureterectomy. The preoperative evaluation was unremarkable. The patient was induced with 50mcg fentanyl, 30mg lidocaine, 130mg propofol, and 100mg succinylcholine. Grade one view was seen on intubation and endotracheal tube was placed without complications. The patient was initially maintained on sevoflurane which was later changed to desflurane. Other maintenance medications included additional doses of fentanyl and hydromorphone. The patient was paralyzed throughout the case using vecuronium. The case proceeded uneventfully. Postoperatively the patient was noted to be restless and disoriented. In the post anesthesia care unit, the patient was maintained on 10L O2 by simple face mask. On physical exam, the patient was noted to have bilateral chest and neck crepitus. A chest x-ray was ordered and were reviewed briefly at bedside. The patient continued to complain of pain though remained disoriented, drowsy, and unable to effectively communicate. The patient was weaned to 6L O2 by simple face mask and transferred to the floor. The patient was weaned to 2-3L O2 by nasal cannula on the floor. The anesthesia team was called to beside to evaluate for confusion. It was determined that her presentation was consistent with postoperative hypoactive delirium given stable vital signs, no hypoxia on 2-3L O2 by nasal cannula, and normal laboratory values. Again bilateral chest and neck crepitus was noted and thought to be secondary to the laparoscopic procedure. On POD#1, final radiologist interpretation of the chest x-ray taken in PACU revealed large right-sided pneumothorax, extensive chest wall and lower neck soft tissue emphysema, pneumomediastinum, and mild pneumoperitoneum. Based on radiographic findings a chest tube was placed with re-expansion of the right lung. An attempt to transition the chest tube to water seal on POD#2 failed due to re-accumulation of the pneumothorax. Subsequent attempt to transition the chest tube to water seal on POD#4 was successful. The chest tube was eventually removed on POD#5. There was no re-accumulation of the pneumothorax 4 hours following chest tube removal on chest x-ray. The patient was discharged without further complications.

Poster Presentation

Presenting Author: Dr. Nick Brunger University of California, Irvine

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Mea Culpa—Was all that really necessary? Central Anticholinergic Syndrome: A late diagnosis for a quickly reversible pathology

Background

Delayed recovery is multifactorial and includes drug, patient, and procedural factors, acid-base, metabolic or electrolyte abnormalities, hyper/hypothermia, respiratory disorders, and neurological complications. Central anticholinergic syndrome (CAS) should be explored as a diagnosis of exclusion. Its clinical spectrum ranges from a depressed to an excitatory state, and if suspected, should be treated with empiric doses of intravenous physostigmine for resolution of symptoms. 1-2

Case Description

A 69-year-old female with morbid obesity, hypertension, atrial fibrillation, obstructive sleep apnea, coronary artery disease, and type 2 diabetes, was scheduled for urgent laparoscopic cholecystectomy. Prior general anesthetics were uncomplicated. The patient was induced with fentanyl, lidocaine, and propofol. After muscle relaxation with rocuronium and intubation, anesthesia was maintained with sevoflurane. After an uneventful intraoperative course, she was given adequate neuromuscular blockade reversal with neostigmine, had sustained tetany for 5 seconds on ulnar nerve stimulation, and met all reasonable criteria for removal of her airway.

Upon PACU arrival, the patient was deeply stuporous and severely hypoxemic. Despite quick resolution of her hypoxemia with bag mask ventilation, she remained unresponsive. Initial ABG showed mild respiratory acidosis with normal electrolytes and glucose. She was hyperventilated but remained unresponsive to aggressive stimulation despite hemodynamic stability and normothermia. Pupil size and reactivity were normal. Another 0.5 mg of neostigmine was given for possible residual blockade. Narcan was dosed without effect. Benzodiazepene antagonism was not indicated. CAS was considered, and physostigmine 0.5 mg was given with concomitant stroke code activation. Two minutes later, she had a significant response (spontaneous eye opening, tracking, moving all four extremities to pain, and improved respiratory effort). She relapsed and became obtunded after ten minutes. Physostigmine 1 mg, divided over several minutes, was re-dosed with another significant, albeit short-lasting response. A repeat ABG showed worsening respiratory acidosis. She was reintubated with propofol. At the same time, another dose of physostigmine 0.5 mg was given. After less than one minute on the ventilator, the patient was responsive, tracked, and followed commands in all extremities. Because the stroke code was already activated, she was sedated for a stat CTA brain that was negative and monitored in the ICU. She was extubated several hours later and remained at her pre-op mental status until discharge.

Discussion
CAS is associated with anticholinergics and a long list of other drugs commonly used in the perioperative anesthetic. The diagnosis can be mistaken for prolonged duration of anesthetics, so it is likely underdiagnosed and reported. In our scenario, the diagnosis was delayed. Physostigmine should have been given at a higher initial dose of 0.04 mg/kg i.v. and repeated at 10-30 minute intervals for its short plasma elimination half-life. The centrally-acting anticholinesterase has minimal peripheral side effects in this range and could have avoided costly consultations, diagnostics, intensive care resources, and patient morbidity.2-3

References


Poster Presentation

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Medium-chain Acyl-CoA Dehydrogenase (MCAD) Deficiency Management in the Laboring Parturient

Introduction: Medium-chain Acyl-CoA Dehydrogenase (MCAD) deficiency is an autosomal recessive disorder defined by the inability of the body to convert medium chain fatty acids into acetyl-CoA via oxidative catabolism (1). Patients undergoing fasting are at high risk of hypoketotic hypoglycemia, rhabdomyolysis, cardiac arrest, encephalopathy, respiratory arrest, and sudden death (2). This syndrome significantly increases risks to the fasting laboring parturient with increased metabolic demands. Case Report: A 31yo G1P0 Caucasian female with MCAD deficiency and GDMA2 (on insulin) was admitted at 39 weeks’ gestation for induction of labor. She was diagnosed on newborn screen and followed by endocrinology throughout her life, including during pregnancy. She was referred to the High-Risk Obstetric Anesthesiology Clinic for multidisciplinary peripartum planning. During early labor she was continued on her home medication of L-carnitine 1000mg BID and normal diet. Her blood glucose was checked every 4 hours by finger stick (FSBG) and corrected with a mild insulin sliding scale. Epidural was offered, but the patient preferred nitrous oxide for pain management. Oxytocin infusion was initiated 35 hours after admission at which point she was switched to clear liquids, and a dextrose 5% lactated ringers infusion. FSBG were checked every hour with mild insulin sliding scale. Her glucose ranged from 83 to 171. She used nitrous oxide for labor analgesia during active labor and had a spontaneous vaginal delivery. A healthy baby boy was delivered with APGARS of 8 and 9 at 1 and 5 minutes respectively. No neonatal hypo- or hyperglycemia was observed and 24-hour glucose levels were between 47-79 mg/dl. Discussion: MCAD deficiency presents significant risk to the laboring parturient. There has only been one prior case reported in the literature of a nulliparous parturient with MCAD deficiency that received spinal-epidural anesthesia, fasted, and was induced for one hour prior to delivery (3). Our patient benefited from multidisciplinary planning and peripartum management given the longer time in labor. Laboring patients with MCAD deficiency require close glucose monitoring and dextrose infusion when fasting, in vomitus or active labor. References: 1. Roe, C. R., and J. Ding. "Schriver CR, Beaudet AL, Sly WS, Valle D (eds) Mitochondrial fatty acid oxidation disorders." Metabolic and molecular bases of inherited disease, 7th edn. MacGraw-Hill Inc., New York 1394 (1995). 2. Lang, T.F. Adult presentations of medium-chain acyl-CoA dehydrogenase deficiency (MCADD). J Inherit Metab Dis (2009) 32: 675. 3. Wang S Y, Kannan S, Shay D, Segal S, Datta S, Tsen L. Anesthetic considerations for a patient with compound heterozygous medium-chain Acyl-CoA dehydrogenase deficiency. Anesthesia and analgesia (2002) 94 (6): 1595-7.

Poster Presentation

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Treacher Collins syndrome is a rare craniofacial cleft syndrome, which includes zygomatic, maxillary, and mandibular dysplasia. Intubation is difficult in these patients, which is a major anesthetic consideration given that many of these children require multiple anesthetics. Potential airway challenges include upper airway obstruction, macroglossia, limited mouth opening, retrognathia, cleft lip and palate, and palatopharyngeal incompetence. Review of literature on airway management describes direct laryngoscopy, laryngeal mask airway (LMA), fiberoptic bronchoscopic intubation, intubating LMA, retrograde intubation and tracheostomy.

Our patient was delivered at an outside hospital to a 42 year old gravida 4 at 31 weeks gestation via emergency cesarean section for non-reassuring fetal heart tones; perinatal course complicated by premature rupture of membranes and prolapsed cord. At time of delivery, patient noted to have severe retrognathia and mid face hypoplasia consistent with Treacher Collins syndrome. Neonate's birth weight was 1608 grams with APGAR scores 2,2,2,4 at 1, 5, 10 and 15 minutes respectively. Resuscitative measures included positive pressure ventilation, 4 rounds of chest compressions, 3 normal saline fluid boluses and 1 bolus of 10% dextrose-water. Greater than 5 attempts at intubation by attending pediatrician and on call anesthesiologist. Minimal improvement with CPAP. Prior to arrival at UC Davis Medical Center, critical care transport nurse orally intubated under direct laryngoscopy; patient was inadvertently extubated when stylet was removed. Transport team secured the airway with size 1 Air-Q LMA. Vital signs on arrival at UC Davis Medical Center significant for SpO2 readings in 70-percentile. After stabilization in NICU, patient went for tracheostomy for a more definitive airway given worsening hypoxia, cyanosis and respiratory acidosis. We continued positive pressure ventilation via Air-Q LMA using NICU ventilator for perioperative airway management to minimize disruption in ventilation. We deferred fiberoptic bronchoscopy because of patient size. Spontaneous ventilation was maintained using short-acting reversible anesthetic agents (fentanyl, midazolam) in case patient developed ventilation difficulties. Surgeons infiltrated lidocaine prior to incision. After successful cannulation with a 3.0 neonatal Shiley tracheostomy, patient color and saturations improved. Post-tracheostomy airway evaluation deferred due to significant airway swelling after removal of LMA. Consideration for airway management in future difficult airway patients may include bedside tracheostomy given risks transporting critical airways.

Poster Presentation

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Multimodal Approach to Detoxification of a Chronic High-dose Fentanyl Infusion

BACKGROUND: Current guidelines suggest that chronic high-dose opioids are not beneficial for non-cancer patients with chronic pain. However, when patients do present on these regimens, successful management of weaning is crucial. The following demonstrates an extreme case of chronic high-dose IV narcotic use and a successful weaning to a multimodal oral pain regimen.

CASE DESCRIPTION: A 59-year-old woman with a history of chronic pain due to complications of systemic lupus erythematosus and a cervical radiculopathy presented to the emergency room in an acute pain flare. She was followed by an unaffiliated chronic pain clinic as an outpatient, and ten years prior she had been started on an at-home IV fentanyl infusion through a PICC line for her difficult to manage pain. This infusion was prescribed at a dose of 900 mcg/hr, in addition to 200mcg boluses every six hours. Her husband, who was a physician and active caregiver, admitted that she had figured out how to manipulate her infusion pump and was self administering up to 1700 mcg of fentanyl per hour on average (equivalent to 12,200 mg PO morphine daily). Despite these high doses, her pain was constantly rated 10/10 unless she was asleep or over-sedated. Her cervical radiculopathy had been slowly worsening over the month prior to presentation, and she was treated several times as an outpatient with epidural steroid injections. MRI on admission demonstrated a C5-6 discitis. Spinal surgeons were hesitant to intervene due to her high levels of narcotic dependence and poor functional status, so she was admitted for IV antibiotics and management of her acute pain crisis. She was initially continued on her home infusion of fentanyl with the addition of a lidocaine infusion, ketamine infusion, and hydromorphone PCA. Psychiatry was consulted for management of her extreme anxiety. Over the next week, she and her husband agreed to undergo a blind weaning of her fentanyl infusion. Her fentanyl was decreased by 100-200 mcg per day until it was completely discontinued. During the time, she was maintained on a ketamine infusion at 20-30mg/hr (in addition to other multimodal agents). She was successfully weaned completely off of all IV medications without demonstrating any signs of withdrawal. Subsequently, she was able to tolerate a cervical spinal fusion with improvement in her symptoms and without a significant pain flare. She was ultimately discharged on an oral pain regimen that included extended and immediate release oxycodone (equivalent to 255mg po morphine/day), gabapentin and acetaminophen. On discharge she was receiving a dramatically lower dose of opioids, was more alert and had increased function as well as lower pain scores.

DISCUSSION: A patient on a chronic high-dose fentanyl infusion was weaned to an oral pain regimen using a multimodal approach that included ketamine and lidocaine infusions. This approach may be useful in other patients on chronic high-dose opioid infusions that require inpatient transition to an oral regimen.

Poster Presentation

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Non-invasive Management of Tension Capnothorax: A Case Report

Background
Laparoscopy is commonly used for a variety of surgical procedures. The benefits of laparoscopy compared to open surgery include decreased post-operative pain, smaller incisions, and reduced hospital length of stay. Laparoscopy is enabled by insufflation of carbon dioxide into the peritoneal cavity producing pneumoperitoneum. Common complications of pneumoperitoneum include hypercapnia, decreased venous return, bradycardia, and subcutaneous emphysema. Here, we present an uncommon complication of laparoscopic surgery and its management.

Case description
A 68 year old, 5’10”, 66kg male was scheduled for elective Laparoscopic Diverticulectomy and Heller Myotomy for diagnosed achalasia and epiphrenic diverticulum. Abdominal insufflation occurred uneventfully following induction of general anesthesia. Forty-five minutes into the procedure, measured EtCO2 acutely decreased from 35 to 23 mm Hg with coinciding drop in BP from 130/70 to 47/29 and increased peak inspiratory pressure (PIP) from 22 to 31 cm H2O. The surgeons noted a large tear in the right diaphragm that they would be unable to repair. Tension capnothorax was presumed. Hemodynamic stability was achieved with Epinephrine 100 mcg, Phenylephrine 500 mcg, and 500 mL of 5% Albumin. A recruitment maneuver was performed. Within three minutes after the event, EtCO2 and blood pressure returned to baseline. PIP remained stably elevated. A recruitment maneuver was again performed prior to emergence, and oxygen saturation was 100% at that time. The patient was extubated in the OR. In the PACU, the patient complained of chest pain with an oxygen desaturation to 92% but stable hemodynamics. Chest X-ray in the PACU was notable for very large right pneumothorax with collapsed RUL. Given the patient’s stable hemodynamics and under the clinical assumption that the patient’s pneumothorax was secondary to abdominal insufflation, the patient was treated expectantly. His symptoms completely resolved within 3 hours after emergence. Serial chest x-rays revealed complete re-expansion of the right lung over the next day. He was discharged home on POD#2.

Discussion
Pneumothorax secondary to carbon dioxide insufflation (capnothorax), has been recognized as a complication of laparoscopic procedures. While perioperative conservative therapy is advocated for recognized capnothorax without hemodynamic compromise, more uncertainty exists when determining the appropriate treatment for tension capnothorax.

Capnothorax during laparoscopy involves a diaphragmatic defect, congenital or iatrogenic, through which pressurized CO2 flows into the pleural space. If a large enough defect allows a very rapid increase in intrapleural pressure, mediastinal shift may occur and cause hemodynamic compromise. Classically, treatment of acute tension pneumothorax involves needle decompression with subsequent chest tube placement. However, these interventions carry inherent risks. In patients with a suspected capnothorax, overcoming the intrapleural pressure through recruitment maneuvers may shift the intrapleural pressure gradient back into the abdomen and relieve hemodynamic compromise. Because CO2 is rapidly reabsorbed by the body, conservative management may be warranted post-operatively. In contrast to patients with pneumothorax, the clinician may choose to manage patients with capnothorax non-invasively throughout the perioperative period.
Poster Presentation

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**Novel Use of the Quadratus Lumborum Block for Iliac Crest Bone Graft Harvesting, A Case Series**

Introduction: The iliac crest is a common site employed for harvesting bone necessary for autologous grafting. Acute and chronic iliac crest donor site pain is a significant postoperative concern. Options to manage this pain perioperatively have primarily been limited to neuraxial and paravertebral approaches, as the iliac crest incision site lies in the T12/L1 dermatome. The quadratus lumborum (QL) block is a variation of the transversus abdominis plane (TAP) block which theoretically functions by the spread of local anesthetic into the paravertebral spaces resulting in somatic abdominal wall analgesia and possibly even visceral pain relief (T6-L1 dermatomes coverage). In this case series, we describe the successful use of the quadratus lumborum block in two patients who underwent iliac crest bone grafts for an upper extremity fracture repair. Methods: Case 1- A 31 year old male was scheduled to undergo repair of his fourth metacarpal fracture with iliac crest bone graft. We performed a single injection supraclavicular block for the hand fracture site and placed a quadratus lumborum catheter for the iliac crest graft site. Via ultrasound, the appropriate anatomical landmarks were identified (Image 1, 2). A 17G tuohy needle was inserted via an in-plane technique targeting the QL muscle and 15 mL of 0.25% ropivacaine was injected hydro-dissecting the fascial layer from the muscle. A 19G styletted peripheral nerve catheter was advanced through the tuohy needle and placed at the anterolateral border of the QL muscle. Another 15 mL of 0.25% ropivacaine was injected through the catheter to confirm its location and local anesthetic spread within the fascial plane (Image 3 & 4). Case 2- A 14 year old male scheduled to undergo repair of a scaphoid fracture with iliac crest bone graft. Single injection supraclavicular and quadratus lumborum blocks were performed (Image 5). For the QL, 20 mL of 0.25% bupivacaine was injected hydro-dissecting the fascial layer of the muscle. Results: Case 1- Intraoperatively, the patient received general anesthesia and consumed 100 mcg of fentanyl. Postoperatively, he had no pain and received no medication. He was discharged from the PACU with a portable infusion pump delivering 0.2% ropivacaine at 10 cc/hr into the QL catheter for three days. Daily telephone follow up with the patient revealed excellent postoperative pain control. Case 2- Intraoperatively, the patient received general anesthesia and only consumed 100 mcg of fentanyl. Postoperatively, he did not require any pain medication for 24 hours (via telephone follow up). Conclusions: Traditionally, the QL block has been used following abdominal surgeries and the potential utility for the QL block to provide pain relief for musculoskeletal pain or procedures involving the T12/L1 dermatome have been infrequently described. Due to the degree of sensory blockade achieved in our patients, as demonstrated by the lack of obvious surgical stimulus during iliac crest bone grafting, it may be possible to perform these procedures without general anesthesia. In this case series, we demonstrated the successful use of the QL block in the management of acute postoperative pain following iliac crest graft harvesting.

**Poster Presentation**
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Operating Room Fires: The Case of Intra-abdominal Explosion from Retained Rectosigmoid Foreign Objects

Background
Approximated 500-600 operating room fires every year in the U.S. with ~10% of these producing serious injuries to the patient.

Burn injuries represent 20% of MAC related malpractice claims, 95% of which involved head/neck surgery.

Intra-abdominal fires are much rarer events, with the first documented case occurring in 1933.

We report an unprecedented case of an intra-abdominal fire upon surgical attempt at retrieving retained rectal paint spray can.

Case Description
A 64 year old male presented to the ED with abdominal pain, found to have retained a high pressure spray paint container and a plastic bottle in his rectum for over a month.

Taken to the OR for trans-anal retrieval of these objects under GETA
Use of ring forceps and Kocher clamp during this procedure resulted in can puncture.
Jet of paint and pressurized gas exited the can through the rectum. The abdomen then became insufflated and tense.
Converted to exploratory laparotomy using scalpel and scissors via a para-median approach. After opening the abdomen, the surgeons manually decompressed the peritoneal cavity to evacuate any retained volatile gas.
Two areas of perforation noted over the sigmoid and descending colon.
Once the peritoneal cavity was decompressed, electro-cautery was utilized at which point a flash explosion emerged from the abdomen rising to a level above to surgeons’ head.
Intra-abdominal cavity was immediately irrigated with a liter of saline. Examination of the abdomen did not show any visceral thermal injury, nor were any persons in the operating room harmed. Surgeon’s gloves were damaged.
Abdomen was left open and packed after retrieving the foreign bodies. The patient was transferred to the ICU. Partial colectomy with a diverting ileostomy was done the following day.
The patient recovered after ten days in the ICU and was discharged in stable conditions.
Discussion
OR fires are infrequent but catastrophic--disfiguring, psychologically traumatic, and a major cause of medical malpractice litigation, and death.
Anticipate the situation where these three elements are present in high concentration and close proximity.

Change practice and processes in order to prevent these largely avoidable events:

Use oxygen blender to reduce Fi02 to 30% which will lessen the risk of combustion.

If more than 30% oxygen is required to maintain saturations then place LMA or intubate.

~70% the time ignition source is electrosurgical unit, which is used in 85% of surgeries. Fiberoptic light sources: Connect cables before activating. Place on standby/off before disconnecting. Avoid proximity to surgical drapes while on.

Flammable skin prepping solutions should be dry before draping. Attention to pooling.

The drying time for skin preparations might need to be longer than the manufacturer's recommendation (usually 2−3 min), 5 min might be preferable where possible

Laser Surgery: use laser resistant ETT, fill cuff with water instead of air.

Surgical drapes should be configured to minimize the accumulation of oxidizers (oxygen and nitrous oxide) under the drapes.

Gauze and sponges should be moistened when used in proximity to an ignition source.

• Where is the fire extinguisher is in your O.R.?

**Poster Presentation**

**Presenting Author:** Dr. Sepehr Rejai Department of Anesthesiology & Perioperative Medicine, David Geffen School of Medicine, UCLA

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Dr. Sumit Singh ucla
Oral to Nasal Tracheal Tube Exchange

A 32-year-old female (52kg, 5’4”) with multiple injuries status post four-story fall and history of difficult oral endotracheal tube (ETT) placement using an asleep fiberoptic bronchoscope (FOB) technique presented to the operating room for fixation of multiple facial and mandibular fractures. Surgical fixation required oral ETT removal, therefore replacement with a nasal ETT was planned. The patient was taken to the OR, placed on standard monitors, and induced. Both nares were then dilated with sequentially larger nasal airways. A 7.0mm nasal RAE tube was inserted into the right nostril. The FOB was then passed through the nasal RAE and directed into the oropharynx. Significant oropharyngeal and subglottic edema were noted. The FOB was advanced anteriorly over the in situ oral ETT and beyond the vocal cords. Attempted advancement of the nasal RAE over the FOB pass the vocal cords was unsuccessful due to limited space. Discussion was made with the surgeon whether to continue attempting a nasal tracheal tube exchange, perform a tracheostomy, or cancel the surgery to await tissue edema improvement. Nasal RAE intubation was preferred if safely achievable. A sterile tracheostomy kit was then opened and ready if required. The patient was disconnected from the ventilator and a Cook Aintree catheter was advanced into the oral ETT with connector pieces available if ventilation became necessary. Under FOB visualization the oral ETT was removed with the Aintree catheter now in the trachea. The FOB was then advanced into the trachea and the nasal RAE was threaded over the FOB while simultaneously removing the Cook Aintree catheter. Appropriate ETT positioning was confirmed and mechanical ventilation resumed. No oxygen desaturations occurred. The nasal RAE was secured and surgery proceeded without complications. The exchange of an oral to nasal tracheal tube is not a common practice, however, this method using a Cook Aintree airway exchange catheter allows continuous immediate availability of ventilation and has not previously been described in the anesthesia literature.

Poster Presentation

Presenting Author: Dr. Anthony Clark UCSD

Authors:

Dr. Anthony Clark UCSD
Dr. Patrick Nguyen UCSD
Dr. Byron Fergerson UCSD
Pain Management and Opioid De-escalation in Patient with Complex Regional Pain Syndrome

Introduction:
Chronic pain management of patients with CRPS involves a multimodal approach to reduce pain and foster physical therapy. The complex nature of the syndrome in conjunction with severity of pain symptoms often provides a challenge in management of pain symptoms. In the case of our patient, allodynia and opioid-induced hyperalgesia stemming from high levels of opioid added to this challenge. Through the use of a multimodal approach utilizing membrane stabilizers and transdermal alpha agonist, we accomplished markedly improved pain scores and patient satisfaction with the added benefit of drastically decreasing opioid use as part of our patient’s pain management regimen.

Case Report:
A 61 year-old male with PMHx of CRPS, bilateral lower extremity lymphedema, lumbar spinal stenosis and stage IV squamous cell neck cancer status post chemo/radiation therapy resulting in severe peripheral lower extremity polyneuropathy presented to our pain management clinic to transfer management of his chronic pain. Patient had previously underwent multiple epidural steroid injections and lumbar spinal cord stimulators in addition to medication trials of Methadone, Fentanyl patch, Dilaudid and Gabapentin with minimal pain relief. Upon initial presentation, patient’s pain medication regimen consisted of MSContin 240 mg TID and Dilaudid 16 mg PO q6h for breakthrough pain. Pain scores were reported as 10/10. Patient was noted to have an agitated and hostile demeanor, at times was verbally and physically abusive, secondary to poor control of pain symptoms. Due to concern for opioid-induced hyperalgesia, the plan was to gradually decrease opioid consumption by 5-10% at each clinic visit while maximizing adjuvant therapy, which our patient was initially reluctant to follow. Ultimately the pain regimen was reduced to MS Contin 90 mg TID. Gabapentin 1200 mg TID, Baclofen 5 mg TID and Clonidine TTS patch 0.1 mg q7 days were successfully initiated. Despite his initial hesitation, our patient now reports “feeling good” with pain scores of 7/10.

Discussion:
This case highlights the difficulty in management of CRPS in a patient with opioid-induced hyperalgesia (OIH). OIH was first described as early as the 19th century as the phenomenon of paradoxical nociceptive sensitization caused by exposure to opioids. Various mechanisms have been proposed with implications for management, involving both central and peripheral pathways, most commonly including the central glutaminergic system, spinal dynorphins, descending facilitation, differences in neurotransmitter re-uptake and genetic factors. The patient population in which OIH is observed also plays a role in the pathophysiology, and resultantly, limited treatment options. Despite that our patient was initially reluctant to decrease opioid consumption, a reduction by 60% ultimately resulted in improvement in subjective pain scores, patient-reported quality of life, and activity levels. Another key component of our therapeutic plan was the implementation of a multi-modal regimen including...
the use of anti-epileptic, muscle relaxant and transdermal clonidine. Previous studies reported the benefit of epidural clonidine for pain management in CRPS patients. Given the mechanism of CRPS and OIH with respect to central and peripheral modulation, Clonidine’s centrally mediated reduction in sympathetic nervous system activity resulted in drastically improved analgesia and patient satisfaction.

**Poster Presentation**

**Presenting Author:** Dr. Sarah Neyssani Harbor-UCLA Medical Center

**Authors:**

Dr. Sarah Neyssani Harbor-UCLA Medical Center
Prof. David Cho Harbor-UCLA Medical Center
Paradoxical bradycardia following epinephrine administration in a premature neonate

We present a case of intraoperative paradoxical bradycardia following administration of epinephrine. This phenomenon is counterintuitive to the cardiovascular effects typically observed. Recognition of this potential hemodynamic effect can help the pediatric anesthesiologist promptly treat an unfavorable decrease in heart rate.

An eight-day old, 0.65kg male neonate prematurely born at 25 weeks via emergency Cesarean section for pre-eclampsia and non-reassuring fetal heart rate presented with pneumoperitoneum and suspected perforated bowel. He arrived intubated for emergent exploratory laparotomy. As the case progressed, mean arterial pressure (MAP) had decreased below 10% of starting values, and infusions of normal saline (12mL total) and pRBC (10 mL/kg) were started in efforts to improve the blood pressure. Heart rate remained stable in low 180’s. Calcium (6mg) was given which transiently improved MAP. The MAP continued to deteriorate with no change in heart rate. Epinephrine 0.5mcg was administered when the systolic blood pressure was in the mid 30s. The heart rate immediately dropped to 61 with an increase in the systolic blood pressure to 55-60 mmHg; CPR was immediately started to ensure adequate cardiac output along with 100% oxygen. Within one minute, the heart rate improved to 108 and the systolic blood pressure had increased into the 70s (43). The procedure concluded soon afterward without further derangement of vitals.

One explanation for bradycardia following exogenous epinephrine includes medication error. It was confirmed postoperatively that the medication that induced profound bradycardia in this case was indeed epinephrine and at the correct dilution, with an administered dose of 0.5 mcg. Most case reports of incorrect epinephrine dosing are based on overdose with subsequent hypertension and tachyarrythmias, not paradoxical bradycardia (1).

Another possibility is reflex bradycardia from a sudden increase in alpha agonism, systemic vascular resistance, and baroreceptor-mediated suppression of sympathetic tone on sinoatrial node automaticity (2). A gradient of receptor agonism occurs along the spectrum of plasma epinephrine levels with dynamic receptor activation. Low dose epinephrine is mostly beta active, with beta-2 mediated vasodilation as well as beta-1 increase in myocardial contractility. Alpha activation increases at higher doses. Typical doses of exogenous epinephrine exceed this varying receptor response and simultaneously stimulate alpha as well as beta receptors, causing vasoconstriction and increased heart rate/contractility, respectively (3).

A third differential for bradycardia would be Bezold-Jarish reflex (BJR). The combination of peripheral vasodilation, subsequent venous pooling and an under-filled left ventricle, in addition to hypercontractility, can result in the (BJR). Inhibition of sympathetic tone and augmented parasympathetic influence on the heart induces profound bradycardia; this is in direct response to signaling from intramyocardial mechanoreceptors that sense the hypercontractility of a relatively empty ventricle. (4, 5, 6). The most likely explanation in this case is reflex bradycardia because the blood pressure increased with the drop in heart rate and further increased once cardiac output increased with the increase in heart rate. Familiarity with this phenomenon of paradoxical bradycardia following a low dose of epinephrine can accelerate recognition and successful clinical management.
Poster Presentation

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Patient characteristics and contributing factors to adult case cancellations at UC Davis Medical Center during an eleven-month period in 2015-2016

Background: Case cancellations pose a significant challenge resulting in a waste of resources, inconvenience to providers and patients, financial strain, and psychosocial consequences to patients. Case cancellations at the day of surgery can be as high as 24% to 40% (1,2). A significant amount of canceled cases are attributed to preventable factors which include incomplete medical/surgical evaluation, lack of insurance authorization, scheduling error, or patient declining surgery (3). In our institution, the contribution margin for each canceled case is estimated to be $6000. Our study aimed to investigate the amount and type of canceled cases at our institution during an eleven-month period and reasons for cancellations as well as individual patient "risk factors". We characterized associations between variables including patient age, gender, type of surgery, number of comorbidities and preventable and nonpreventable causes of surgery.

Methods: We analyzed all case cancellations in the main operating room in our institution from November 2015 to September 2016, collecting data from the electronic medical record including age, gender, type of surgery, elective versus urgent/emergent surgery and reason for cancellation. We also reviewed patient comorbidity counts and categorized preventable versus nonpreventable surgery. Preventable cancellations included “Surgery already performed”, “Patient rescheduled”, “Patient no show”, “Insurance issues”, “Patient not medically ready”, “patient re-evaluated, surgery not needed”. Nonpreventable cancellations included “Patient no longer wants surgery”, “patient illness/cold”, “patient had surgery elsewhere”, and “patient wants second opinion”. We created a logistic regression model to investigate the impact that variables had on odds that a cancellation was preventable or nonpreventable.

Results: Our patient population consisted of 1819 cancelled cases out of 15910 scheduled cases, for a cancellation rate of 11.43%. The mean age for cancelled cases was 51.92 years old and 52.06% were female versus 47.94% male. 1643 (90.32%) of cancelled cases were "elective", while 11 (0.60%) were "emergent", the remaining falling under the category of "urgent". The most common reason for cancellation was "Patient-No longer wants surgery" with 285 (15.67%), followed by "Provider-Patient not medically ready" with 284 (15.61%). 1006 cancelled cases were considered preventable (62.02%) versus 616 nonpreventable (37.98%). There were 776 cancelled cases the day of or day before surgery (42.66%) versus 731 for greater than one day before scheduled surgery (40.19%). Based on the logistic regression model every one year increase in age corresponded with a 0.87% decrease in odds that the cancellation was preventable (p=0.002). The odds that cancellation was preventable was 19% higher in males than females (p=0.092), and the odds that an urgent case was preventable was 34.99% higher than that of elective cases (p=0.107).

Conclusion: The majority of cancelled cases at our hospital are elective (90.32%) and/or preventable (62.02%), with the most common preventable reason being “Patient not medically ready”. There was a tendency for a cancellation to be nonpreventable as age increased. Males had a greater tendency to have preventable cancellations than females, as did urgent cases versus elective cases. This
study underlines the importance of early intervention to reduce the rate of case cancellations, most of which are preventable.

**Oral Presentation**

**Presenting Author:** Dr. Michael Yim University of California, Davis

**Authors:**
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Dr. Niroop Ravula University of California, Davis
**Patient with Serious Ongoing Postoperative Complications: Hemorrhage and Sepsis**

We are presenting a surgical patient who underwent serious and ongoing events of sepsis, shock, bleeding, and massive transfusion that was successfully managed by the Anesthesia/ICU team.

67 year old morbidly obese male with Gleason 4+4 prostate CA s/p uneventful 6 hour robotic radical prostatectomy and RPLND and floor admission. Originally planned for discharge POD #3, he became distended from ileus, tachypneic, and tachycardic. CT revealed left pleural effusion and pelvic fluid collection. IR drained 550cc fluid, temporarily relieving respiratory distress. However, he became tachypneic, tachycardiac, hypoxic, and hemodynamically unstable that evening, during which time he became severely bradycardic, then pulseless, and required compressions, epinephrine, and atropine. Remaining hypotensive, he was taken to OR for abdominal compartment syndrome and underwent laparotomy, drainage, and loop colostomy.

Abdominal fluid cultures yielded E. Coli and Streptococcus, ultimately requiring cefepime and meropenem. Platelets dropped to 31, and pRBCs and platelets were given, and patient was stable for extubation on the third postoperative day. The next day he suddenly became diaphoretic, pale and hypotensive with severe right abdominal and flank pain and collapsed. He was resuscitated with fluid, and the Hb was found to be 6 indicating acute bleeding. Vascular consult was called. They suspected ruptured aortic aneurysm. Massive transfusion was started in ICU and patient was rushed to OR. Aortic clamps were placed as an emergent measure. On examination, aorta was intact and bleeding, pelvic in origin (erosion of vessels), and was uncontrollable. Patient rushed to IR for visceral angiogram and embolization of bilateral internal iliac and inferior mesenteric arteries. Diffuse oozing continued overnight. Amicar, Factor 7, and pressors were given with blood products. Patient then underwent partial abdominal closure and partial sigmoidectomy, followed by primary closure 2 days later.

Patient remained intubated, requiring blood products and platelets, and septic despite appropriate antibiotic coverage. He developed renal failure requiring dialysis, and required tracheostomy. Repeat CT showed several pockets of fluid collections inaccessible to surgery. Patient was taken to IR for abdominal drainage, during which there was acute bleeding indicating injury of a major vessel, and patient became hypotensive. He was resuscitated with blood products and taken to the OR. He was found to have a right epigastric artery bleed requiring ligation, after which 5 drains were placed. The patient required massive transfusion during this episode.

Antibiotics were continued, patient began to show signs of improvement, and renal function resumed. Dialysis was discontinued, and he was weaned off the respirator. Patient was transferred to floor 5 weeks after initial surgery. Over 2.5 weeks, he was de-lined, decannulated, and tolerating PO intake. After acute rehabilitation, he transferred home. He recently returned for stoma takedown.
In conclusion, this patient suffered numerous potentially fatal complications including massive hemorrhage and septic shock, and he required multiple surgeries and transfusions (~80 units pRBCs and 150 units blood products). The perioperative management was provided by the anesthetic team with expertise in both ICU and high risk anesthesia.

Poster Presentation

Presenting Author: Dr. Mohamed Eloustaz University of Southern California

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Pediatric Airway Challenge: Ventilatory Difficulty in a Trauma Case

Introduction: Mastery of the airway is a fundamental skill for all anesthesiologists. Pediatric airways present unique challenges and pediatric trauma can compound the complexity of pediatric airway management. Case: A 12 year old male was an unrestrained passenger in a motor vehicle crash. Initial GCS on the scene was a 3 and he was emergently intubated in the field. After arrival in the ED patient became hemodynamically unstable and was noted to have a large epidural hematoma, open, depressed skull fracture, multiple facial fractures, and spinal cord injuries. Patient was taken emergently to the OR for right frontal craniectomy and other stabilizing procedures. During the operative course, there was significant difficulty with ventilation and oxygenation. CT images obtained prior to the OR demonstrated an ETT morphology with narrowing of the lumen toward the distal tip without complete occlusion or obvious obstruction. Efforts to pass a fiberoptic bronchoscope were unsuccessful. Video laryngoscopy was utilized without any obvious supraglottic swelling or obstruction. A bougie was gently inserted and was unable to pass the length of the ETT. Decreasing the volume of air in the balloon tip of the ETT with simultaneous relaxation of the cervical collar allowed increased ventilation and oxygenation and eventual tube exchange with a video laryngoscopy-assisted bougie exchange technique. Discussion: Here we present an unusual case of delayed ventilatory challenges in an intubated patient. The patient sustained significant traumatic injuries resulting in a challenging airway (facial and cervical injuries) and a neurologic status requiring intubation. Despite successful intubation, airway management became very challenging hours later. CT imaging suggests a clear narrowing of the lumen in the coronal dimension with a patent distal end. Radiographic differentials include saber sheath trachea1,2 or a distended ETT balloon3; but neither of these conditions seems to fit given the lack of tracheal malformation, the absence of an obvious obstructing object distally, or any readily apparent compressive forces. Potentially, the ETT was defective with an intrinsic defect with a combination of an overdistended balloon with neck edema and external compression (tracheal collar) resulting in a net effect of lumen narrowing. Ultimately, as anesthesiologists we must be prepared to manage challenging airways and despite having a ‘secure airway’, we must remain vigilant and consider defective equipment if standard troubleshooting efforts fail to correct issues.

Poster Presentation

Presenting Author: Dr. Daniel Hansen Mayo Clinic Arizona

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Pediatric Anesthesiologists' Perceived Ethical Challenges Due to Drug Shortages

Background: Anesthesia drug shortages are increasingly common. However there is little information on the qualitative experience of anesthesiologists providing clinical care in the face of repeated drug shortages. This interview study of pediatric anesthesiologists working at a high-volume children's hospital sought to examine how clinicians perceive the impact of drug shortages on their work.

Methods: Using a semi-structured series of questions, pediatric anesthesiologists were interviewed regarding the impact of drug shortages on their clinical work. Interviews are coded and analyzed as the data is being generated, incorporating methods from grounded theory, as described by Strauss and Corbin (1990). This method utilizes a combination of inductive and deductive approaches to analyzing data and involves an iterative, conjunctive process of reviewing interviews. It identifies emerging themes within qualitative text data and develops theories about the phenomenon described by these themes, sampling until new data no longer change the developed theory (saturation). All members of the research team code each interview. Divergent coding is reviewed and discussed by the group until consensus is reached. After completing the coding, we discuss the themes that emerge. Using an iterative approach, comprehensive themes and the specification of relationships among these themes are developed.

Results: Preliminary results suggest several emerging themes including "What is the appropriate level of information that is still considered informed consent?" “Who is responsible for managing drug shortages/allocations of resources?”

Conclusions: While research is still ongoing, preliminary data suggests pediatric anesthesiologists feel obligated to take bedside responsibility for failures in the drug supply chain for patients and that absence of specific drugs (such as succinylcholine, vasoactive agents, or propofol) are more concerning than other shortages. The case performed influences such concerns. Providers express uncertainty about how to best inform parents about drug shortages that could negatively affect care.

Oral Presentation

Presenting Author: Dr. Daniel Hunt Stanford University

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Dr. Danton Char Stanford University
**Perceptions of Anesthesia Resident Candidates of Harbor-UCLA Medical Center**

Background: Despite the timely and costly process of recruiting a class of incoming residents, minimal research has been done to determine if optimization can alleviate some of the pressures. The NRMP conducted a survey of all 2015 Main Residency Match applicants about the influencing factors of their rank choices and the relative importance of each of those factors. On a scale of 1 to 5, with five being the most important, the survey determined that the mean importance rating of students ranking a particular program based on geographical location, morale, training, and career paths is 4.5, 4.6, 4.6, and 4.4, respectively. If assuming agreeable program perceptions are also linked to higher rank order then determining which applicants perceive them highly in these categories could influence who to interview and rank during the recruitment process.

Purpose: To reveal the perceptions, the changes in perceptions, and the demographic correlation of perceptions of the Harbor-UCLA Anesthesia residency program by applicants.

Methods: Candidates to the Harbor-UCLA Anesthesia residency program completed a handwritten exit interview survey during the 2015-2016 year consisting of: Demographics; Perceptions; Preferences; and Rating of reception/interview day. During the 2016-2017 application cycle, candidates were emailed a link to an online survey consisting of demographics and program perceptions prior to their interview, and a second online survey consisting of follow up perception questions and rating of the reception and interview day. The online surveys were completely anonymous and voluntary. Mean perception ratings were determined for different sub-groups utilizing the demographics data from each of the surveys.

Results: Perceptions of the Harbor-UCLA Anesthesia program have increased from the 2015 to the 2016 year, especially in the programs reputation of graduates getting good jobs and fellowships where the mean perception score improved from 4.2 to 4.66. In addition, perceptions of the program were improved after the interview. When comparing the NRMP’s data of the mean importance scores in geographical location, morale, training, and career paths to the mean perception score of Harbor-UCLA, perception scores exceeded importance scores in every category except training. In 2015, the demographic group with the highest perceptions of Harbor-UCLA were southern California residents who attended medical school outside of California or on the Western Coast. In 2016, the demographic group with the highest perceptions of Harbor-UCLA were Outside residents who attended medical school outside of California.

Conclusions: Based on the data, the perceptions of the Harbor-UCLA Anesthesia residency program are improving among applicants, and the interview day has had a positive influence. The demographical correlation of sub-groups to perceptions was not consistent between the 2015 and 2016 cohort. Therefore, it is not recommended to make any assumptions about a candidate’s perceptions of the program based on their demographics. Because emotions like “fit” influence the decision to rank programs, it may be difficult to use algorithms to aid in the application process. More research is needed to optimize the recruitment process.
References:


**Poster Presentation**

**Presenting Author:** Dr. Trish Hubbard Department of Anesthesiology, Harbor-UCLA Medical Center

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Percutaneous transcatheter aortic valve-in-valve replacement for degenerated sutureless aortic valve

Background: Sutureless aortic valves are an alternative to conventional surgical aortic valve replacement with proposed benefits including shortened cardiopulmonary bypass and aortic crossclamp times. These devices differ structurally from standard valves and little data is available addressing the benefits and safety of transcatheter valve-in-valve implantation for degenerated sutureless valves.

Case Description: An 80 year old female with a history of sutureless (Perceval) aortic valve replacement for severe aortic stenosis and one-vessel coronary artery bypass grafting presented with worsening exertional dyspnea and angina. Transesophageal echocardiography reports from outside hospital noted development of moderate to severe valvular and perivalvular aortic insufficiency and valvular thrombus. Given the patient’s multiple comorbidities, she was considered to be high surgical risk and the decision was made to proceed with valve-in-valve transcatheter aortic valve replacement. Pre-operatively the patient was hypotensive and anemic with resting angina. Arterial and central venous access was challenging given peripheral arterial disease, presence of a left arm hemodialysis fistula and occlusive thrombus in the right internal jugular vein. The patient underwent an uneventful anesthetic induction and intubation. Intraoperative transesophageal echocardiography revealed restricted prosthetic aortic valve leaflet motion, severe valvular and moderate perivalvular leak and moderate mitral regurgitation. Coronary catheterization revealed an occluded graft to the left circumflex artery and drug eluting stent was placed. Percutaneous transcatheter valve in valve implantation was performed with a 23-mm Edwards Sapien S3 with good valve seating and only trivial perivalvular leak. Post-deployment the patient developed complete heart block. Attempts to place a permanent pacemaker were unsuccessful due to complete right central venous occlusion and an inaccessible left side due to fistula, so left femoral Permatemp was placed. The patient was extubated and transferred to the intensive care unit awaiting leadless pacemaker placement. On two-month follow up the patient continues to report significant symptomatic and functional improvement.

Discussion: Early results from a multicenter study on outcomes for patients receiving the Perceval valve report low rates of major perivalvular leak, valve degeneration and reintervention. The structural characteristics of these devices present special considerations for valve-in-valve implantation with concern regarding valve stability and fixation. A recent pilot series reported successful use of transcatheter aortic valve replacement for degenerated sutureless aortic valves with no early major adverse events. Larger, multicenter studies are needed to evaluate outcomes.

Poster Presentation

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Dr. Roya Yumul Department of Anesthesiology, Cedars-Sinai Medical Center, Los Angeles, CA
**Peri-operative Analgesia With a Stellate Ganglion Block For Upper Extremity Surgery**

The stellate ganglion nerve block selectively inhibits the sympathetic innervations of the upper limb, head and neck while preserving sensory and motor functions. The sympathetic nervous system is activated when the body experiences stresses such as pain. The sympathetic nervous system also influences arteriolar tone, which may modify pain by washing out the inflammatory mediators which sensitize nociceptors. Clinically, the stellate ganglion block is often used for treating chronic pain conditions. Recent studies have showed that the block also has potential for use perioperatively to reduce post-operative pain scores, opiate consumption and opiate side effects. We present a case in which the stellate ganglion block was performed preoperatively instead of a brachial plexus nerve block to improve postoperative analgesia while also allowing for immediate post-operative motor function testing.

**Poster Presentation**

**Presenting Author:** Dr. Koorosh Elihu Harbor-UCLA Medical Center

**Authors:**

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Prof. David Cho Harbor-UCLA Medical Center

Dr. Jeff Wu Harbor-UCLA Medical Center
Perioperative Management of a Large Thyroid Mass Causing Significant Tracheal Compression

32 year old previously healthy male presented to the ED with 6 months of neck swelling and 1 week of mild dyspnea while lying flat. CT scan on admission noted a large mass centered in the isthmus of the thyroid gland and tracheal compression with 3-4mm airway. He was admitted to the MICU for airway monitoring. Interventional pulmonology, ENT were consulted and the patient was taken to the OR for rigid bronchoscopy with proximal stent placement and percutaneous biopsy. The patient was induced with the head of the bed elevated 45 degrees and slow induction with propofol with the goal of keeping the patient spontaneously breathing was executed. Patient tolerated induction with minimal desaturations. Rigid bronchoscopy was placed by the interventional pulmonologist and revealed severe stenosis of the proximal trachea. At the end of the case, the patient was stable for removal of the rigid bronchoscope. He was transferred to the MICU for post-operative stent management and close airway monitoring. Biopsy pathology revealed papillary thyroid carcinoma. Flexible bronchoscopy was performed in the MICU to evaluate the tracheal stent which showed tracheal stent compression. Decision was made to take the patient to the OR for total thyroidectomy, bilateral neck dissection and central neck dissection. The patient was induced with ketamine and versed and again kept spontaneously breathing. The interventional pulmonary team remove the stent with a rigid bronchoscopy. A NIM tube was then passed through the stenotic region of the trachea. The case was complete uneventfully and the patient was eventually extubated in the MICU and discharged without complications.

Poster Presentation

Presenting Author: Dr. Michael Ross University of California, Irvine

Authors:
Dr. Michael Ross University of California, Irvine
Dr. Darren Raphael irvine
Perioperative management of a patient with hereditary angioedema undergoing medial collateral ligament repair under regional anesthesia

Background Hereditary angioedema is a rare genetic disorder most commonly caused by C1 esterase inhibitor deficiency, which leads to overactivity of the complement system and excess production of the vasoactive mediator bradykinin. It is characterized by recurrent episodes of angioedema affecting the skin, upper airway, and gastrointestinal tract. Triggers include but are not limited to trauma, surgery, intubation, dental work, infection, menses, and estrogen-containing oral contraceptives. The most feared complication is laryngeal edema leading to airway obstruction. Serum complement studies can be obtained to support the diagnosis of HAE. Patients may be on long-term prophylaxis with agents such as C1 inhibitor concentrate, androgens (e.g. danazol), and antifibrinolytics (e.g. tranexamic acid). Short-term prophylaxis prior to procedures may similarly be achieved with C1 inhibitor concentrate (or FFP if unavailable) and androgens. For acute attacks, the priorities are airway management and early administration of C1 inhibitor concentrate (or FFP if unavailable), ecallantide (kallikrein inhibitor), or icatibant (bradykinin B2 receptor antagonist).

Case Description A 46-year-old female with HAE and right knee dislocation presented for elective arthroscopy and open medial collateral ligament repair. Her symptoms included episodic skin swelling, abdominal pain, & dyspnea secondary to airway edema requiring intubation at the age of 22. She was taking C1 esterase inhibitor by intravenous self-administration for prophylaxis every 48 hours and for acute attacks as needed. Her symptoms were currently well-controlled on this regimen. On the day of surgery, the patient was given C1 inhibitor one hour prior to incision. She had a single shot femoral nerve block with 21 milliliters 0.5% ropivacaine, 50 mcg clonidine, and 150 mcg buprenorphine for post-operative analgesia. This was followed by a single shot spinal with 1.8 milliliters 0.75% bupivacaine in 8.25% dextrose and 15 mcg fentanyl. She was given intravenous midazolam and dexmedetomidine for sedation. Surgery proceeded uneventfully without airway compromise and the patient was brought to the recovery room in stable condition. On post-operative day number 1, the patient experienced swelling in the operative leg felt to be from angioedema and she was promptly given a dose of C1 inhibitor with resolution. She was discharged later that day and was doing well when seen in clinic one month post-operatively with no further exacerbations.

Discussion Our patient with hereditary angioedema successfully underwent knee arthroscopy with peripheral nerve blockade and neuraxial anesthesia. We chose regional anesthesia to decrease the stress response associated with surgery and to avoid intubation, both known triggers for angioedema attacks. It also allowed our patient to communicate with us if she had the sensation of an acute attack coming on. We administered prophylactic C1 inhibitor as this has been shown to significantly decrease the risk of angioedema attacks and had additional doses of C1 inhibitor in case of an acute attack in the operating room. Lastly, the patient was admitted for observation as angioedema attacks can occur up to 48 hours following the procedure.

Poster Presentation
**Presenting Author:** Dr. Robert Bellerose UC Davis Department of Anesthesiology

**Authors:**

Dr. Robert Bellerose UC Davis Department of Anesthesiology

Dr. Eugene Mansour UC Davis Department of Anesthesiology
Perioperative Management of Increased Intraocular Pressure in a Patient with Glaucoma Undergoing Robotic Radical Prostatectomy

Background: Prostate cancer is the second most common cancer in American men, and 80% of all radical prostatectomies in the United States are performed robotically. It is known that robotic surgery, which is associated with pneumoperitoneum and steep Trendelenburg positioning, significantly raises intraocular pressure (IOP). Intraperitoneal carbon dioxide due to insufflation elevates choroidal blood volume. In addition, since aqueous humor drains into the episcleral venous circulation, elevated central venous pressure (CVP) due to head-down positioning impairs aqueous outflow. In one study of 33 patients, IOP was found to reach an average peak level 13 mm Hg higher than that prior to anesthetic induction. Thus, special concern is raised when patients with primary open-angle glaucoma, who have elevated IOP at baseline, undergo robotic radical prostatectomy.

Case Description: We present a case of a 69-year-old male with prostate cancer, hypertension, and open-angle glaucoma who underwent robotic radical prostatectomy over a 4-hour period at our affiliated institution. His home medication regimen included timolol-dorzolamide eye drops, which reduce aqueous secretion by the ciliary body. Preoperatively, in order to prevent pupillary dilation, we medicated bilateral eyes with neostigmine eye drops. Intraoperatively, opioids (intravenous fentanyl and morphine) were also given for the dual purpose of pain control and the prevention of mydriasis. To reduce orbital edema, a steady infusion of mannitol and a bolus of furosemide were administered. To keep CVP low, a nitroglycerin infusion was continued throughout the case. A low-dose propofol infusion also supplemented our anesthetic maintenance with isoflurane, as propofol has been shown to reduce IOP by inhibiting arginine vasopressin (AVP) release. Furthermore, in order to prevent the choroidal vasodilation associated with hypoxemia/hypercarbia, we followed ABGs and adjusted ventilator settings as needed, keeping the PaCO2 between 35 and 40 mm Hg. Peak inspiratory pressure (PIP) and PEEP were also kept low, as some studies have shown an association with increased PIP, PEEP, and elevated IOP. Finally, we prevented coughing, bucking, and vomiting – all of which can significantly increase IOP – by ensuring adequate neuromuscular relaxation prior to intubation, titrating propofol prior to emergence, and by administering anti-emetics (dexamethasone and ondansetron). As a point of interest, we were aware that giving intravenous acetazolamide intraoperatively has been described as a way to prevent increases in IOP. Carbonic anhydrase inhibitors interfere with the production of bicarbonate, which is necessary for the synthesis of aqueous humor. However, we opted not to use acetazolamide due to the risk of metabolic acidosis and the choroidal vasodilation that could ensue. Our patient’s vision remained intact both immediately after and during follow up throughout his 3-day hospitalization, as well as one month after discharge, when he returned for another procedure.

Discussion: Increased IOP and potential visual dysfunction is a real concern in patients with glaucoma undergoing robotic surgery. We prevented this in our case by preventing pupillary dilation, reducing orbital edema, lowering CVP, preventing hypoxemia/hypercarbia, preventing sudden increases in PIP and PEEP, and by preventing coughing, bucking, and emesis.
Poster Presentation

Presenting Author: Dr. Jane Moon University of Southern California

Authors:
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Perioperative Stroke in Patient Undergoing EC-IC Bypass for Moyamoya: A Delicate Balance

Moyamoya disease is a syndrome of progressive stenosis and occlusion of the intracranial branches of the internal carotid artery and the formation small collaterals resulting in the typical "puff of smoke" appearance on angiography. The condition can be associated with both ischemic and hemorrhagic strokes, and it is most effectively treated with direct bypass procedures, which connect a branch of the external carotid artery to a more distal branch of the internal carotid, such as the middle cerebral artery. These surgeries, however, are associated with a number of complications including graft failure, ischemic stroke, intracranial hemorrhage, cerebral hyperperfusion syndrome, and graft problems such as thrombosis or compression. Here, we present a case of a 62 yo F with Moyamoya disease and prior successful right-sided STA-MCA bypass and no baseline neurologic deficits, who underwent a left-sided STA-MCA bypass. While the surgery successfully achieved a patent bypass between STA and MCA and the patient initially woke up well from anesthesia, she rapidly deteriorated after extubation and had seizure-like activity during transport to ICU. She also developed new aphasia and facial droop, and post-operative imaging revealed multiple small infarcts in watershed territories. This case provides an example the complex intracerebral hemodynamics in Moyamoya disease patients, and the unfortunate complications that can result from perioperative perturbations of those hemodynamics.

Poster Presentation

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Peripartum Management of IUFD in the Setting of Di-Di Twins: a case report

Background: The advancement of fertility medicine and the increasing age of many parturients has contributed to the overall increased frequency of multiple pregnancies since the 1970s. Since that time the number of twins has doubled and the rate of twins has risen from 18.9 to 33.2 per 1,000 births in the U.S. Sadly, single intrauterine fetal demise (IUFD) in twin pregnancies is not rare, occurring in 0.7 percent of dichorionic twin pregnancies before 22 weeks gestation. These patients present a unique and challenging set of considerations for the obstetric anesthesiologists, as outlined below. Case Description: We present a 35-year-old G2P0 who presented at 24 weeks gestation for preterm labour in the setting of dichorionic-diamniotic twin pregnancy. Her past medical history was significant for back pain following a MVA in the past for which she underwent six different spinal cord stimulator surgeries for placement and removal, which resulted in keloid scars in mid thoracic and upper lumbar distributions. She had known demise of Twin A approximately 4 weeks prior to arrival for which she had been expectantly managed without complication. On admission she was found to have a bulging amniotic sac with A’s fetal parts visible at the cervical os. The plan was for administration of betamethasone for Twin B and expectant management. After lengthy discussions with both the obstetrics team and patient, and baseline coagulation panel was confirmed normal, an epidural was placed with minimal difficulty despite her previous back procedures. On hospital day 2, Twin A was delivered vaginally at 24w1d. Her epidural was maintained until the day following delivery as she was closely monitored to ensure Twin B stability. The patient stabilized and did not continue to labour. After counseling on options, the decision was made to attempt interval delivery of Twin B. On hospital day 5, the patient began to experience painful contractions and it was decided to place another epidural in anticipation of possible delivery. Twin B’s fetal heart rate tracing indicated significant fetal distress and the decision was made to proceed with urgent delivery. Twin B was delivered via uncomplicated c-section under neuraxial anesthesia and taken to the NICU. Discussion: This case report contains several interesting educational aspects. The management of an IUFD in the setting of di/di twins with a borderline gestational age created a unique patient demographic. Close collaboration with all care teams, the patient and her spouse allowed careful consideration of when to place and duration of epidural through her multiple stages of labour. The placement and management of the epidural during both scenarios required a thorough evaluation. All usual modalities, including regional anesthesia, should be available and reviewed with the patient. It is particularly important for women with IUFD, as they may find labour and delivery physically insufferably harder.

Poster Presentation

Presenting Author: Dr. Lauren McLaughlin University of Colorado Department of Anesthesiology

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Pharmacy labeling can cause, rather than prevent, drug errors: an unintended consequence of design

Background: Pharmacies rely on printing software for labeling drugs. Software typically interfaces with electronic medical record to reduce error by automation, producing an adhesive label. Pharmaceuticals requiring dilution, doses prescribed to pediatric patients, and drugs administered by syringe pump all run a labeling error risk because they must be dispensed to the user in containers not labeled by the manufacturer. We report a 10-fold drug overdose caused by a design and usage flaw in pharmacy labeling, and discuss ergonomic issues related to labeling intravenous preparations in high intensity and acuity environments like the operating room.

Methods/Case: A 15-year-old healthy girl with scoliosis underwent thoracic posterior spinal instrumentation and fusion. Anesthesia was induced with sevoflurane with propofol and remifentanil maintenance infusions. Tranexamic acid was administered with loading dose of 10mg/kg over 20 minutes, followed by an infusion of 5mg/kg/h. This dose has been shown to maintain therapeutic levels in children, and was administered by a syringe pump (Medfusion 3500, Smiths Medical ASD Inc., St. Paul, MN, USA) from a 60ml syringe that was dispensed from the operating room pharmacy. Although these pumps have “drug libraries” which load preset parameters for each drug, the hospital has not implemented that software; instead the pumps are manually user programmed. After completion of loading dose, maintenance infusion was begun after confirming the pump was programmed in accordance with the syringe label, which depicted a concentration of 5mg/ml. Soon after starting surgery the pump alarmed, indicating a near empty syringe, which alerted the anesthesiologist that there was a problem, as the syringe should have lasted the entire case. Upon close inspection, it was noted that the label was ripped and stuck back on the syringe, obscuring the “0” in the drug concentration, which should properly have read “50mg/ml” rather than 5mg/ml. The infusion was stopped, and the patient suffered no consequences of the error.

Results/Discussion: There are many regulations that stipulate how manufacturers must design drug vial labels, however despite numerous studies and advisories about optimal labeling of syringes and infusions, there is no standardized labeling practice after dilution, reconstitution, or preparation of drugs. Indeed, there is often no communication between the pharmacy and end-user (anesthesiologist or nurse) regarding formatting or use of drug labels to enhance safety and identification. Labels can emphasize data of little use to the clinician while obscuring the information that is critical for safe administration of the drug. Labels not specifically designed to fit on syringes further obscure these data, and orientation of print and international standardized color codes may be ignored.

Conclusions: Hospital pharmacies and anesthesiologists must work together to utilize drug labels that are designed to enhance readability and instantaneous recognition of clinically important drug information, especially when syringes are mounted in pumps. Labeling of syringes with stickers not optimized for this purpose compound the risk of drug errors. This is of greater importance as anesthesiologists rely on pharmacies to mix and prepare drugs. Standardized concentrations with pre-programmed pump drug libraries, use of barcodes or RFID may also be effective strategies to reduce errors.
Poster Presentation

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Physicians versus hospital administrators: the cost of misinterpreting regulations.

Background: The United States Pharmacopeia Convention (USP) is the organization that sets standards for drugs, supplements, and food ingredients, and is responsible for creating the current standards under which medication compounding is monitored. Unfortunately, hospital administrators often quote USP Chapter 797 as the standard for managing commercially prepared IV bags after they have been spiked (attached to a sterile IV administration set), misunderstanding the difference between spiking and compounding. Since USP 797 only refers to pharmaceutical compounding of sterile preparations, commercially prepared arterial line flush solutions and IV solutions are not by definition compounded preparations and therefore they are not subject to USP time-limits between compounding and use. The objective of our study was to determine: if spiking IV bags under the ordinary conditions found in a busy anesthesia workroom could result in microbial contamination of the IV solution. if simple storage of a spiked IV bag in that same workroom would eventually result in microbial contamination of the IV solution. if excess cost is associated with treating spiked saline solutions as sterile compounds.

Methods: Twenty-five bags of normal saline were spiked at our institution by our anesthesia technologists. The technologists had no knowledge that these bags were to be used for a study, and they were prepared in their usual fashion in a non-sterile environment without masks, but using clean gloves and sterile IV tubing. Samples were collected within one hour of spiking, and again after 1, 2, 5 and 9 days. Twenty milliliters of saline were collected from each of five bags selected at random at each time period. Each 20 ml sample was then divided equally between two blood culture vials. The vials were brought to our hospital microbiology lab to be monitored for five days for growth of bacteria and fungi. Each IV bag was discarded after sampling.

Results: At day zero, one, two, five, and nine, no growth of bacteria or fungi was observed in any sample after five days of incubation under standard blood culture conditions.

Conclusion: We learned the following: That under the present anesthesia workroom non-sterile, blinded conditions in which our saline bags were spiked, no growth of bacteria or fungi occurred at zero, one, two, five, or nine days after spiking. This demonstrates that there is no need to change existing protocols that assume the maintenance of sterility for at least 24 hours. Hospital resources should not be wasted on a misinterpretation of USP recommendations. The cost savings achieved by this educational effort was calculated to be approximately $500,000 per year in labor, in addition to a one-time cost avoidance of three million dollars to build a level 5 clean room dedicated to the IV bag spiking as proposed by our hospital and pharmacy administrators. Additional costs for sterile clothing and cleaning should also be factored in. Additional intangible costs of employee job dissatisfaction, employee replacement and the treatment of repetitive motion injuries would probably be substantial. The misunderstanding of regulations can be very costly.

Poster Presentation

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Political Advocacy Amongst Anesthesiology Residents, A Survey of Perception of Professional Citizenship and Familiarity with Major Policy Issues

Title: Political Advocacy Amongst Anesthesiology Residents, A Survey of Perception of Professional Citizenship and Familiarity with Major Policy Issues Authors: Jeffrey B. Lewis, MD, Nicholas Halzack, MPH, Amanda Ott, BA. Affiliated institution: University of California, Davis Medical Center; American Society of Anesthesiologists, Washington DC Office Background: Key policy issues such as APRN scope-of-practice, Anesthesiology Assistants, MACRA, ACA repeal/replace and out-of-network billing are being discussed and legislated at state and national levels. The outcome of legislative and regulatory activities will shape the future of anesthesia practice in the United States. Residents have minimal exposure to advocacy issues as part of residency training. Policy advocacy training is required curriculum by the Standard for Accreditation for Nurse Anesthesia Programs. We advocate exploring the possibility of policy advocacy education as a component of residency training to promote professional citizenship among anesthesiology residents.

Methods: A survey inquiring as to the perceived importance of advocacy and self-assessment of familiarity with key legislative topics as identified by the American Society of Anesthesiologists, Advocacy Division was sent to the forty-two residents of the University of California Davis Anesthesiology Residency program. Data will be analyzed and the results tabulated upon completion of the survey. Results: TBD, pending data collection and analysis. Conclusions: Pending collection and analysis of survey results. Discussion: TBD, pending data collection and analysis. Future potential studies include supplying tested residents with relevant policy educational materials and then reassessing familiarity with major issues.

Poster Presentation

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Post-extubation Subcutaneous Emphysema in a Patient with Anterior Cricoid Cartilage Fracture

A 56-year-old woman with a history of well-controlled hypertension on losartan and idiopathic subglottic stenosis compromising her airway by 75% presented to our institution for an outpatient direct microlaryngoscopy, CO2 laser of stenosis, tracheal dilation, and injection of steroid and mitomycin C. The patient previously had excellent functional capacity and was a marathon runner, however as her stenosis progressed she presented with hoarseness and dyspnea on exertion. She was able to tolerate lying supine. Her history, physical exam, labs, and vitals were otherwise unremarkable.

The patient was premedicated with midazolam and brought to the OR. General anesthesia was induced with propofol, lidocaine and succinylcholine. Mask ventilation was easy. The patient was turned 180 degrees and the airway handed off to ENT who inserted an Ossoff Karlan laryngoscope with jet ventilation cannula. Maintenance of anesthesia was with propofol and remifentanil infusion. Per ENT request the patient was given muscle relaxation with 4mg cisatracurium to assist with Ossoff Karlan laryngoscope placement and visualization. The case proceeded as planned with intermittent jet ventilation titrated to chest rise. At the conclusion of the case, the Ossoff Karlan laryngoscope was removed and anesthetic infusions titrated down. Mask ventilation was performed and when train of four demonstrated 0 twitches the decision was made to place an LMA while the patient regained muscle strength. The patient's strength gradually improved, muscle relaxation was reversed and she emerged from anesthesia. The LMA was removed without complication. Upon transfer to the gurney, the patient coughed. She continued to cough and became dyspneic, complaining of difficulty breathing and progressively worsening chest pain. A chest xray was ordered and ENT notified. Over the course of 5 minutes post-extubation the patient was noted to have swelling around the bilateral eyes, midface, anterior and lateral neck, and anterior chest with crepitus. Her condition worsened and the decision was made to reintubate the patient. Chest xray demonstrated massive subcutaneous emphysema. ENT performed an additional direct laryngoscopy and the patient was found to have an anterior cricoid cartilage fracture. The patient was transferred to the ICU intubated and returned to the OR on POD#2 for anterior cricoid fracture repair and evacuation of subcutaneous emphysema. The patient was discharged on POD#3 and the following month ran a half marathon.

Discussion:

1) Subcutaneous emphysema
2) Jet ventilation
3) Cricoid cartilage fracture, tracheal stenosis lasering, balloon dilation

Poster Presentation

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Postoperative paraplegia in a patient who underwent extra-anatomic thoracic aorta bypass

Background: Paraplegia is a devastating complication of spinal cord ischemia following descending thoracic and thoracoabdominal aortic surgery. The incidence of spinal cord ischemia ranges from 8-22%. The mechanisms are multifactorial but are related to ischemia-reperfusion injury. Case Description: A 61-year-old Hispanic male presented to the emergency department complaining of hemoptysis. In 1974, he underwent an aortic isthmus interpositional graft for a traumatic aneurysm of the thoracic aorta. An endovascular graft was placed in 2014 for an aorto-bronchial fistula. In 2015, the patient was started on suppressive antibiotics for a chronic aortic graft infection. Surgery was planned for a complete resection of the indwelling grafts with extra-anatomic bypass. After induction, we performed remote ischemic preconditioning of the left upper extremity for three five-minute periods. A lumbar drain was placed and cerebrospinal fluid was drained intermittently throughout the procedure. The surgeons performed a median sternotomy and laparotomy. Bypass grafts were placed from the low ascending aorta to the innominate and left common carotid artery, and from the low ascending aorta to the supra-celiac aorta. During this time, the innominate artery, left common carotid, and supra-celiac aorta were cross-clamped intermittently. The distal ascending aorta was ligated and the sternotomy closed. The patient then became hypertensive followed immediately by profound hypotension with 3L of blood output from his chest tubes. The sternotomy was emergently reopened and manual cardiac massage was performed and the patient was resuscitated. An aortic tear at the proximal graft anastamosis was repaired and the sternotomy closed. The patient was placed in right lateral decubitus for a thoracotomy and the remaining aortic graft was resected. He was brought to the ICU intubated and sedated. The patient awoke four hours postoperatively with lower extremity paraplegia and intact sensation. His symptoms improved with drainage of CSF and all neurological symptoms resolved following arterial blood pressure augmentation. Discussion: The potential for severe morbidity and mortality demands that prevention of spinal cord ischemia be a part of the anesthetic plan for all thoracic or thoracoabdominal aortic repairs. Aortic cross-clamping causes decreased distal MAP and increased CSF pressure which lowers spinal cord perfusion pressure. Perioperative hypotension is also a major factor implicated in spinal cord ischemia. Reperfusion after ischemia produces oxygen free radical species and proinflammatory cytokines which worsen the initial injury. Several preoperative interventions and pharmacological agents have been shown to provide some protection from ischemic injury however further investigation is needed as no method has been ultimately successful. Anesthetic management should include identification of patients at risk for spinal cord ischemia, maintenance of spinal cord perfusion pressure, detection of neurological deficits, and facilitation of lumbar CSF drainage. Additional measures can aim to improve ischemic tolerance, reduce spinal cord oxygen demand, scavenge free radicals, decrease inflammation, and mitigate neuronal injury.

Poster Presentation

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Posturing secondary to anesthetics following emergence from anesthesia

Clinical Features: A 14 month old female was brought in by ambulance to a level one trauma center following a facial mauling by a family pit bull. Injuries sustained included a skull fracture, left ear avulsion, transection of the left facial nerve, eyelid laceration of the right upper and lower eyelid, and lip through and through laceration. The patient was immediately intubated using etomidate and succinylcholine on arrival and emergently brought to the operating room where she underwent irrigation and debridement of facial lacerations, exploration of the canalicular system on the right, repair of upper and lower lid lacerations, repair of facial lacerations and lip lacerations. Intraoperatively, patient was maintained under anesthesia with sevoflurane, a total of ketamine 10mg IV and fentanyl 100mcg IV, paralyzed with rocurronium and reversed with glycopyrrolate and neostigmine at the end of the case. Upon emergence, patient was noted to have extreme stiffness and rigidity of the arms and legs which was concerning for decerebrate posturing. Patient was transported from the OR directly to CT intubated, however imaging did not demonstrate any new overt bleeding. She was then transported to PICU intubated and was later extubated a day after surgery without any signs of neurological deficits. CT head and MRI brain were obtained without any radiologic evidence that would explain the posturing. Neurosurgery commented that the injuries sustained by the dog mauling was unlikely to account for the symptoms seen postoperatively and it was likely caused by medications administered during anesthesia. Conclusions: Medications used in general anesthesia are known to have caused dystonias, ankle clonus, Babinski reflex, and decerebrate posturing. Decerebrate posturing is associated with serious neurological pathology. It is characterized by tonic extension of the knees and elbows, internally rotated shoulders, flexed MP joints, and extended interphalangeal joints. Decerebrate posturing can be seen when there are lesions between the red nucleus of the brain and the reticulospinal and vestibulospinal tracts, allowing for unopposed extension of antigravity muscles. Dystonia can be interpreted as posturing as well, and is characterized by contractions in opposing flexor and extensor muscles. It is caused by hyperdopaminergic and hypodopaminergic states in the motor cortex. For instance, a lack of dopamine in the caudate and putamen in Parkinson’s disease is the cause of the movement sequela seen. Opioids have been shown in animal models to prevent the release of dopamine and cause symptoms similar to Parkinson’s disease. A case report cited ketamine as the source of dystonia in a 20 year old IV drug abuser and suggested that the mechanism may be increased central noradrenergic activity. Additional anesthetics used in pediatrics such as nitrous oxide and midazolam have been cited for causing dystonia. It is important for anesthesia providers to keep in mind the central effects of the medications we commonly use while providing an anesthetic. One consequence of these effects is posturing on emergence from anesthesia.

Poster Presentation

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Predictive Factors Associated with a Successful Clinical Outcome from Radiofrequency Ablation of the Genicular Nerves for the Treatment of Chronic Knee Pain due to Osteoarthritis

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Background: Radiofrequency ablation of the genicular nerves has been introduced as a treatment for chronic knee pain, yet predictive factors of successful outcomes are poorly described. The authors sought to identify factors that predict clinical success following cooled radiofrequency ablation (cRFA) of the genicular nerves for the treatment of chronic knee pain due to osteoarthritis (OA). Methods: A cross-sectional cohort study of patients with knee OA, anterior-posterior and lateral weight-bearing radiographs, pain numerical rating scale (NRS) score ≥4, diagnostic response (≥50% pain relief) to genicular nerve blocks, who underwent subsequent cRFA of the genicular nerves with minimum 6-month follow-up were included. Outcome data were collected by standardized phone survey. The primary outcome was a composite “treatment success” variable defined as: ≥30% reduction NRS score, patient global impression of change (PGIC) of “improved” or better, and lack of total knee arthroplasty (TKA). Multivariate logistic regression was used to identify covariates associated with treatment success including age, gender, body mass index, duration of symptoms, baseline NRS score, marital status, comorbid mood disorder, history of arthroscopy, knee compartment-specific Kelgren-Lawrence OA scores, and unilateral vs. bilateral procedures. Results: Fifty-four patients (79 discrete knees), median age of 66 years [IQR: 62-75], 22% male, were included. Median time to follow-up was 6 [IQR 6-7] months. Forty-three treatments (54%; 95% CI: 43-65%) met success criteria. In the multivariate model, younger age (p=0.01), shorter symptom duration (p=0.04), higher baseline NRS score (p=0.02), and lack of prior arthroscopy (p=0.04) were associated with successful treatment (AU-ROC curve: 0.84). Conclusions: Genicular nerve cRFA resulted in a 54% success rate at minimum 6-month follow-up using a composite definition. Younger age, shorter symptom duration, higher baseline NRS score, and lack of prior arthroscopy predicted success. These factors should be considered when selecting patients for genicular cRFA to treat painful knee OA.

Oral Presentation

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Preoperative Hemoglobin A1c is Associated with Increased Odds for 60-day Postoperative Wound Infection in Diabetic Patients

Introduction: A history of diabetes has been associated with postoperative wound infection. Consecutively, it has been proposed that a low HgbA1c level should decrease the risk of postoperative wound infections. However to our knowledge the effect of an increased HgbA1c level on postoperative wound infection has not been published. We hypothesized that increased levels of HgbA1c are associated with increased surgical wound infections.

Methods: This study was approved by our institutional review board and was exempt from the consent process. Data from all surgical patients from a single institution were queried from January 2014 to December 2016. All patients who had preoperative HgbA1c data available (up to 3 months prior to surgery) were included. Patients with HgbA1c values less than 5.0 or greater than 20 were excluded. In the instance when patients had multiple surgeries, only the first encounter was included in the analysis. The outcome was 60-day postoperative wound infection, which was identified by the presence of this diagnosis code 60 days following surgery. Multivariable logistic regression was performed to determine if HgbA1c was associated with infection. The covariates in the model included surgical service, age, and gender.

Results: There were a total of 17,971 surgical patients included in the analysis after exclusion. Of these, there were 354 (2.0%) postoperative wound infections. The median preoperative hemoglobin A1c value was 5.8 [25-75% interquartile range 5.4, 6.3] and the range was 5.0 to 15.6. Univariable logistic regression analysis demonstrated that there was a 14% increased odds of 60-day postoperative wound infection for every one unit increase in HgbA1c after 5.0 (OR 1.14, 95% CI 1.07 – 1.22, p<0.0001). After adjusting for age, sex, and surgical specialty, the association was still significant (OR 1.11, 95% CI 1.04 – 1.18, p=0.005). The rate of postoperative wound infection in patients with HgbA1c &lt;= 5.0 and &lt;= 7 was 1.87%; HgbA1c &gt;= 7 and &lt;= 10 was 2.41%; and HgbA1c &gt;= 10 was 3.97%. Conclusion: In this retrospective study we observed that an increase in the HgbA1c level was associated with a significant increase in postoperative wound infections. Further studies need to be completed to determine whether decreasing HgbA1c levels will result in a decrease in the postoperative wound infection rate.

Poster Presentation

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PREOPERATIVE PECS I AND II NERVE BLOCKS REDUCE POSTMASTECTOMY INTRAOPERATIVE AND POSTOPERATIVE OPIOID CONSUMPTION: A MAJOR U.S. ACADEMIC MEDICAL CENTER EXPERIENCE

Background
The appropriate inclusion and use of regional anesthesia can result in better pain control and reduce overall costs for facilities. Currently, paravertebral nerve blocks remain one of the most common and technically challenging nerve blocks to perform. In recent years, the pectoral nerve blocks have been shown to be a more accessible regional anesthetic to perform in patients undergoing mastectomies. Several reports have also demonstrated superiority of pectoral blocks over the paravertebral approach in such patients. In 2015, Bashandy et al. reported a significant reduction in postoperative nausea and vomiting in 120 patients in Egypt who received intraoperative thoracic intercostal nerve blocks while undergoing implant-based breast reconstruction. In addition to an anticipated reduction in opiate requirements, Shah and colleagues also demonstrated cost savings of approximately $1,500 and $2,900 to patients at a single major academic center for unilateral and bilateral reconstructions with nerve blocks, respectively. Study Description
A retrospective chart review was performed using the electronic medical records available at the UC Davis Medical Center (Sacramento, California) to search for patients having undergone unilateral or bilateral mastectomies between 2012 and 2016. Patients over the age of 18 years with planned unilateral or bilateral mastectomy without additional procedures, operations, and/or primary diagnoses directly unrelated to the mastectomy were included in the study. Qualifying patients were divided into two groups based on the laterality of the surgery as documented by the performing surgeon(s): unilateral or bilateral mastectomy. The patients were further subdivided based on whether pectoral blocks were performed or not, as determined by the anesthesia documentation in the medical records. Discussion
A total of 43 patients received preoperative pectoral blocks at our institution with a significant reduction in both intraoperative ($p < 0.003$) and postoperative opioid requirements over 24 hours for pain control ($p < 0.01$), based on morphine milligram equivalents (MME) compared to 50 patients who did not receive preoperative pectoral blocks. Post-recovery opioid consumption after discharge from the PACU was not statistically significant between the two intervention and control group. Possible follow-up studies include larger retrospective studies for increased statistical power, prospective studies, and a retrospective study on potential impact on post mastectomy pain syndrome.

Poster Presentation
Presenting Author: Dr. Tim Lee UC Davis Department of Anesthesiology
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Preventing postoperative respiratory depression: can continuous CO2 monitoring help?

Background
Respiratory depression (RD) is a significant cause of morbidity and mortality in the postoperative period. Previous studies have shown RD complications to be as high as 3%1,2 and have implicated various contributing factors, including use of neuromuscular blocking agents (NMBAs), opioids, obstructive sleep apnea, unmonitored settings, etc.3-6 Past studies have also identified the potential use of continuous monitoring to mitigate the risk of RD and called for additional investigation.4-6 Given this context, we investigated the potential use of universal continuous monitoring via capnography in the PACU as a means of detecting adverse respiratory events in the postoperative period.

Methods
Using an IRB-approved protocol, 125 patients were enrolled at our institution over a 9-month period as part of a multi-center prospective observational trial. Inclusion criteria consisted of the following: age ≥18 years, ASA score II-IV, procedures necessitating general anesthesia with a duration ≥1.5 hours, use of intraoperative opioids, ≥45 minutes of recovery in the PACU, and discharge to an inpatient setting. Exclusion criteria included pregnancy. The FDA-approved Capnostream20p (CS20p) bedside monitor provided real-time measurements of ventilation parameters (end-tidal CO2, respiration rate, and raw CO2 waveform as a function of time) and oxygenation parameters (heart rate and SpO2). The CS20p was blinded and its alarms silenced to staff and study personnel during standard of care in the PACU. Subsequently, inpatient charts from the first 24 hours post-discharge from the PACU were reviewed for evidence of clinical intervention indicating possible RD (reintubation, ICU admission, administration of naloxone, etc.). Data pertaining to ventilation and oxygenation parameters was collected and is currently undergoing further analysis by Medtronic.

Results
125 patients were enrolled. 61.7% were female; mean age was 54.7±15.1 years (range, 20-82 years); mean BMI was 29.7±7.7 (range, 18-66); and ASA scores were II (47.9%), III (50.0%), and IV (1.1%). Of 125 enrolled patients, 2 were omitted due to the need for unblinded continuous CO2 monitoring per standard of care. Of the remaining 123 patients, 0 patients were documented to necessitate clinical intervention for suspected RD in the first 24 hours post-discharge from the PACU. Both omitted patients had uncomplicated recoveries.

Conclusions
This study did not demonstrate the utility of universal continuous CO2 monitoring in our PACU as none of the enrolled patients required clinical intervention for suspected RD in the first 24 hours after PACU discharge. Therefore, it may be beneficial to continue studying the role of CO2 monitoring in settings with higher rates of RD. While continuous CO2 monitoring may not be necessary for all patients, further investigation into a potential reduction of relative risk in select high-risk patients may be warranted. For example, one patient was removed from our study for unblinded continuous CO2 monitoring due to obesity. Apart from calls for potential universal continuous CO2 monitoring, other risk factors contributing to RD have been addressed and altered (i.e. more judicious administration of opioids, fewer NMBAs). Ultimately, more research is needed to determine what patient populations will most benefit from expanded continuous CO2 monitoring protocols.

Poster Presentation
Presenting Author: Mr. Ryan Schmoll University of Arizona College of Medicine - Tucson

Authors:
Mr. Ryan Schmoll University of Arizona College of Medicine - Tucson
Ms. Olivia Valencia University of Arizona College of Medicine - Tucson
Dr. Peter Lichtenthal University of Arizona College of Medicine - Tucson
**Q fever endocarditis**

**Background**
Q fever is a zoonotic disease caused by the pathogen Coxiella burnetii. Farm animals and pets are the main source of infection and transmission to humans occurs via aerosolized inhalation. Clinical manifestations range from self-limited febrile illness to chronic infections lasting over 6 months. Once diagnosed by serologic testing, doxycycline is the treatment of choice with the addition of hydroxychloroquine in cases of endocarditis. Although less than 5% of patients with Q fever develop endocarditis, the incidence of endocarditis among patients with pre-existing valvular abnormalities ranges from 39-75%. Endocarditis is the most common chronic manifestation among other conditions including hepatomegaly, glomerulonephritis, and embolic phenomenon.

**Case Description**

57M with history of atrial fibrillation and bicuspid aortic valve stenosis s/p AVR with bioprosthetic valve in 2005, developed malaise, myalgia, and weight loss 6 months prior to developing night sweats, fever, and joint pain. The patient owns a mobile pet cleaning and grooming business, in which he partakes in cleaning the van and bathing tanks. Workup revealed leukocytosis with TTE demonstrating mitral and aortic valve vegetations as well as splenic abscesses and SMA thrombus, for which he underwent a splenectomy. He was started on doxycycline and plaquenil, with the addition of rifampin once testing with PCR+ and anti-phase 1&2 antibody titers confirmed Q fever endocarditis. The patient underwent a prophylactic median arcuate ligament release given SMA thrombus and celiac artery narrowing to avoid bowel ischemia complications prior to cardiac surgical intervention. He then underwent a redo sternotomy, AVR, MVR, aortic root debridement and replacement, with post-operative echo showing normal cardiac function with no evidence of residual vegetation. His post-operative course was complicated by right lower leg critical limb ischemia secondary to CFA thrombus, requiring a right CFA and popliteal artery embolectomy and four compartment fasciotomy. The patient also developed ventricular tachycardia requiring multiple shocks and vasoactive support, SBO, symptomatic cholecystitis requiring percutaneous cholecystostomy tube for drainage, and candida bacteremia.

**Discussion**

Q fever endocarditis is not often detectable in blood cultures; Hoen et al. observed negative blood cultures in 88 (14%) of 620 cases of infective endocarditis during a 1-year nationwide survey in France, 7 of which were caused by Q fever. Thus, it is imperative to perform serology testing when endocarditis is suspected, especially in individuals with prosthetic valves or history of valvular abnormalities. Patients with antiphospholipid syndrome are also at increased risk for developing endocarditis and persistent infections. Once diagnosed with Q fever, a 12 month treatment course of doxycycline has been shown to protect at-risk individuals with Q fever from developing endocarditis. Patients with chronic infection will require dual treatment with hydroxychloroquine for 18-24 months. Q fever endocarditis requires surgical replacement, however there is one reported case of successful conservative management with doxycycline monotherapy. Even after treatment, patients may experience post-Q fever fatigue.
syndrome, characterized by fatigue, nausea, arthralgias, and depression. Q fever endocarditis is a rare but life-threatening condition and prompt evaluation and treatment is imperative if Q fever is suspected, especially in patients with history of valvular abnormalities.

**Poster Presentation**

**Presenting Author:** Dr. Caroline Kan Cedars Sinai Medical Center

**Authors:**

Dr. Caroline Kan Cedars Sinai Medical Center
**Rapidly Progressive Glomerulonephritis with ANCA and Anti-GBM Antibodies in the setting of Acute Dengue Infection**

Rapidly progressive glomerulonephritis (RPGN) is the acute loss of renal function due to deposition of anti-glomerular basement membrane (GBM) antibodies, immune complexes, and/or antineutrophil cytoplasmic antibodies (ANCAs), causing intra-glomerular inflammation. Being doubly positive for ANCA and anti-GBM is exceedingly rare and carries a poorer prognosis. Molecular mimicry has been implicated in the pathogenesis of anti-GBM disease and ANCA-associated vasculitis. A 66 year-old Honduran woman presented to our institution for further evaluation of suspected RPGN. A month prior, she experienced nausea, dysgeusia, and progressive fatigue. She also suffered from mosquito bites. She was admitted to a Honduran hospital with frothy, blood-tinged urine and bilateral palpebral edema. Laboratory values showed hemoglobin (Hgb) 9.7 g/dL (baseline 13.6 g/dL), serum creatinine (Cr) 6.1 mg/dL (baseline 0.74 mg/dL) and microscopic hematuria and proteinuria 1.2 gm/day. Renal biopsy showed cellular crescents with positive anti-GBM antibodies, ANCA Myeloperoxidase (MPO) and anti-dengue IgM antibodies. Thus she was diagnosed with RPGN and acute dengue infection, started on systemic corticosteroids and cyclophosphamide and transferred to our institution for further management. On arrival, the patient had no hemoptysis or evidence of pulmonary hemorrhage. Patient was initiated on plasmapheresis, prednisone and cyclophosphamide. Treatment was complicated by progressive anemia (Hgb 6.6 g/dL), thrombocytopenia (platelets 62 K/mcl), and a coagulopathy (international normalized ratio (INR) 1.7) that developed after her fifth course of plasmapheresis. Normal peripheral smear and additional labs excluded hemolysis, but confirmed a shearing effect secondary to plasmapheresis. After 14 total sessions of plasmapheresis and supportive transfusions, repeat renal biopsy showed progression from acute to chronic phase of disease. Before discharge, Hgb 10.4 g/dL, platelets 6 K/mcl, Cr 4.3 mg/dL, INR 1.2 and antibody titers undetectable. This demonstrates a unique case of MPO and ANCA mediated anti-GBM disease, in the setting of acute dengue, managed with plasmapheresis, prednisone and cyclophosphamide. Newfound thrombocytopenia and anemia secondary to plasmapheresis complicated management of this insidious renal failure.

**Poster Presentation**

**Presenting Author:** Dr. Linda Nguyen University of Utah

**Authors:**

Dr. Linda Nguyen University of Utah
Refractory Intraoperative Hypoxemia Secondary to Tracheal Bronchus

Background

A tracheal bronchus is a congenital anomaly in which an accessory bronchus originates from the trachea about 2 to 6 cm proximal to the carina. The prevalence of right tracheal bronchus is 0.1%-2% and left tracheal bronchus is 0.3-1%1,2. Although usually asymptomatic, tracheal bronchi can cause recurrent pneumonia, chronic bronchitis or bronchiectasis. Atelectasis due to obstruction caused by an endotrachael tube (ETT) has been reported3,4,5. We present a case of refractory intraoperative hypoxemia in an infant with an undiagnosed aberrant right upper lobe bronchus arising directly from the trachea.

Case Description

A 19 month-old previously healthy female infant presented with fulminant liver failure following ingestion of amanita mushrooms and underwent deceased donor liver transplantation. Her postoperative course was complicated by direct hyperbilirubinemia in the setting of bile duct dilatation seen on serial abdominal ultrasound. She was scheduled for exploratory laparotomy and biliary revision.

The patient was pre-oxygenated and anesthesia was induced with sevoflurane followed by fentanyl, propofol and rocuronium. She was intubated with a 3.5 mm cuffed ETT that was secured at 11 cm at the lip. Oxygen saturation progressively declined to the high 80s despite 100% O2 and diminished right upper breath sounds were noted. ETT was readjusted to 9 cm at the lip and recruitment breaths were delivered. Scant secretions were noted on ETT suctioning. Albuterol was given for mild upsloping of ETCO2 tracing, though no wheezing was noted. Intraoperative CXR revealed an ETT above the thoracic inlet and low lung volumes. ABG revealed a significant A-a gradient with PaO2 71 on 100%. Patient developed tachycardia and hypotension, which resolved with brief low-dose dopamine infusion. Oxygen saturation gradually increased above 95%, though she remained on 100% O2. The case was canceled due to persistent hypoxia of unknown etiology.

The patient was transported to the ICU without complications. Postoperative CXR revealed new mild right upper lobe atelectasis. A chest CT angiogram did not demonstrate any evidence of pulmonary embolism (PE) but a right upper lobe tracheal bronchus was diagnosed about 2 cm proximal to the carina.

Discussion

Significant difficulties in airway management and hemodynamic disturbances have been reported with tracheal bronchi3,4. Our patient had no known history of cardiac or pulmonary shunting, however she developed refractory intraoperative hypoxemia with a significant A-a gradient following intubation despite delivery of 100% O2. Given the lack of evidence suggesting a diagnosis of PE, mucous plugging, bronchospasm or pulmonary edema, we hypothesize that the initial ETT position may have obstructed the tracheal bronchus resulting in
right upper lobe collapse. Subsequent ETT repositioning and recruitment breaths may have resulted in temporary resolution of her lobar collapse. As demonstrated in this case, chest radiograph may be normal despite the presence of a tracheal bronchus and chest CT will reliably establish the diagnosis. Flexible bronchoscopy is the gold standard for diagnosis and may be helpful intraoperatively for delineating anatomy and avoiding bronchial obstruction due to ETT positioning. Although uncommon, anesthesiologists should consider a diagnosis of a tracheal bronchus in intubated patients with unexplained refractory hypoxemia.

**Poster Presentation**

**Presenting Author:** Alec Peniche University of California, San Francisco

**Authors:**

Alec Peniche University of California, San Francisco
Dr. Gail Shibata University of California, San Francisco
Remote Ischemic Preconditioning in Aneurysmal Subarachnoid Hemorrhage.

Introduction:

Aneurysmal subarachnoid hemorrhage (aSAH) is a common cause of death and disability, accounting for as many as 10% of stroke cases in the United States. While much of the resulting injury to the nervous system is caused by the initial bleeding from the aneurysm, many of these patients develop cerebral vasospasm, pathological constriction of the blood vessels supplying the brain, several days following hemorrhage. This delayed brain injury accounts for a significant percentage of poor outcomes following aneurysm rupture. Remote ischemic preconditioning (RIPC) by transient limb ischemia (produced by inflation of a blood pressure cuff on the arm or leg) has been shown to minimize ischemic injury to other organs, most notably studied in the heart. In other forms of stroke the onset of ischemia cannot be predicted in the general population, following aneurysm rupture the investigators know patient’s risk of developing vasospasm. Therefore, we applied RIPC to see if it would confer protective effects from delayed ischemic injury

Methods:

In this pilot trial, 25 patients with SAH were randomized to undergo maximum of 6 cycles of treatment vs sham from days 3-14 post-aSAH. Inflating a manual blood pressure cuff 20 mmHg above the systolic blood pressure (SBP) and loss of a distal pulse for 5 minutes with 5 minutes break and four cycles total was considered a single treatment. Sham treatment group received an inflation of the blood pressure cuff to 20mmHg below the SBP, with the rest of the procedures the same as the treatment group. Outcomes noted were one month and six month modified Rankin Scores (mRankin), ICU and hospital length of stay, and mortality.

Results:

At conclusion of the study we had eleven patients in the treatment group and fourteen in the sham group. The age, baseline mRankin score, Hunt and Hess score, Fisher Grade and admission GCS were not significantly different between the treatment group and the sham group. The one month and six month mRankin score, ICU length of stay, hospital length of stay and mortality were not significantly different between the treatment and sham groups.

Conclusion:

This pilot study showed that inducing RIPC in patients with aSAH patients is easy and safe, the vitals stayed within the 20% variation range for both the treatment and sham groups. Patients who were alert and awake only noted mild tolerable discomfort with the treatment. Although there were no significant differences in the outcomes we believe that can be due to the small nature of this pilot study, the wide variability in patient presentation, and clinical treatments (most notably coiling vs clipping). Further studies should be focused on the patients at greatest risk of delayed ischemia (Fisher grade 3 and 4), possibly remove patients with
complications that can be attributed to a clinical treatment and will likely need a much larger sample size to elucidate true effects of RIPC on aSAH.

**Oral Presentation**

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Respiratory Compromise in a Patient with a Known Difficult Airway

Title: Respiratory Compromise in a Patient with a Known Difficult Airway

Authors: Murad Arif, MD

Affiliated Institution: Cedars Sinai Medical Center

Background: A 73 year old patient in the medical intensive care unit for treatment of acute respiratory decompensation is found to be requiring increasing oxygen support and developing increasing hypercapnea. The on-call anesthesia airway team is called for urgent intubation; prior airway documentation in the EMR lists the patient as having been previously intubated however with a grade 4 view requiring multiple attempts with a C-MAC video laryngoscope. A strategic plan to establish airway control is imminently required.

Case Description: Brief history and physical for this 73 year old female were taken and notable for influenza A diagnosis, morbid obesity, atrial fibrillation on anticoagulation, OSA, and difficult airway. Previously intubated several days ago and noted to be a grade 4 view with CMAC after multiple attempts by anesthesia staff and requiring a bougie for successful passage of ETT, also known difficult bag mask ventilation at that time. Physical notable for a morbidly obese woman in acute distress. Large circumference neck with minimal mouth opening. Apparent anterior neck mass with limited thyromental distance and recessed chin. Minimally responsive (opens eyes to stimulation and some grimacing). Upon arrival to bedside, patient being bag mask ventilated by three providers. Oral airway placed and saturations 99-100%. Given previous difficult airway, patient prepped for awake fiberoptic intubation with 0.4 mg glycopyrrolate (with esmolol titrated to keep HR &lt;120) and an ovassapian airway lubricated with 4% lidocaine jelly. Airway easily placed without difficulty, tolerated by patient. Difficult airway cart/equipment present and trauma surgery contact readily available. AFOI attempted x 2 without adequate visualization of glottic opening (only soft tissue and tongue seen). Trauma surgery team was requested to be present before additional attempts at intubation be made, with concern for acute decompensation/loss of airway and need for surgical airway. Mask ventilation at this time became increasingly difficult and an LMA 4 was easily placed with adequate ventilation and oxygenation. A fiberoptic scope was placed through LMA with good visualization of cords, which were topicalized with 2% lidocaine. A 6.0 ETT was then loaded on scope and patient intubated via scope through LMA. Due to body habitus, significant concerns that 6.0 ETT would not be adequate for ventilation. Decision made to proceed to OR for ETT exchange and possible tracheostomy. In OR patient prepped and draped for potential tracheostomy. CMAC placed in oropharynx with view of LMA. Bougie placed in ETT and LMA/6.0ETT removed under direct visualization with CMAC in place. 7.5 ETT easily exchanged over bougie. EtCO2 confirmed.

Discussion: This case report highlights the importance of the difficulty airway algorithm as well as the need in such situations to have several backup plans available and ready.

Poster Presentation

Presenting Author: Dr. Murad Arif Cedars Sinai Medical Center

Authors:

Dr. Murad Arif Cedars Sinai Medical Center
Respiratory Distress in the PACU

Introduction
Paradoxical vocal fold motion (PVFM) is a phenomenon where inappropriate motion of the vocal cords is seen. Patients often present to the emergency department with symptoms of wheezing, inspiratory stridor and concerns for upper airway obstruction. Patients may have multiple health care provider visits with extensive workup and delays in diagnosis. The disorder is commonly associated with asthma, exercise, post-extubation status, neurologic injury, and psychosocial disorders.

Case Report
Patient is a 35 year-old female with a history of asthma seen in the PACU following laparoscopic appendectomy. While in the PACU, the patient did well, with mild operative site pain treated with 25 mcg of Fentanyl. Subsequently, the patient felt nauseous and became stridulous and dyspneic with SpO2 readings in the 70s while seated in an upright position. Physician anesthesiologists were one bay adjacent and immediately responded, applying 100% oxygen and positive pressure using an Ambu bag with improvement of her stridor and saturations without assistance. Head of the bed was lowered for albuterol SVN therapy and the patient again became stridulous. The head of the bed was then raised, and CPAP re-placed. Albuterol and racemic epinephrine were administered via face mask, as well as lidocaine 25mg IV, and dexamethasone 4mg IV. The patient improved initially, but worsened. She was given epinephrine 0.3 mg IV, and became tachycardic with short runs of ventricular tachycardia. Ventricular tachycardia resolved without intervention, and the patient’s stridor improved. However, she continued to be extremely anxious, and was administered midazolam 1mg IV. Nasal fiberoptic examination was performed, showing severe adduction of the bilateral true vocal folds with supraglottic squeezing, and a posterior glottal gap through which she was oxygenating. Laryngeal structures including the arytenoids and true vocal folds were quivering. The bilateral vocal folds were seen to move with phonation and sniffing, allowing for some abduction. Following the fiberoptic examination, CPAP was applied, and the patient was transferred to the ICU.

Discussion
Dyspnea, stridor and hypoxia represent a critical presentation for anesthesia providers, and possible etiologies such as laryngospasm, bilateral vocal cord paresis, and other causes of upper airway obstruction should be considered. Patients presenting with prolonged inspiratory stridor, wheezing and concerns for airway obstruction may benefit from inclusion of PVFM in the provider’s differential diagnosis. The gold standard for diagnosis of PVFM is laryngoscopy, and may be differentiated from laryngospasm by its time course, which is often over hours to days, whereas laryngospasm usually lasts seconds to minutes. Patients with PVFM have increased difficulty with inspiration vs expiration, and minimal response to asthma therapy. If performing pulmonary function tests, patients with PVFM may have a flattened inspiratory flow-volume loop with normal expiratory spirometry, lung volumes, and arterial blood gas measurements. Acutely, patients benefit from reassurance and supportive care with CPAP until spontaneous resolution. Panting and Heliox has been reported to be helpful. Endotracheal intubation and tracheostomy are not indicated in PVFM, and should be used only if other etiologies are suspected. Prevention strategies include minimization of laryngeal irritation, as well speech language pathologist therapy.

Poster Presentation
Presenting Author: Dr. Christopher Bailey Mayo Clinic Arizona

Authors:
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Retrospective Chart-Review of Intraoperative Ketamine and Methadone for Lumbar Spine Surgery: Effect on Recovery, Postoperative Pain and Opioid Requirements

Background: Post-lumbar spine surgery is associated with increased morbidity and postoperative complications. Patients who undergo spine surgery often have higher baseline opioid requirements, which lead to an increased perioperative use of opioids, which lead to side effects and complications. N-methyl-D-aspartate (NMDA) receptor antagonists such as ketamine and methadone have been shown to have opioid sparing effects, minimize opioid tolerance, and improve quality of postoperative pain control in chronic pain patients; however, their combined effects remain largely unknown. We hypothesize that post-lumbar spine surgery patients who were administered intraoperative ketamine and methadone have improved postoperative pain scores than those receiving intraoperative ketamine or methadone alone. Methods: This is a retrospective, single-center study involving patients who were undergoing lumbar spine surgery from February 2013 to January 2017 who received ketamine, methadone or ketamine and methadone combined. Chart review was performed examining their baseline demographics, opioid and adjunct medication use, and pain scores as well as perioperative opioid and adjunct medication use, pain scores and postoperative complications up to 72 hours post surgery. Results: 58 patients received ketamine only, 67 patients received methadone only, 18 patients received combined ketamine and methadone. Preoperatively, patient’s who received ketamine and methadone combined had a significantly higher baseline opioid requirement with significantly higher baseline pain scores. Postoperatively, the combined ketamine and methadone group received significantly more opioids in the PACU with a trend toward higher requirements at 24, 48 and 72 hours. Patients in the combined group also had significantly higher pain scores in the PACU with a trend towards higher pain scores at 24, 48 and 72 hours. Total length of stay demonstrated a trend towards longer length of stay in the combined group. Conclusion: Patients who received combined ketamine and methadone in the perioperative period had higher preoperative opioid requirements and pain scores as well as postoperative opioid requirements and pain scores compared to patients who received ketamine or methadone alone. This may be due to a higher likelihood for baseline chronic pain and therefore for providers to administer combined therapy intraoperatively.

Poster Presentation

Presenting Author: Dr. Valerie Au Cedars-Sinai Medical Center

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Retrospective Study to Assess Efficacy of Peripheral Lidocaine for Pain Management of Rib Fractures

Authors: Anuj Aggarwal, M.D.; Einar Ottestad, M.D.
Affiliation: Department of Anesthesiology, Perioperative, and Pain Medicine, Stanford University, Stanford, CA, USA

Background: Management of pain secondary to rib fracture is a common consult to the acute pain service at Stanford; nationally, greater than 150,000 patients are admitted annually with rib fractures. Pain control is an important component of management of rib fractures to promote deep breathing and clearance of secretions to prevent complications including pneumonia; 10% of patients admitted with rib fractures to American trauma centers die each year. Many methods have been studied to reduce reliance on narcotic analgesics for pain control and several surgical societies advocate epidurals for pain management. However, even in centers that emphasize epidural pain control, only a minority of patients with rib fractures receive epidurals secondary to technical, logistical and functional considerations that affect clinical utility; as such, opioids remain the cornerstone of pain management of rib fractures. At Stanford, we have utilized peripheral lidocaine infusions with anecdotal success for pain management in patients with rib fractures, and currently, no reports exist in the literature of this approach.

Methods: With IRB approval, we reviewed charts from January 1, 2011 to June 30, 2016 for patients with diagnosis of rib fractures for whom the primary service had consulted the acute pain service. Including patients who were admitted and managed by the acute pain service for management of pain secondary to rib fractures, we reviewed adverse events, opioid usage, care delivery factors, vital signs, and other factors of pain management with a focus on patients managed via epidural versus peripheral lidocaine infusion.

Results: 204 patients were admitted with rib fractures for which the acute pain service was specifically consulted. Of these, 86 received epidurals, 89 received peripheral lidocaine infusions, with an overlap of 15 patients. A variety of factors excluded the use of epidurals and our results in aggregate show successful use of peripheral lidocaine for pain management of rib fractures. Conclusions: Very little data exists of the use of peripheral lidocaine infusions in the management of nonoperative acute pain, and to our knowledge, this is the first demonstration of the use of peripheral lidocaine infusion for pain management of rib fractures. As a modality, peripheral lidocaine infusions are safe, simple, and have the benefit of not being site/dermatome specific. This study serves as the first set of data currently for acute pain management in the trauma patient with peripheral lidocaine infusions. As a vulnerable population with many risk factors disfavoring both opioid analgesics and invasive pain management strategies, peripheral lidocaine infusions may offer a unique tool as part of a comprehensive pain management strategy.

Poster Presentation

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Dr. Einar Ottestad Department of Anesthesiology, Perioperative and Pain Medicine, Stanford School of Medicine, Stanford, California
Right Ventricle Perforation: Rare Complication During Intraoperative Central Line Placement for Orthotopic Liver Transplantation

Background:

It is estimated over 5 million central venous catheters (CVC) are placed per year. A large bore MAC multi-lumen central venous access catheter is routinely placed in the internal jugular vein for central venous access during orthotopic liver transplantation (OLT). Central venous access is critical for intravascular resuscitation, vasopressor support, and hemodynamic monitoring via pulmonary artery (PA) catheter. Perforation of the heart during central line placement causing pericardial effusion and tamponade may not be readily present after central line placement. Prompt evaluation using echocardiography intraoperatively can easily detect the rare, life-threatening complication of pericardial tamponade.

Case Description:

63 year old female with Hepatitis C and alcoholic end stage liver disease was brought to the operating room for OLT. A 9 French MAC catheter and 8 French PA catheter were easily placed in the right internal jugular vein. MAC catheter position was confirmed with ultrasound, and PA catheter position was confirmed by waveform analysis and transesophageal echocardiography (TEE). Cardiac function appeared normal with no pericardial effusion seen on initial TEE. The patient was hemodynamically stable on low dose norepinephrine drip until 30 minutes after reperfusion of the transplanted liver. The patient required increasing norepinephrine and addition of vasopressin drip for hemodynamic support despite minimal bleeding noted by the surgical team. TEE was used to evaluate cardiac function and a new pericardial effusion with some right ventricle diastolic collapse was visualized. Cardiac surgery was consulted, and the surgeon performed a pericardial window with bloody fluid visualized in the pericardial space. A small perforation in the inferior wall of the right ventricle was actively bleeding and repaired with a pledgeted suture. The patient’s hemodynamics subsequently improved, and the patient was transferred to the ICU after successful OLT.

Discussion:

Complications of CVC may include infection, bleeding, pneumothorax, hemothorax, pericardial effusion, cardiac muscle or valve injury, thrombus, or arrhythmias. Since postoperative chest imaging for this case showed the tip of the CVC to be in the appropriate location in the lower portion of the superior vena cava, the cause of the right ventricle perforation is likely secondary to the guide wire or PA catheter placement instead of the CVC catheter itself. Postoperative imaging showed the tip of the MAC catheter to be 13 cm from the tricuspid valve eliminating the dilator as the cause of perforation. Though literature often cites difficulty in CVC line or PA catheter placement as an indicator of potential cardiac perforation, the CVC and PA catheter were both easily placed in this case. We hypothesize the low pressure system of the right heart minimized the amount of the blood flowing to the pericardial space and only until after
reperfusion, where the patient’s preload substantially increased with return of blood flow from the IVC, did the pericardial effusion become hemodynamically significant and apparent on TEE. We recommend strong consideration of cardiac perforation with pericardial effusion when there is an increasing need in vasopressors even in easily placed CVC and PA catheters. Prompt evaluation can easily be accomplished intraoperatively with echocardiography.

Poster Presentation

Presenting Author: Dr. Daniel Hwang UCLA Department of Anesthesiology and Perioperative Medicine

Authors:
Dr. Daniel Hwang UCLA Department of Anesthesiology and Perioperative Medicine
Dr. Jennifer Nguyen-Lee UCLA Department of Anesthesiology and Perioperative Medicine
Role of Dexmedetomidine on Postoperative Recovery and Perioperative Narcotic Consumption in Third World Mission Trips for Cleft Palate and Cleft Lip Repair

Background: Dexmedetomidine has been extensively studied in recent years for its anxiolysis, sympatholysis, analgesia and anesthetic-sparing effect with minimal respiratory depression. Given these properties, and despite lack of FDA approval for pediatric use, its role in the pediatric perioperative setting has expanded steadily. Rotaplast International provides free cleft lip and palate repair in less-developed countries around the world as well as education and training for comprehensive treatment of these children. A large pediatric population is served in Guatemala, and dexmedetomidine has seen increased use intraoperatively to aid in postoperative recovery. This study examines whether dexmedetomidine has a significant impact on emergence and PACU times as well as total opioid consumption. Methods: The study design was reviewed with our local IRB and constructed for collection of de-identified data that did not require informed patient consent. Medical records from Rotaplast missions in 2016 to Retalhuleu, Guatemala; Chittagong, Bangladesh; Lima, Peru; and Pereira, Colombia were retrospectively reviewed to identify cleft lip, cleft lip revision, cleft palate and cleft palate revision cases. 61 cases were identified, 44 in the Guatemala trip, all whom were administered dexmedetomidine intraoperatively and 17 cases from the other 3 trips where dexmedetomidine was not used. From these charts information was collected regarding age, weight, surgery length, time to emergence, episodes of severe hemodynamic changes (hypotension and bradycardia), PACU length of stay, and perioperative complications as well as total dosage of fentanyl, morphine, and tylenol. Results: Data available at this time from the 2016 Retalhuleu, Guatemala trip was compared to 3 other trips in 2016 with patients not receiving any dexmedetomidine. The 44 patients in Retalhuleu, Guatemala of which 12 were cleft lips, 10 lip revisions, 21 cleft palates and 1 palate revision were compared to 8 cleft lips, 2 lip revisions, 3 cleft palates and 4 palate revisions. For the Guatemala trip (mean +/- stdev): age 68 +/- 56.4 months, weight 18 +/- 12.7 kg, dex 0.6 +/- 0.4 mcg/kg, intraoperative fentanyl 2.5 +/- 2.2 mcg/kg, emergence time 7 +/- 5.7 mins, and PACU length of stay 63 +/- 30.2 min. With the 3 other missions: age 36 +/- 38.8 months, weight 13 +/- 9.7 kg, intraoperative morphine 0.1 +/- 0.1 mg/kg, emergence time 10 +/- 9 min, PACU length of stay 59 +/- 29.3 min. Conclusions: To date there has been no retrospective study based on intraoperative anesthetic records from the Rotaplast mission trips. This study, as a proof of concept, shows that even though anesthesia is being performed under challenging conditions in a resource limited environment, quality data has been preserved in these records. However our current study is extremely limited at this time and it would be beneficial to review a greater volume of intraoperative records prior to performing a more robust analysis on the effects of dexmedetomidine on measured outcomes such as emergence time, PACU duration and use of perioperative opiates.
**Presenting Author:** Dr. Allen Zeitlin UC Davis Department of Anesthesiology

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Dr. Eric Fok UC Davis Department of Anesthesiology
Dr. Neal Fleming UC Davis Department of Anesthesiology
Dr. James Littlejohn UC Davis Department of Anesthesiology
Severe Methemoglobin Induced Hypoxemia Secondary to Transdermal Lidocaine Patch

Methemoglobinemia is a blood disorder in which the iron of the heme group is in the ferric state (Fe3+), not in the ferrous state (Fe2+). This change in the hemoglobin molecule renders it incapable of carrying oxygen. The association between local anesthetics and methemoglobinemia is well known. Among the different local anesthetics, benzocaine and prilocaine appear to carry the most significant risk. Lidocaine induced methemoglobinemia is rare in current literature. In this case report, we describe a patient who developed severe methemoglobinemia secondary to the use of transdermal lidocaine patch for the management of postoperative pain. Other cases of transdermal lidocaine patch associated methemoglobinemia have been reported. However, this is the first case of an adult with severe methemoglobinemia secondary to the use of transdermal lidocaine patch that resulted in life threatening hypoxemia.

Poster Presentation

Presenting Author: Dr. Fidel Acevedo University of Arizona

Authors:

Dr. Fidel Acevedo University of Arizona
Show Me the Data: Understanding Data Structures and Governance to Optimize Data Acquisition.

Background

Data aggregation and analytics is an essential aspect of modern-day medical practice to ensure safe and high quality care to patients. Such tailored knowledge at the provider level has major implications for patient care and is further mandated by the Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009. Unfortunately, at many institutions, obtaining data can be a rigorous and lengthy process especially when the requested information is divided into different sources or it requires clearance by a data governing body. Beyond the process of obtaining data, a data request requires insight into data and information structures as well as the processes by which it moves through various platforms. Such knowledge is essential in order to acquire data efficiently and appropriately. Under this concept, a quality improvement initiative was developed to: 1) Identify the many data ‘silos’ (electronic medical record, billing systems, scheduling, imaging, visual data streams, etc.) utilized by the institution to construct a clear data process flow map; 2) verify the institution's process by which data can be requested to discover possible areas of process improvement; 3) discover what hinders data reports by creating a fish-bone diagram.

Methods

Meetings with Data Governance (DG), Epic Liaison Officers, hospital administration, Patient Safety and Reliability, and ‘high data utilizers’ in order to learn the data architecture, data request process and hear their frustrations and difficulties with obtaining or creating reports. Diagrams were produced from the resources provided and content discussed these meetings.

Results

A multitude of data sources were identified some of which are not represented in Figure 1. Each source can produce internal reports requested through a Data Steward. Queries can also be created in EPIC through various self-service portals (Workbench, Healthy Planet, and SplicerDicer) depending on access permissions. Further, verified live data streams of key performance indicators were identified moving into an enterprise data warehouse where this dynamic information could be accessed for reporting, analytics, and data discovery tools.

Additionally, a process map for data requests (Figure 2) was created informing the construction of a fish-bone diagram (Figure 3) which highlights potential explanations for delays and inaccurate queries. Waste and errors during the creation of reports could largely be attributed to understaffing of data stewards, delays in clarifying request, and requestors ineffectively communicating their request due to deficiencies in understanding the format or availability of data.

Conclusions
Deficiencies in the process of acquiring data can produce delayed, invalid, or irrelevant reports. A data source map can help physicians understand the data architecture of an institution so they may be able to identify and locate data and responsible persons for their own projects and research. By providing them knowledge of how to access data streams, a physician - or any care provider - can then begin to assess, modify, and refine their department's and/or personal medical practice.

**Poster Presentation**

**Presenting Author:** Dr. Michael Douglas Loma Linda University

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Stepwise Hypotension During C-Section with Epidural Anesthesia in Parturient with Moderate to Severe Rheumatic Mitral Stenosis

Background: Maternal heart disease complicates between 0.2%-3% of pregnancies. Severe mitral stenosis (MS), which carries a fetal mortality up to 25%, is poorly tolerated by the parturient due to increased intravascular volume with limited ability to increase cardiac output. Understanding cardiovascular and hemodynamic changes that occur in these patients during pregnancy and delivery, particularly those undergoing neuraxial anesthesia, is paramount to delivering safe care.

Case Description: A 33-year-old G32002 female at 38 weeks gestation with gestational diabetes mellitus and moderate-severe rheumatic MS was transferred from an outside hospital for workup and management prior to delivery. The patient reported prior diagnosis of a "heart condition" at age 14 years in Micronesia. Her first pregnancy was an uncomplicated C-Section; her second pregnancy, also a C-Section, resulted in significant postpartum heart failure and pulmonary edema requiring intubation. She recovered, but declined to pursue follow-up. On arrival, the patient endorsed 2-pillow orthopnea with no dyspnea on exertion, significant edema, chest pain, or palpitations. TTE was significant for moderate-severe MS, moderate MR, mean mitral gradient of 10.2 mmHg, and mitral valve appearance consistent with rheumatic heart disease. Metoprolol was started per cardiology recommendations. Once in the operating room, an arterial line was placed. Then, an epidural was placed; after a negative test dose, incremental local anesthetic boluses were given while closely monitoring hemodynamic changes. Simultaneously a vasopressor infusion was uptitrated to maintain systemic vascular resistance.

Once a T4 dermatomal level to sharp stimulation was achieved, cesarean delivery was completed. Soon after delivery, mean arterial pressure rapidly dropped, despite increased phenylephrine dosing, and oxygen requirements increased. Norepinephrine infusion was initiated. After achieving hemodynamic stability, a dose of furosemide was given for presumed acute pulmonary edema. The parturient recovered from her acute post-delivery episode quickly and was taken to the ICU on low-dose phenylephrine infusion. Her vasoactive and oxygen requirements quickly resolved. Repeat echocardiogram indicated improved mean mitral gradient. The patient was discharged on post-delivery day 3 with cardiology follow up at 6 weeks.

Discussion: The main complication in the setting of MS is a relatively fixed stroke volume. Inability to increase cardiac output as intravascular volume increases leads to obstructive/congestive physiology, resulting from increasing left atrial pressure. Epidural anesthesia has improved morbidity and mortality compared to general anesthesia in high-risk patients. Epidurals significantly blunt the large sympathetic surges that accompany delivery; however, they also create additional physiologic challenges in the parturient with MS. Sympathectomy leads to decreased peripheral vascular resistance and hypotension with an inability for patients to tolerate reflex tachycardia. These changes explain the significant
decrease in MAP seen after cumulative boluses of the epidural. Finally, immediately postpartum, uterine involution leads to auto-transfusion, which can increase cardiac output by 75-80%. This new volume, in the setting of an inability to adequately increase cardiac output, explains our second step-wise decrease in blood pressure, since the congestive physiology becomes further volume overloaded. Vigilant post-partum monitoring and follow-up is crucial, as most deaths occur during post-partum days 2-92.

References: Available on request.

Poster Presentation

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Successful Extraction of Right Atrial Thrombus by AngioVac System under TEE Guidance

Right sided cardiac thrombi can result in pulmonary embolus leading to hemodynamic instability, arrest and mortality even in spite of anticoagulation. We present a case of successful TEE guided removal of a right atrial clot using an Angiovac aspiration device from a patient with high surgical risk for open removal. A 52 year old male with a history of Protein S deficiency, multiple DVTs, pulmonary embolus on lifelong Coumadin, obesity with severe OSA, HIV with undetectable viral loads, chronic kidney disease with a baseline Creatinine of 2.7, presented with acute shortness of breath and chest pain. On arrival to the emergency department, he had an episode of syncope and was noted to be cyanotic and in Atrial Fibrillation with rapid ventricular rate. Bedside TTE revealed a severely dilated right ventricle, with decreased RV function, and a flattened RV septum during both systole and diastole. Additionally, a mobile mass was noted in the right atrium. Estimated PASP based on the TR jet was 70 mmHg. Based on these findings a V/Q scan was performed (CT contraindicated due to elevated Creatinine) which showed high probability for PE. The patient was subsequently started on a heparin infusion and brought to the operating room for percutaneous embolectomy (Angiovac). After placing an awake arterial line and central venous access, the patient was induced and placed under general anesthesia. Intraoperative TEE revealed a large, mobile, thrombus in the right atrium intermittently advancing across the tricuspid valve. Real-time TEE and fluoroscopy helped guide successful clot extraction using the Angiovac system. Post-procedural TEE revealed no residual clot. The patient was successfully extubated and brought to the critical care unit for monitoring. While conventional therapy and open intervention have historically been primary treatment options for pulmonary embolisms and intracardiac masses, both have inherent risks including increased bleeding, distal embolization of thrombi and intra-op morbidity/mortality. While the Angiovac Thrombectomy system is relatively conventional, prior studies have illustrated successful removal of right atrial thrombi in 73% of cases with 87% survival to the end of hospitalization (1). While fluoroscopy guides the Angiovac to the thrombus location, TEE allows for direct real time vision of clot extraction, examination for residual mass and right heart strain, and monitoring for Angiovac complications including right atrial/ventricular rupture and tamponade. The less invasive percutaneous aspiration by AngioVac has been proven to be successful with a higher safety profile when used with TEE and fluoroscopy guidance.

Poster Presentation

Presenting Author: Dr. Michael Kissen Cedar Sinai Medical Center

Authors:

Dr. Michael Kissen Cedar Sinai Medical Center
Dr. Rebecca Aron Cedar Sinai Medical Center
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Successful Ketamine Coma in a Patient with Metastatic Breast Cancer: A Case Report.

Author: Amanda Hu, MD
Affiliated institution: UC Irvine Medical Center

Abstract:
Background: Intractable chronic pain can occur in patients with metastatic cancer who have received opioids for extended periods of time. A ketamine-induced coma has been induced in some individuals as a way to assist in the “resetting” of pain receptors, during which a patient’s usual opioid regimen is largely decreased or eliminated altogether. Case description: A 39-year-old female with history of metastatic breast cancer and worsening chronic pain treated with intrathecal fentanyl pump and fentanyl PCA was admitted to UC Irvine Medical Center for a five-day ketamine coma. Her previous daily pain regimen included: ketamine 360mcg, 8 mg clonazepam, 200mcg fentanyl transdermal patch, 600 mcg fentanyl oral spray, baclofen 80mg, and gabapentin 600mg qAM, gabapentin 1200mg; she was then started on a fentanyl intrathecal pump which was eventually increased to 400 mcg/day, as well as a fentanyl PCA pump w/ 200mcg basal and 200 mcg PRN every 6 minutes for pain. However, the patient had become hyperalgesic, with acute distress from “whole body” pain, possibly exhibiting some allodynic components. For example, the application or removal of a tegaderm bandage would elicit severe 10/10 pain. Patient was admitted, subsequently intubated and treated with ketamine and propofol gtt (at 3mg/kg/hr and 30mcg/kg/in, respectively), and all systemic opioids were discontinued including the fentanyl PCA with basal rate. Her intrathecal pain pump was decreased just prior to admission by her pain physician from 400mcg/day to 200mcg/day, then decreased further after admission to 50mcg/day. After five uneventful days, the patient self-extubated, just hours before her scheduled wakeup. Patient awoke in no acute distress or discomfort, consistently describing her pain as 0-1/10. Patient’s intrathecal pump was decreased by about 10% per day, from 50mcg/day to 44mcg/day, then to 40mcg/day at which point patient began having moderate (6/10 or higher) back and abdominal pain. After increasing the intrathecal fentanyl pump back to 44mcg/day, patient’s pain was again well controlled and she was discharged shortly afterwards. Discussion: While the patient’s pain was clearly improved upon waking from the ketamine coma, she did have significant anxiety and was started on buspirone 15mg BID, diazepam 5mg PRN, and restarted on home venlafaxine 225mg QD. The patient also had some brief visual hallucinations two days after waking, likely residual effects of ketamine combined with lack of adequate sleep hygiene. Additionally, the patient took about two days to become completely oriented and alert; initially she was fairly sedated, although appropriate and able to follow commands. Overall, she had a dramatic decrease in her pain requirements as well as in her perceived pain, observed consistently by multiple providers as well as verified by her husband, and no lasting adverse effects from the ketamine/propofol. She was discharged home with significant improvements in her quality of life. Her experience has powerful implications for other patients in similar positions of severe chronic pain refractory to high dose opioids.

Poster Presentation

Presenting Author: Dr. Amanda Hu UC Irvine Medical Center
Authors: Dr. Amanda Hu UC Irvine Medical Center
Successful Use of Sugammadex for NMBA Reversal in Patient with Lambert Eaton Myasthenic Syndrome

Background: Lambert Eaton Myasthenic Syndrome (LEMS) is an autoimmune disorder that forms antibodies against presynaptic voltage-gated calcium channels, resulting in muscle weakness, especially the limbs. The prevalence is around 3.4 per million. Sixty percent of the patients have an underlying malignancy, which is most commonly small cell lung cancer. In contrast to myasthenia gravis, muscle weakness is most often seen in proximal arms and legs and may be temporarily relieved after exertion. This can present as an anesthetic challenge as patients have increased sensitivity to both depolarizing and non-depolarizing muscle relaxants and may have associated perioperative complications. Case description: Our patient is a sixty-nine year old female with past medical history significant for metastatic small cell lung cancer complicated by LEMS, hypertension, type 2 diabetes mellitus and CKD on dialysis, presenting for mediastinoscopy and bronchoscopy. She had generalized weakness and limited exercise tolerance, likely due to a combination of LEMS and her chronic disease process, but she was able to walk short distances with a walker. Preoperatively, she continued her home pyridostigmine dose and was pre-medicated with ranitidine. She was induced with propofol and ventilated by mask while we checked for baseline train-of-four response. She was then paralyzed with less than 0.6mg per kg dose of rocuronium after taking into account of increased sensitivity to NMBAs in LEMS patients. Anesthesia was maintained with desflurane while analgesia was provided with fentanyl. At the end of the case, the patient had 2/4 twitches on ToF. We reversed muscle relaxation with 4mg per kg sugammadex. We confirmed 4/4 strong ToF twitches and sustained tetanus prior to extubation. She remained stable throughout the whole case and was discharged home on POD#1 without residual weakness in PACU or during the remainder of her hospital stay. Discussion: The preferred method in managing patients with LEMS includes the avoidance of NMBAs in order to prevent the need for post-operative mechanical ventilation due to residual muscle weakness. However, since FDA approval of Sugammadex use in the US, we have been presented with another option. Sugammadex is a modified gamma-cyclodextrin that sequesters rocuronium and vecuronium. Upon reviewing the literature, we found a fair amount of literature on use of sugammadex in patients with MG but very limited case reports and studies on the use of sugammadex for NMBA reversal in patients with LEMS. Historically, compared to MG patients, LEMS patients have a poorer response to neostigmine, which may result in increased risk of postoperative residual muscle weakness. This makes sugammadex an ideal NMBA reversal agent in patients with LEMS.

Poster Presentation

Presenting Author: Dr. Shao-Pu Hsu Cedars Sinai Medical Center

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Successful Utilization of the Decision Tree Proposed by Leffert et. al. to Assess the Neuraxial Anesthesia Risk in Two Symptomatic Arnold Chiari Type 1 Patients Scheduled for Cesarean Delivery

Introduction: Arnold Chiari type 1 malformation (CM1) is a rare neurologic defect resulting in herniation of the cerebellar tonsils into the foramen magnum. Elevated intracranial pressure (ICP) has been associated with CM1 patients, potentially prohibiting neuraxial anesthesia. Reports of safely performed obstetric neuraxial anesthesia, including Combined-Spinal-Epidural (CSE), exist (1). Leffert et al. reviewed parturients with intracranial pathologies and provided a decision tree to assess feasibility of neuraxial anesthesia. Briefly, if there is no evidence of mass effect or obstructed CSF flow, intrathecal anesthesia is low risk for herniation (2). We report two primiparous patients with symptomatic CM1 who presented for primary Cesarean delivery (CD) where this decision tree was successfully applied.

Case one: 27 year-old primigravida at term presented to our high risk clinic with a history of MCTD, SLE, and bilateral avascular necrosis of the hips with mobility restrictions preventing vaginal delivery. She described symptomatic CM1, surgically decompressed three years prior, with progressive visual symptoms, positional headaches, and vomiting since decompression. A pre-admission MRI of brain and spinal cord was obtained due progressive symptoms; it was negative for midline shift or hydrocephalus. After counseling the patient, a routine spinal anesthesia (SPA) was performed. CD was uneventful and she was discharged on POD2 with no new neurologic symptoms; she remained stable at her 6-week post-partum visit.

Case two: 30 year-old primigravida at term presented to our high risk clinic with obesity, status post gastric-bypass, OSA, chronic low-back pain, multiple psychiatric comorbidities, and symptomatic CM1 planned for decompression post-partum. Neurological symptoms included stable upper extremity radiculopathy, headaches, and ataxia since her last MRI. MRI showed significant 14cm herniation of peg-like tonsils and a small syrinx from C6 to T1. There was no evidence of hydrocephalus or midline shift. Neurosurgical consultation confirmed herniation risk to be minimal. The patient desired neuraxial anesthesia over GA for maternal-infant bonding. Routine CSE anesthesia, due to surgical duration, was performed for her uneventful CD. She was discharged on POD2 with stable neurologic symptoms which were unchanged at her 6-week post-partum visit. Neurosurgical decompression is pending.

Conclusion: In conjunction with our high risk clinic, we used the decision tree suggested by Leffert et. al. (2) for risk assessment of neuraxial blockade in two complex, symptomatic CM1 parturients. Symptomology, MRI, and neurosurgical consultation were considered together to determine that both patients likely had normal ICP and were thus safe for intrathecal anesthesia. Both patients had uneventful CD with effective neuraxial anesthesia and the opportunity for early maternal-infant bonding.

1 Hopkins AN, Semin Perinatol. 2014
2 Leffert LR, Anesthesiology. 2013
Presenting Author: Dr. S Camellia Baldridge University of Washington

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**Sudden Cerebral Swelling in Multiple System Atrophy**

Background: Multiple System Atrophy (MSA) is a progressive neuropathological disease characterized by autonomic instability plus Parkinsonian syndrome or ataxia. Case: A 69-year-old male with history of MSA presented to our institution after a mechanical fall. On examination, patient was responsive but lethargic. His motor strength was 4/5 in right upper and 1/5 in right lower extremities. Initial CT scan revealed a 1.8 cm left subdural hematoma with 13 mm midline shift. An urgent craniotomy was performed for hematoma evacuation. The procedure was uneventful both from anesthesia and neurosurgical perspectives. The brain was noted to be "relaxed" prior to replacement of the bone flap and closure. Upon emergence from anesthesia, the patient remained unresponsive with an atypical respiratory pattern.

Neurosurgery was notified and a stat head CT was obtained. The patient remained intubated and vital signs remained within target range during anesthesia transport. CT imaging revealed profound diffuse cerebral edema with loss of gray-white differentiation. Repeat physical exam revealed nonreactive, dilated pupils. A "brain code" was called, and the patient was transported directly back to the operating room for emergent decompressive hemi-craniectiony, while hyperosmolar therapy was administered. Upon opening of the dura, rapid, profound herniation of brain occurred in a manner incompatible with neurologic recovery. The scalp was rapidly approximated with staples, and the patient was transferred to the ICU. Shortly thereafter, the patient became hypotensive and required neuro-endocrine stabilization. The patient was declared brain dead the following morning.

Discussion: MSA is a progressive neuropathological disease that is a clinical diagnosis of exclusion based upon findings of autonomic instability along with Parkinsonian syndrome or ataxia. There have been case reports of perioperative hemodynamic volatility, which was not observed in our patient. There is also some data suggesting that MSA patients may have impaired cerebral autoregulation. There are a few notable findings from this case: 1) the development of profound cerebral edema that involved the entire brain including the right (non-injured) hemisphere; 2) the short time period over which the cerebral edema developed; 3) the severity of edema that was completely refractory to aggressive medical and surgical management; 4) the absence of the typical cardiovascular response of profound intracranial hypertension. Rapidly progressive diffuse cerebral edema can result from global hypoxic brain injury, such as following cardiac arrest, although development usually occurs over 6 hours and its progression is usually slowed by medical therapy. Conversely, vasogenic edema can develop rapidly due to profound hyperemia, as seen following carotid endarterectomies or surgical treatments of large AVM's. In our case, the etiology of cerebral edema remains unclear, but it is likely that the underlying MSA and its effect on autonomic function played a significant role. In the future, we would consider the use of neurophysiologic monitoring (SSEP/EEG) during intracranial operations through emergence from anesthesia in MSA patients as a method to identify the rapid development of cerebral edema. To the best of our knowledge, this is the first documentation in literature to describe anesthesia considerations for neurological surgery with MSA.

*Poster Presentation*
Presenting Author: Dr. Dennis Kuo UC San Diego Department of Anesthesiology

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**Surprising Results: Sodasorb™ performs better than Litholyme™ in a standard clinical setting**

Introduction: Litholyme™ (Allied Healthcare Products Inc., St. Louis, MO, USA) utilize Ca(OH)2 as the primary absorbent of CO2 in their granules, while Sodasorb™ (W.R. Grace, Lexington, MA, USA) utilizes a proprietary mixture of CA(OH)2, NaOH, and KOH (1,2). The NaOH levels of Sodasorb™ require the wasted granules to be disposed of in medical waste. An obvious advantage with Litholyme™ granules is that it can be disposed of with normal waste. Litholyme™ has been reported to have particularly favorable data in respect to CO2 absorbent capabilities (3). In in vitro experiments utilizing a model anesthetic setup, Litholyme™ had an absorptive capacity 1.5x that of its nearest competitor (4). This study is a direct comparison between Litholyme™ and Sodasorb™ in a clinical setting by measuring CO2 absorbent depletion times.

Methods: The study was conducted, over a 12 week period in 2016-17, at the Stanford University Hospital and approved by the University of Stanford Institutional Review Board. 20 CO2 canisters were filled with Sodasorb™ (n=10) or Litholyme™ (n=10) per standard operating theatre policies regarding the refilling of the reusable canisters, and were placed in Drager Apollo® anesthetic machines. A resident (C.F.) or an attending (M.B.) were present for all the anesthetic cases studied. The CO2 absorber was randomly assigned throughout the study period. General endotracheal anesthesia was administered and the fresh gas flow (FGF) recorded. During the induction and emergence phases of the case, FGFs were approximately 10 L/min. FGFs of less than 2 L/min were used during the maintenance phase of the case. The CO2 absorber was counted as expired when there was evidence of exhaustion as determined by inspired CO2 fraction (FiCO2) at 1.0 %. There was no restriction to the type of the surgery case. Liters of FGF processed by the same volume of absorbent in each canister were the primary endpoint and extracted from the automated anesthetic record. Results: There was no difference in surgical case type or patient characteristics between the cases done by the attending (M.B) or resident (C.F). The CO2 absorbents had similar characteristics when handled by the resident or attending, with no statistical difference seen between the Litholyme or Sodasorb canisters when controlling for investigator (Figure 1a). Significant difference was noted between the Litholyme™ and Sodasorb™ CO2 absorbents with respect to total liters of gas absorbed by each absorbent (p<0.005, two-tailed t test, Figure 1b). Conclusion: Despite previously reported favorable data for Litholyme™, in this clinical study, Sodasorb™ was able to absorb 1.4x as much CO2 as Litholyme™.

**Oral Presentation**

**Presenting Author:** Dr. Cedar Fowler Stan

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Dr. Mark Burbridge Stanford University School of Medicine  
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Dr. John Brock-Utne S
Surviving and THRIVE-ing the difficult airway: Gaining calm, control, and time during an emergent tracheostomy.

Background: The surgical airway is the final pathway of the difficult airway algorithm and is often employed hastily amidst the chaos of difficult ventilation and desaturation. Apneic oxygenation via Transnasal Humidified Rapid-Insufflation Ventilatory Exchange (THRIVE) can maintain oxygenation, providing the luxury of time in which to secure the difficult airway.

Case description: 57 Y male patient with recurrent squamous cell carcinoma of the larynx status post chemotherapy and radiation was scheduled for total laryngectomy.

Two months prior: Flexible laryngoscopy showed radiation changes to the pharynx and larynx, with moderate glottic edema. Video laryngoscopy revealed a grade 1 view. The patient was intubated with a 5.0 laser safe endotracheal tube and a small vocal cord tumor was removed.

Five days prior: Flexible laryngoscopy demonstrated moderate-severe glottic edema and interval growth of the L supraglottic mass with extension of tumor onto the superior surface of the L arytenoid complex.

The morning of surgery, the patient was comfortable, without respiratory distress or stridor. His oxygen saturation was 98% on RA. He endorsed new shortness of breath with ambulation. Imaging was reviewed with the ENT surgeons who agreed with our plan to induce the patient, place a supraglottic airway (AirQ) and to intubate the patient with a small fiberoptic scope through the AirQ.

The patient was preoxygenated to end tidal oxygen of 93%, induced, and an AirQ supraglottic airway was placed. Upon passing the fiberoptic scope, the glottic opening was noted to be smaller and more obstructed by tumor compared with 5 days prior. Two attempts to enter the glottis resulted in bleeding of friable tissue in the airway. After discussion with the surgeon, there was agreement to progress to tracheostomy. At this point, the patient became more difficult to ventilate. The THRIVE apparatus was requested and he was started on 70 L/ min of humidified oxygen at 100% FiO2. Anesthesia was maintained with propofol and remifentanil.

The procedure was technically difficult as the area was highly vascular. The patient's vital signs remained stable and his O2 saturation never fell below 100% during 25 minutes of apneic oxygenation. The end tidal CO2 upon resumption of tracheal ventilation was 53 mmHg--up from 29 mmHg before initiation of apnea.

Discussion:

This case could have become an airway catastrophe. However, apneic oxygenation allowed for calm and considered control of this difficult airway. THRIVE is based on the principle that in an apneic patient, approximately 200-250 mL/ min oxygen will move from the alveoli into the blood, whereas only 8-20 mL/ min of carbon dioxide moves into the alveoli. This leads to subatmospheric pressure in the alveoli, which generates flow of gas from the pharynx. The high flow fills the pharynx with high FiO2 gas and functions as an oxygen reservoir, as long as airway patency is maintained. As observed in this patient, PCO2 typically increases
approximately 1 mmHg/min of apnea. The use of THRIVE in this case demonstrates the benefits of invoking this technology to prolong the apneic window to calmly and safely secure the difficult airway.

**Poster Presentation**

**Presenting Author:** Dr. Nicole Arkin Stanford University School of Medicine

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Dr. Erin Bushell Stanford University School of Medicine
**Sustained Deadly Arrhythmia in a Patient with Left Ventricular Assist Device as Destination Therapy**

Introduction

Cardiovascular disease remains the 2nd cause of death in the developed world with CHF being a large component. Orthotopic heart transplantation is still the best therapeutic option for end-stage CHF but the number of transplant has remained relatively stable since the 2000’s. For carefully selected patients, left ventricular assist devices (LVAD) have become a standard therapy as bridging to therapy, bridging to recovery, or more recently as destination therapy (DT). Ventricular arrhythmias (VA) are largely a potentially life threatening rhythm if not converted/fixed. LVAD patients have VA at a variable reported prevalence of 18.3% to 59%. VA can have a variable clinical presentation, the most consistent finding in LVAD patients presenting with persistent VA is drop in device pulsatility index and/or flow due to inadequate preload. We reported a case of a DT LVAD patient that presented to the clinic with a VA. Case Description A 44 y/o female with ischemic cardiomyopathy on LVAD support since 2008. Currently with Heart Ware as DT last device exchanged 2012. Presented to the clinic due to “remote monitoring” report of 80% reduction of pulsatility in her LVAD. She denied all symptomatology. Upon presentation she was completely stable, blood pressure 75mmHg by Doppler. Pump flows 4.4 L/min, 2880 rpm, with a power of 4.9. Laboratory values with normal CBC and CMP, therapeutic INR 2.56 and stable NT-proBNP 2341. She presented with First EKG (Figure A). Amiodarone infusion after bolus was given and she was started on a heparin infusion. Following day she persisted in VF (Figure B), therefore she underwent TEE under sedation, which revealed only a small atrial thrombus (1.8mm). Decision was made to proceed with DC cardioversion. One attempt with 200 J was unsuccessful. Next attempt was made with 560 J with transecting vectors, which was successful in re-establishing atrial fibrillation rhythm. Afterwards she converted to a normal sinus rhythm (Figure C) Subsequently she was transitioned to oral amiodarone. Additionally she underwent placement of an implantable loop recorder to observe her for further ventricular arrhythmia. Discussion

The therapeutic approach to VF in patients with LVAD support is often problematic as there is limited experience on the available options. VA associated with LVAD are common and correlate with increased mortality. Despite most LVAD patients can tolerate VA, the majority of LVAD require adequate LV filling and decent right ventricular function to maintain optimal output. Persistent VA can lead to severe RV dysfunction and subsequently result in poor left ventricular filling and LVAD malfunction. Previously described there are several cases of asymptomatic VF in LVAD patients; but they have been in older support devices, have AICD shock as presenting sign and presented shortly in the perioperative period. Our patient is unique as she has been on LVAD support for over 9 years, presented with VA due to monitor alarm in flows, and doesn’t have an AICD. Her VA that was successfully cardioverted with 560J after amiodarone loading and documenting no significant thrombotic disease by TEE, which is a treatment pathway previously described.

**Poster Presentation**

**Presenting Author:** Dr. Tomas Carvajal Mayo Clinic Arizona
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The Anesthesiologist's Role in a Ventriculoatrial Shunt

Ventricular shunts are commonly performed for the treatment for hydrocephalus; they divert the CSF accumulated in the ventricles to an extra-cranial space. When the most common of these, the ventriculoperitoneal shunt, fails or is no longer an option, a ventriculoatrial shunt should be considered. Whether it be due to surgeon inexperience or our experience with obtaining central access, anesthesiologists may be called upon to assist with such a procedure. In this case report, we discuss a patient whose ventriculoperitoneal shunt became infected, necessitating an alternative to his hydrocephalus. Once the surgeons decided to place a ventriculoatrial shunt, our assistance was requested in cannulating the internal jugular vein, where the shunt catheter would reside. Our role is also valuable in confirming the placement of the catheter, possibly via transesophageal echocardiography, and in understanding the complications of ventriculoatrial shunts when managing patients with them in a perioperative or intensive care unit setting.

Poster Presentation

Presenting Author: Dr. Paul Lee University of Southern California

Authors:

Dr. Paul Lee University of Southern California
Dr. Vladimir Zelman University of Southern California
**The Artery Mapper: A novel device to localize peripheral arteries for sampling and cannulation**

**Background:**

Arterial cannulation can at times be difficult to perform using palpation alone to locate the best site to access the artery. Often when difficulty in arterial access is anticipated, the proceduralist will use a tool such as an ultrasound or a doppler. Both of these techniques afford the user improved ability to locate the position of the artery. The authors herein describe the development of a novel device, the Artery Mapper, that can also aid the user in more accurately locating a peripheral artery. The authors’ goal was to design and build a device that would be easier to use than the ultrasound, and less expensive so that it could be readily available in every anesthesia cart.

**Methods:**

The basic design consisted of a sensor with an overlying display. It was determined that a sensor that measured the pressure from arterial pulsations would be the most reliable way to find the artery. Thus a literature review was conducted on different kinds of pressure sensors such as piezoelectric crystals and polymer based sensors. Since one of the goals of this project was to keep the device inexpensive, it was determined that the cheaper, polymer based pressure sensors would be the better choice. A collaboration with the UW Center for Intelligent Materials and Systems (CIMS) was then formed, and work began shortly thereafter to build the device.

The sensor material chosen was dielectric elastomer (DE), which uses capacitance based sensing. When a pressure is applied across the sensor, a measurable capacitance change (pF) results. Many versions of this sensor were created with the goal of maximizing sensitivity, resolution, and accuracy, while not sacrificing signal to noise ratio and pixel independence, and without overburdening the support electronics.

For the overlying screen, initially electrochromic materials were investigated since they could be manufactured to have a slim, flexible profile. However, preliminary testing showed that it would be prohibitively difficult and expensive to pixelate the electrochromic material to an adequate resolution. Thus work shifted to stock LCD or oLED screens to interface with our sensor.

**Results:**

The current iteration of the device consists of a DE sensor array with 1mm² pixels. The support electronics, which are mainly comprised of a capacitance to digital converter, multiplexers, and a microprocessor, have been optimized for this DE sensor. Lastly, an oLED screen sits atop the sensor. Casing to enclose the device is currently being designed to be 3D printed. Conductive polymer will be used for the casing with the hopes of creating a Faraday cage-like effect to shield the device from ambient electrical noise.

**Conclusions:**
In conclusion, a novel device aimed to aid in arterial cannulation and sampling has been built. Preliminary testing in the lab has shown favorable sensitivity to the radial pulses of the engineers involved in building it. A large scale clinical test to validate the device is planned, pending IRB approval.

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Poster Presentation

Presenting Author: Dr. Sheena Hembrador University of Washington Department of Anesthesiology and Pain Medicine

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Dr. Kevin Kadooka University of Washington Department of Mechanical Engineering
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The Benefits of Metabolic-flow Volatile Anesthetics and A Simple Technique To Achieve It

The use of low-flow anesthesia circuits offers numerous benefits to the patient, the hospital, and the environment. In this project, we used a simple technique to reduce oxygen fresh gas flows soon after induction to equal metabolic demand. After confirming the feasibility and ease with which this technique could be used in the clinical setting, we conducted a cost-savings analysis for the hospital assuming this approach were used for all adult general anesthetics. We discovered through the use of low-flow anesthesia, it is possible to achieve significant cost-savings, maintain airway moisture and humidity in the breathing circuit, limit thermal losses, and decrease greenhouse gas release. Although these are significant benefits, it should be noted that use of low fresh gas flows prevents rapid changes in end-tidal agent concentrations. Sudden increases in surgical stimulation may be addressed through the use of IV agents.

Poster Presentation

Presenting Author: Dr. Evan Thilo Oregon Health & Science University

Authors:

Dr. Evan Thilo Oregon Health & Science University
Dr. Mark Zornow Oregon Health & Science University
The effects of acute marijuana toxicity on the induction and maintenance of anesthesia in patients undergoing ORIF of the Mandible

Authors: Jeffrey Cashin, M.D. Kevin Dewalt, M.D.
Affiliated institution: Harbor UCLA Medical Center

Background: In America, the use of recreational and medical marijuana is at an all-time high. According to the NIH, the percentage of Americans who reported using marijuana more than doubled between 2002 and 2012. For many anesthesiologists, anesthetizing patients with urine toxicology screens positive for marijuana is an increasingly common occurrence. Despite this, there are profound gaps in our knowledge as to the effects of marijuana on our anesthetics.

Methods: All ORIF mandible cases performed from 11/1/2014-03/01/2017 at Harbor UCLA Medical Center in Torrance, California (HUMC) were retrospectively analyzed. Due to the prevalence of cocaine and methamphetamine use in the patient population who suffer mandibular fractures, many anesthesia providers obtain urine toxicology screens the day of surgery. The implementation of an electronic medical record and electronic intraoperative documentation system at HUMC enabled us to sort patients according to toxicology results and to track multiple intraoperative metrics. These results were compared to a control group, who had negative toxicology screens and denied using marijuana.

Results: Based on our preliminary data analysis, patients with positive urine toxicology screens for marijuana require additional intravenous anesthetics on induction. Additional metrics (e.g. total narcotics given, narcotics given within one hour of induction or emergence, narcotics given in PACU) are still being analyzed.

Conclusions: Based on the increasing prevalence of marijuana use in the United States, anesthesia providers can expect to encounter marijuana-positive patients with increasing regularity. It is critical that these providers have an understanding of the effects of marijuana on our anesthetic medications. Our retrospective analysis is a small step toward increasing our understanding. Certainly, more research is needed into the effects of marijuana on our anesthesia practice.

Poster Presentation

Presenting Author: Dr. Jeffrey Cashin Harbor UCLA Medical Center

Authors:

Dr. Jeffrey Cashin Harbor UCLA Medical Center
Dr. Kevin Dewalt Harbor-UCLA Medical Center
The Equivocal Epidural: Diagnosing an Inadvertent IT Catheter

Background: Thoracic epidural analgesia is a proven technique for post-operative pain control in open upper abdominal and thoracic surgeries with many potential benefits. However, successful and safe analgesia requires catheter placement in the epidural space. Inadvertent puncture and placement of an intrathecal catheter carries inherent risk; namely a high spinal, vasoplegia leading to significant hypotension, or a motor block. Thus, this case-review attempts to distinguish appropriate ways of diagnosing an intrathecal catheter. Case description: We present a 72 year-old man presenting for a liver mass resection via open right heptectomy. A thoracic epidural was placed for postoperative pain management. No CSF or heme was noted during or following placement of the needle or catheter. An infusion of bupivacaine 0.05% with 0.005mg/ml of hydromorphone was started at 8ml/hr with a patient demand dose of 2ml every 10 minutes. Intraoperative hypotension was treated with a low-dose phenylephrine infusion rather than crystalloid as part of our standard hepatic resection protocol. No other significant hemodynamic changes were noted. After the operation, the basal epidural rate was titrated down over the course of 12 hours to 2 ml/hr for persistent hypotension. On morning pain rounds, the patient’s remained persistently hypotensive despite adequate resuscitation and reassuring laboratory values. The patient had adequate pain control with a sensory block up to approximately T2. Given the relatively high sensory block and significant hypotension, the team was concerned for a possible subarachnoid catheter. An epidurogram was performed, which demonstrated equivocal results, though concerning for intrathecal spread. Thus, a sample was drawn off the catheter and sent for analysis. Glucose and protein were not concerning for CSF. Discussion: An accidental subarachnoid puncture during epidural placement will generally result in CSF return visible either spontaneously via needle or with aspiration of the catheter. However, it is possible that the needle has only partially punctured the dura and may not return CSF with aspiration. Subsequent delivery of anesthetic to the subarachnoid space may lead to a high spinal block with hemodynamic and respiratory effects. Evaluation with epidurograms, sending aspirate for analysis, and epidural waveform analysis can assist the practitioner in confirming the placement of an epidural catheter. When interpreting epidurograms, contrast spread through the epidural space is typically described as honeycomb in appearance and vacuolated. This irregularity of contrast spread is secondary to fat within the space. Contrast should also spread laterally under the pedicles. Lastly, the number of levels the contrast spreads caudal and rostral is less compared to intrathecal spread. In comparison, intrathecal injection of contrast would demonstrate a more homogenous spread, appearing columnar, and with greater caudal and rostral spread. Another diagnostic tool is sending CSF for analysis. CSF glucose is typically two thirds of the serum glucose, ranging from 18 to 58 mg/dL. Epidural waveform analysis can be useful in equivocal cases. Once the needle tip enters the epidural space, the pressure tracing becomes synchronized with arterial pulsations.

Poster Presentation
Presenting Author: Dr. Ryan Lilley Virginia Mason Medical Center

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Dr. Ryan Lilley Virginia Mason Medical Center
The Value of Preoperative Endoscopic Airway Examination (PEAE) in Complex Airway Management of a Patient with Supraglottic Cancer

Authors: James McAvoy, MD; Tyler Ewing, MD; Vladimir Nekhendzy, MD

Institution: Stanford Department of Anesthesiology, Perioperative and Pain Medicine

Background: Airway management of patients with head and neck cancer presents significant challenges and requires carefully devised strategies. Patients with supraglottic and glottic tumors or history of radiation therapy require the longest intubation times and represent the highest risk for adverse outcomes. In NAP4, airway management was considered poor in nearly 30% of these cases. Preoperative endoscopic airway examination (PEAE) is a powerful tool that provides precise information about upper airway and laryngeal anatomy to formulate appropriate airway management strategies. It is the only technique that allows the anesthesiologist to visualize the degree of obstruction and tumor mobility directly. Even in urgent situations, PEAE may help with anticipation and planning for a difficult airway.

Case Description: A 78 year-old woman with recurrent T2N2 squamous cell carcinoma of the right neck, status-post modified radical neck dissection, presented for direct laryngoscopy and biopsy of the supraglottic lesion. A nasal endoscopy in ENT clinic 2 weeks prior to surgery revealed a new 3.5 cm right superior pyriform sinus mass involving the right aryepiglottic fold and the base of the epiglottis. Given the rapid presentation of the recurrence and its proximity to the endolarynx, the anesthesia team performed a PEAE to facilitate airway management planning. The PEAE revealed a large right pyriform sinus mass extending into valecula and significantly displacing the epiglottis and laryngeal inlet (Figure 3). There was no ball valve phenomenon, and no glottic/subglottic obstruction.

Given significant anatomical distortion, a difficult laryngeal view, and a concern for traumatizing the tumor during endotracheal tube (ETT) advancement off the flexible fiberoptic scope (FFS), the plan was formulated for an asleep, combined video laryngoscopy (VL) - FFS intubation. After induction of anesthesia, the Pentax Airway Scope (AWS) was inserted under the epiglottis in a Miller blade-type fashion, and provided a clear laryngeal view. FSS was then placed through the ETT positioned inside the channel of AWS, and maneuvered through the glottic opening into patient’s trachea using AWS enlarged laryngeal view as a target. Atraumatic ETT (6.0 mm ID) advancement was observed continuously on AWS and FFS video screen. The remainder of the anesthesia and surgical procedure proceeded without complications, and the patient was extubated uneventfully at the end of the case, fully awake.

Discussion: The presented case demonstrates the essential role of PEAE in helping to formulate optimal airway management strategies in patients with anticipated difficult airway. PEAE findings in this patient with a significant vallecular tumor intrusion helped to choose the appropriate VL technique to minimize tumor disturbance. Furthermore, the combined VL-FFI provided unique advantages for complex airway management, facilitating FFS manipulation
and allowing for continuous observation of the whole intubation procedure and atraumatic ETT advancement. While the combined video techniques will likely continue to play bigger role in complex airway management of head and neck patients, the PEAE should become an integral part of the anesthesiologist’s armamentarium in anticipated difficult airways.

**Poster Presentation**

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There is a Fracture, Do We Need to Fix It? An Unusual Injury After Intubation

Background: Tracheal injury is a known complication following intubation. The incidence of complication after prolonged intubation has been estimated at anywhere from 4–19%[1]. The most common injuries seen include mucosal lacerations, tracheal stenosis and even tracheal rupture. Tracheal ring fracture is a rare complication and has been reported after tracheostomy and external laryngeal manipulation for endotracheal intubation[2], however to our knowledge there has never been a report of tracheal ring fracture secondary to prolonged intubation alone. Risk of tracheal injury is increased in the setting of emergency intubation and multiple intubation attempts, however the primary mechanism of laryngotracheal injury after intubation is thought to be secondary to overinflation of the tracheal cuff and pressure exerted by the cuff on the tracheal wall[3]. Animal studies have shown ischemia of the tracheal mucosa at pressures exceeding 30 mm Hg[4]. Factors that may predispose a patient to injury of membranous parts of the trachea after intubation include weakness of the membranous trachea, distortion of the trachea secondary to mass compression, steroid therapy, chronic obstructive pulmonary disease and tracheomalacia1.

Case Description: We present a case of a 21-year-old male who presented to the Emergency Department with worsening shortness of breath and difficulty breathing. Approximately one month prior to presentation he had been intubated at an outside hospital for 8 days. He reported sore throat and some difficulty breathing since then. Past medical history was significant for anxiety, depression, asthma and prior history of methamphetamine abuse. A CT of the neck revealed a fracture of the first upper cervical tracheal ring with resulting cervical tracheal stenosis, the most narrow portion measuring approximately 6mm in diameter. He was taken to the OR for balloon tracheal dilation. The case was done under general anesthesia using jet ventilation and a total intravenous anesthetic with propofol and remifentanil infusions. Postoperatively he reported an improvement in symptoms, though ultimately had a recurrence in his shortness of breath and subsequently required tracheal resection, which was complicated by anastomotic dehiscence that required reoperation.

Poster Presentation

Presenting Author: Dr. Marisa Hernandez-Morgan University of California, San Francisco

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There’s the Revised Cardiac Risk Index, But What About Predicting the Risk of Reintubation?

Background: The incidence of reintubation in the post-anesthesia care unit (PACU) is a rare occurrence, between 0.15-0.45% of all general anesthetic cases. This case report is aimed to highlight the effectiveness of the less frequently used perioperative pulmonary risk assessments. Case Description: A 73 year old male with multiple co-morbidities including, a five-month old myocardial infarction with placement of drug-eluting stents, a cardiac apical thrombus and ejection fraction of 20%, and severe chronic obstruction pulmonary disease (COPD; on two liters of supplemental oxygen at home), suffered a mechanical fall at home and was brought to the emergency department (ED) for a left intra-trochanteric femur fracture. Orthopedic surgery determined his case to be urgent and needing close reduction and internal fixation with a short intramedullary nail. The patient had an inconspicuous airway and lung exam, and given his co-morbidities, a revised cardiac risk index for the patient was performed (11% risk of a major cardiac event). However, it was stressed from the orthopedics team that the patient should not have a delay in surgery. The risks of general anesthesia were discussed with the patient, including his higher risk of intra- or post-operative cardiac complications. His case proceeded with one hour surgical time and an uneventful intraoperative course. At the end of the case, the patient was given a reversal agent while he was breathing spontaneously at volumes similar to pre-induction and he was extubated once the patient opened his eyes to command. Within 30 minutes after extubation, the anesthesia team was called to evaluate the patient who could no longer follow commands and began taking shallower breaths. The patient did not receive any benzodiazepines, and only had minimal opioids with induction. When he did not respond to naltrexone, a repeat arterial blood gas showed the patient was suffering from hypercarbic respiratory failure requiring reintubation. He was then transferred to the intensive care unit for mechanical ventilation and successfully extubated the following day. Discussion: Given the rarity of reintubation, there has been few published literature to suggest risk factors (e.g., COPD, emergent cases, ASA class III or higher) associated with reintubation. However, this complication can lead to significant morbidity and mortality, including prolonged hospitalization, intensive care stay, and further negative respiratory outcomes (e.g., pneumonia, prolonged mechanical ventilation, tracheostomy). Risk calculators are created to help patients make medical decisions based on their probability of suffering a complication. This patient received scores between 13-15% risk of having some type of pulmonary adverse event based on two known calculators, ARISCAT preoperative pulmonary index and a postoperative respiratory failure calculator by CHEST. Interestingly, these scores are higher than his risk of cardiac complications. Most preoperative assessments emphasize the importance of calculating cardiac risks in the preoperative period, with smaller stress on respiratory complications. Using these tools can help accentuate the importance of assessing pulmonary adverse events and when applied, can help prevent a negative outcome such as reintubation.

Poster Presentation
**Presenting Author:** Dr. Craig Rumbaugh University of New Mexico, Department of Anesthesiology and Critical Care Medicine

**Authors:**

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Dr. Brian Starr University of New Mexico, Department of Anesthesiology and Critical Care Medicine
Thromboelastography (TEG) as a tool to guide product replacement in the gravid patient with severe blood loss.

The use of TEG (Thromboelastography) is utilized more and more in the intraoperative setting where either severe bleeding is a factor, or where iatrogenic alterations in coagulation are indicated, such as cardiac surgery. Given that a TEG provides information about coagulation status from whole blood rather than just from plasma, if used appropriately, it should allow a clinician to transfuse product more precisely. In specific patient populations that are inherently hypercoagulable such as gravid patients, TEG could potentially be used to perfectly titrate the administration of platelets, FFP, and fibrinogen to ensure the optimum level of coagulation. This would be especially useful in gravid patients with severe hemorrhage requiring massive transfusion.

Poster Presentation

Presenting Author: Dr. Jonathan Barnier University of California, Davis

Authors:

Dr. Jonathan Barnier University of California, Davis
Dr. Rostam Bakhtari University of California, Davis
Title: Stepwise Hypotension During C-Section with Epidural Anesthesia in Parturient with Moderate to Severe Rheumatic Mitral Stenosis

Background: Maternal heart disease complicates between 0.2%-3% of pregnancies. Severe mitral stenosis (MS), which carries a fetal mortality up to 25%, is poorly tolerated by the parturient due to increased intravascular volume with limited ability to increase cardiac output. Understanding cardiovascular and hemodynamic changes that occur in these patients during pregnancy and delivery, particularly those undergoing neuraxial anesthesia, is paramount to delivering safe care.

Case Description: A 33-year-old G32002 female at 38 weeks gestation with gestational diabetes mellitus and moderate-severe rheumatic MS was transferred from an outside hospital for workup and management prior to delivery. The patient reported prior diagnosis of a "heart condition" at age 14 years in Micronesia. Her first pregnancy was an uncomplicated C-Section; her second pregnancy, also a C-Section, resulted in significant postpartum heart failure and pulmonary edema requiring intubation. She recovered, but declined to pursue follow-up. On arrival, the patient endorsed 2-pillow orthopnea with no dyspnea on exertion, significant edema, chest pain, or palpitations. TTE was significant for moderate-severe MS, moderate MR, mean mitral gradient of 10.2 mmHg, and mitral valve appearance consistent with rheumatic heart disease. Metoprolol was started per cardiology recommendations.

Once in the operating room, an arterial line was placed. Then, an epidural was placed; after a negative test dose, incremental local anesthetic boluses were given while closely monitoring hemodynamic changes. Simultaneously, a vasopressor infusion was uptitrated to maintain systemic vascular resistance. Once a T4 dermatomal level to sharp stimulation was achieved, cesarean delivery was completed. Soon after delivery, mean arterial pressure rapidly dropped, despite increased phenylephrine dosing, and oxygen requirements increased. Norepinephrine infusion was initiated. After achieving hemodynamic stability, a dose of furosemide was given for presumed acute pulmonary edema. The parturient recovered from her acute post-delivery episode quickly and was taken to the ICU on low-dose phenylephrine infusion. Her vasoactive and oxygen requirements quickly resolved. Repeat echocardiogram indicated improved mean mitral gradient. The patient was discharged on post-delivery day 3 with cardiology follow up at 6 weeks.

Discussion: The main complication in the setting of MS is a relatively fixed stroke volume. Inability to increase cardiac output as intravascular volume increases leads to obstructive/congestive physiology, resulting from increasing left atrial pressure. Epidural anesthesia has improved morbidity and mortality compared to general anesthesia in high-risk patients. Epidurals significantly blunt the large sympathetic surges that accompany delivery; however, they also create additional physiologic challenges in the parturient with MS. Sympathectomy leads to decreased peripheral vascular resistance and hypotension with an inability for patients to tolerate reflex tachycardia. These changes explain the significant decrease in MAP seen after cumulative boluses of the epidural. Finally, immediately postpartum, uterine involution leads to auto-transfusion, which can increase cardiac output by 75-80%. This new volume, in the setting of an inability to adequately increase cardiac output, explains our second step-wise decrease in blood pressure.
since the congestive physiology becomes further volume overloaded. Vigilant post-partum monitoring and follow-up is crucial, as most deaths occur during post-partum days 2-92. References: Available on request.

Poster Presentation

**Presenting Author:** Dr. Joel Roberts University of Colorado Department of Anesthesiology

**Authors:**

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Dr. Leah Webb University of Colorado Department of Anesthesiology
Dr. Alison Brainard University of Colorado Department of Anesthesiology
Dr. Jason Papazian University of Colorado Department of Anesthesiology
Toxic Flowers and Aconite Poisoning: A Case of Critical Illness after Chinese Herbal Tea

Background: Aconite is a highly toxic alkaloid found in flowering plants used in traditional Asian medicine to treat pains, bruises, and other ailments. Also known monkshood or wolfsbane, the substance can cause life-threatening cardiac and neurological toxicity by binding and maintaining sodium channels in the open position. Case description: We present an otherwise healthy 36 year old male who presented with acute life-threatening aconite poisoning one hour after ingesting a Chinese herbal tea for upper respiratory symptoms. The patient collapsed upon presentation to the emergency department, developing seizure-like activity and found to be in unstable ventricular tachycardia. After initial resuscitation, antiarrhythmic, and anticonvulsant treatment, the patient was admitted to the critical care unit intubated for continued management. Toxicological analysis confirmed aconite in tea samples brought in by the patient's family and the department of public health was informed. The patient continued to improve in the critical care unit and was discharged in stable condition two days later.

Discussion: A review of the literature accompanies this rare but significant intoxication. Aconite has a well-documented association with life-threatening ventricular dysrhythmias and neurological symptoms such as weakness and paresthesias. A narrow therapeutic index and lack of an antidote have been implicated in its toxicity. As the popularity of herbal medicine increases, examples such as this case highlight that such herbal remedies are not without potential harm.

Poster Presentation

Presenting Author: Dr. Michael Jung UCSF Medical Center

Authors:
Dr. Michael Jung UCSF Medical Center
Dr. Steven Hur UCSF
Tracheal Obstruction Upon One Lung Ventilation in Patient With Right-sided Aortic Arch and Kommerell’s Diverticulum

Kommerell’s diverticulum (KD) is a rare congenital anomaly of the aortic arch. It usually refers to the aneurysmal outpouching at the origin of an aberrant left subclavian artery in the setting of a right-sided aortic arch. The presentation is often asymptomatic, but can cause symptoms of esophageal or tracheal obstruction. If left untreated, the major complications can include dissection or even rupture. While tracheal compression has been previously described preoperatively or after induction of anesthesia, few case reports have described tracheal obstruction that manifested after initiation of one lung ventilation.

Our case describes a 32 year old woman who presented for surgical correction of her aberrant left subclavian artery and 18 mm KD, which was causing proximal esophageal compression. A 37 Fr Mallinckrodt left-sided double-lumen endotracheal tube (DLT) was placed for the case after induction of anesthesia. After initiation of one lung ventilation by clamping the left bronchial lumen, there was significant difficulty with ventilation. Upon examination, the posterior wall of the trachea was found to be protruding inward distal to the tracheal lumen. This airway compression caused increased airway pressures upon one lung ventilation, and difficulty maintaining adequate tidal volumes for oxygenation and gas exchange.

This case report highlights the utility of assessing for airway obstruction via fiberoptic bronchoscopy, as well as suggests that the use of a right-sided DLT should be considered in patients with right-sided aortic arch, regardless of degree of airway obstruction noted prior to induction of anesthesia.

Poster Presentation

Presenting Author: Dr. Joe Chung Cedars Sinai Medical Center

Authors:
Dr. Joe Chung Cedars Sinai Medical Center
Dr. Manxu Zhao Cedars Sinai Medical Center
Training Anesthesia Residents To Effectively Lead Family Conversations: A Novel Communications Curriculum in the ICU

Background

Anesthesia providers are increasingly recognized for their integral role in perioperative care, where unexpected circumstances may arise at any time; anesthesiologists must be able to effectively and compassionately communicate with families during such times.

While Interpersonal and Communication Skills are ACGME core competencies, they are not sufficiently taught or evaluated in residencies. Aside from short pre-operative interviews on the day of surgery, anesthesia residents have limited opportunities to practice effective communication skills with patients and families. In a pilot survey, residents who completed the Medical ICU (MICU) rotation unanimously responded that a curricular component addressing communications skills would help them lead difficult family conversations. Since residents interact with critically ill patients and their families in the MICU, a required rotation, there are ample opportunities for residents to initiate dialogue and lead family meetings.

The primary goal of this curriculum is for anesthesia residents to acquire communication skills necessary to proficiently lead multidisciplinary meetings in the ICU and apply these skills to leading difficult family conversations throughout the perioperative process.

Methods

Target learners were incoming CA1 anesthesia residents rotating through the MICU. New anesthesiology residents attend daily lectures throughout July. This curricular initiative introduced residents to ICU communications through a patient-interactive session followed by an introductory lecture on communication skills and SPIKES protocol in their orientation month. During the MICU rotation, the critical care faculty present daily high yield topics to residents during morning lectures. The Palliative Medicine faculty was actively involved in this new curriculum and led interactive sessions for residents to practice leading family meetings through role-play and debrief each month. Residents completed pre- and post-rotation assessment surveys, as well as narrative reflections describing standout patient family encounters.

Results

In the pre self-assessment survey administered in July, over 50% of incoming CA1s stated that they felt anxious and only slightly confident when holding difficult discussions with patients. The majority of new anesthesia residents stated that they had not received formal communications training in their medical education.
In the five blocks that we implemented this project, the residents’ post-assessment surveys demonstrated that all felt at least moderately to extremely confident leading family meetings. Over 70% of residents used the newly learned SPIKES protocol at least half the time. As only 2-3 residents rotate through the ICU each block, we have limited data points to date. However, we have received invaluable qualitative comments.

Conclusions

Effective communication between physicians and patients not only improves health outcomes and patient satisfaction, but also reduces error and misunderstandings. Anesthesiologists are expected to communicate effectively with colleagues, patients, and families throughout the perioperative process. However, there is often limited time to formally teach this skill during anesthesiology residency. Throughout this year, we have implemented a new curriculum in the Medical ICU that introduced residents to the SPIKES protocol and techniques to effectively lead family discussions. An overwhelming majority of residents and critical care attendings have enthusiastically supported this curricular addition and advocate for the continuation of this curriculum.

Poster Presentation

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Dr. Joshua Fronk Stanford University School of Medicine

Dr. Pedro Tanaka Department of Anesthesiology, Perioperative and Pain Medicine, Stanford University School of Medicine, Stanford, CA
Trans-Catheter Aortic Valve-in-Valve in a Patient with Acute Cardiogenic Shock and Gastric Bleeding

Background
A 70 female with history of severe aortic stenosis (s/p trans catheter aortic valve replacement 18 months prior) was transferred to our facility from an outside hospital in acute cardiogenic shock. Co-morbidities were significant for end-stage renal disease on hemodialysis, coronary artery disease, and hypertension. Following progressive shortness of breath for 4 months, she was admitted for NSTEMI treated with angioplasty & initiation of temporary support with an intra-aortic balloon pump and inotropes at the outside facility. Trans-esophageal echocardiogram demonstrated severe stenosis of existing bioprosthetic valve (0.6 cm²), low normal ventricular ejection fracture, and moderate mitral regurgitation. Following transfer, the patient also developed coffee-ground emesis with worsening hypotension requiring blood transfusion, initiation of norepinephrine, and continuous renal replacement therapy. Case
In the procedure suite, the patient was intubated with a rapid sequence technique. New central venous access and invasive arterial monitoring lines were established. Upper endoscopy demonstrated esophageal ulceration and a bleeding arteriovenous malformation in the stomach, which was clipped. The trans-esophageal echocardiogram probe was passed without difficulty. Under fluoroscopy, a new bioprosthetic valve was then deployed within the existing bioprosthetic valve. There was an immediate improvement in hemodynamics allowing removal of the intra-aortic balloon pump and rapid weaning of inotropic infusions.

Discussion
Hemodynamic instability at the time of TAVR is associated with increased mortality, but the mortality is lower than emergent surgical aortic valve replacement or valvuloplasty. In a patient who is not a candidate for either of the latter interventions, TAVR can be a life-saving intervention. Valve-in-valve TAVR is a recent intervention for degenerative valves, with feasibility studies performed in 2007 and FDA approval granted in 2015. TAVR registries have shown a median time to valve degeneration of approximately 9 years. Stenosis is more common (42%) compared to regurgitation (34%), with the remaining (24%) developing both pathologies. One-year all-cause mortality is 13.4% (8.9% due to cardiac pathology). Stenosis is associated with a lower survival rate compared to regurgitation (76% versus 91%).

Poster Presentation
Presenting Author: Dr. Evan Bohnenblust Cedars-Sinai Medical Center
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Dr. Evan Bohnenblust Cedars-Sinai Medical Center
Dr. Lorraine Lubin Cedars-Sinai Medical Center
Transesophageal Echo Guided Thrombus Extraction and Catheter-Directed Thrombolytic Therapy during Orthotopic Liver Transplantation

Introduction
Intra-Cardiac Thrombosis (ICT) is a rare but high mortality complication of Orthotopic Liver Transplantation (OLT) (Peiris P, Pai SL, Aniskevich S, et al, 2015). We present a case of using Transesophageal Echocardiography (TEE) guidance for an intra-operative CDT and thrombectomy in the setting of an OLT complicated by an ICT. Case Our patient is a 59-year-old female with history of End Stage Liver Disease (ESLD) due to alcoholic cirrhosis. She was admitted after a routine paracentesis complicated by a rectus sheath hematoma treated with multiple blood products including K-Centra (prothrombin complex concentrate with Factors II, VII, IX, X, Protein C and S), Tranexamic acid (TXA) and ultimately embolization. Patient remained coagulopathic but improved over the course of 10 days. On the day of transplantation, patient’s Model of End Stage Liver Disease (MELD) score was 41. Her comorbidities included atrial fibrillation with rapid ventricular response treated with diltiazem, thrombocytopenia (49,000), International Normalized Ratio (INR) of 2.1. In the operating room a pre-induction arterial line and invasive monitors was placed and general anesthesia was induced uneventfully with fentanyl, propofol, and rocuronium. A TEE was then performed which showed normal bi-ventricular function and no evidence of an ICT. The pre-anhepatic phase was notable for surgical bleeding addressed with platelet and cryoprecipitate administration. The preferred surgical approach at our institution is the “piggyback method” without veno-veno bypass (VVB). During the anhepatic phase after vena caval anastomoses, a TEE exam in the 4-chamber and bi-caval views revealed a new massive expanding ICT measuring 3x3 cm extending from the superior vena cava (SVC) to the Tricuspid Valve (TV). Given the stage of the transplantation, a decision was made to administer 10000 units of heparin and continued with the portal vein anastomosis, hepatic reperfusion, then followed by an attempt at thrombolysis and thrombectomy. At this time, the Interventional Radiology team was consulted for potential ICT extraction. An end-to-side donor vein graft was sewn on to the IVC just below the liver for thrombolytic access. Utilizing a combination of fluoroscopic and TEE guidance, a 12-French directional sheath was used for an aspiration thrombectomy with moderate effect. Furthermore, CDT was undertaken with alteplase (recombinant tissue plasminogen activator) 4 mg mixed with sterile water was slowly infuse to dissolve the large thrombus. TEE evidence of marked decreased in ICT size in the SVC and right atrium (RA). The case however proceeded with significant hemorrhage during the reperfusion/neohepatic phase, requiring a total of 45 Packed Red Blood Cells, 21 Fresh Frozen Plasma, 10 Platelets, 7 Cryoprecipitate, and Protamine. ConclusionThis case report features the first multi-disciplinary therapeutic administration of TEE-guided IVC-accessed thrombus extraction and catheter-directed thrombolytic therapy during OLT. TEE may serve the anesthesiologist well in diagnosis, intervention, and post-intervention assessment as well. TEE-proficient anesthesiologists provide an invaluable skillset in the management of critically ill patients. Furthermore, a novel multi-disciplinary approach was utilized to address a massive ICT/PE
with CDT, while minimizing systemic anticoagulation exposure and decreasing the risk of severe coagulopathy commonplace in liver transplantations.

Poster Presentation

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Treatment of Presumed Intraoperative Anaphylaxis

Background Intraoperative hypotension and hypocarbia are harbingers of severe hemodynamic compromise. Swift action to treat the underlying cause can prevent adverse perioperative outcomes. True anaphylaxis is rare in general anesthesia, the diagnosis of which is difficult and invites collaboration between allergists and anesthesiologists. The objective of this report is to highlight the management of intraoperative hemodynamic instability from presumed anaphylaxis, despite equivocal etiology. Case Description A 41-year-old obese woman with history of DMII and psoriasis was seen for laparoscopic cholecystectomy. She had a remote history of hives with penicillin and shellfish. Past surgeries included appendectomy and a neck mass excision without incident. Following pre-oxygenation, she was induced with fentanyl, propofol, and rocuronium, and her airway was secured with an endotracheal tube (ETT). Surgery began 10 minutes after cefazolin was administered for antibiotic prophylaxis and after skin preparation with betadine. She was hemodynamically stable. Then, upon insertion of a trochar into the right upper quadrant for laparoscopic access, end-tidal CO2 acutely dropped from 41 to 25 mmHg, with concurrent drop in mean arterial pressure from 90 to 30 mmHg and SpO2 from 99% to 90%. Surgeons were immediately notified. Breath sounds were diminished bilaterally, with right side slightly more diminished. A 14-gauge needle was inserted into the second intercostal space as thoracostomy for possible pneumothorax without audible return of air. Concurrently, a total of epinephrine 40 mcg, dexamethasone 20 mg, albuterol 900 mcg, and diphenhydramine 50 mg were given with improvement in hemodynamics. Once the patient was stabilized, fiberoptic scope verified placement of ETT above the carina. Breath sounds were equal and chest x-ray was negative for pneumothorax. The procedure was aborted. Postoperative serum tryptase level, drawn within one hour of the event, was normal at 3 ng/mL, and follow-up allergy skin testing for rocuronium was negative. Discussion Anesthesiologists frequently encounter acute derangements in vital signs without obvious precipitating cause. In this case, a wide differential consisting of tension pneumothorax from trochar placement, endobronchial intubation, and anaphylaxis was considered and addressed. Large body habitus, along with ambient operating room noise, limited the reliable evaluation of breath sounds. A needle thoracostomy was performed due to its high diagnostic and therapeutic yield if indeed a pneumothorax were present. No rush of air was heard, either indicating absence of pneumothorax or inadequate access to the pleural cavity due to a thick chest wall. Fiberoptic scope ruled out endobronchial intubation. Serum tryptase level was normal, which can be seen in 36% of anaphylactic patients; sensitivity of this marker for anaphylaxis would be increased if serial measurements had been taken. Although rocuronium skin test was negative, the allergy clinic is unable to perform an intravenous challenge, which is the standard route of administration. Finally, given previously reported history of hives to penicillin and shellfish, it was recommended that cefazolin and betadine be avoided in the future. The diagnosis of anaphylaxis is challenging; often a specific trigger cannot be identified. As described, prompt management of presumed anaphylaxis is essential and can lead to avoidance of significant morbidity.

Poster Presentation
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**Triple threat: Hemiplegic migraine, paradoxical vocal cord dysfunction and postoperative seizure in a patient undergoing ERCP**

Background  Idiosyncratic reactions after general anesthesia are rare but real. If unknown beforehand, they can lead to overly aggressive workup and over-treatment, as well as prolong hospital stay significantly. We present a case of a patient with three different rare post-anesthetic conditions, which we were fortunately aware of and anticipated preoperatively. Case Description  A 38 year old female with a history of paradoxical vocal cord dysfunction, hemiplegic migraine, and possible migraine-associated seizures presented for ERCP for papillary stenosis. She had a history of post-operative aggravation of paradoxical vocal cord dysfunction, which required use of her non-invasive positive pressure ventilator. She also described transient changes in mental status, paresis and other focal deficits on emergence from anesthesia in the past. Her physical exam in the preoperative area was unremarkable. The procedure was performed under general anesthesia. Following extubation, the patient indicated difficulty breathing, so her home non-invasive ventilator was applied. She then had generalized seizure-like activity, which resolved with intravenous midazolam. She also had periods of non-responsiveness, right facial droop and paresis, but remained hemodynamically stable. She was admitted to the ICU overnight for monitoring and use of her non-invasive ventilator. Her neurological and respiratory symptoms improved by postoperative day 1, and she was discharged home. She had a subsequent ERCP procedure under sedation. She was restarted on her non-invasive ventilator postoperatively and had an otherwise unremarkable recovery. Discussion  Paradoxical vocal cord dysfunction involves adduction of the vocal cords during inspiration, leading to acute respiratory distress. It is traditionally associated with underlying psychiatric illness or anxiety, and triggers can include emotional distress. (1) This condition should be considered in the differential diagnosis for postoperative stridor. Management includes reassurance, non-invasive positive pressure ventilation and light sedation (2,3,4). Fortunately, our patient had established non-invasive ventilation settings for management of her symptoms. Hemiplegic migraine is a rare subtype of migraine that typically presents with a motor aura of transient hemiparesis or hemiplegia along with migraine headache. It can mimic a cerebrovascular accident or transient ischemic attack if the aura develops acutely. (5) It can be managed with most typical abortive migraine treatments, and is best managed with guidance from the patient’s prior experiences. In this case, the patient had known aggravation of her symptoms in the postoperative period that reliably resolved with time. (6,7) The association between migraine and seizures is unclear, but has been described. (8) The patient had prior episodes of seizure-like activity associated with migraines, and her seizure-like activity resolved with benzodiazepine therapy. References  1. Denipah N, et al. Ann Emerg Med. 2017 Jan;69(1):18-23.  2. Gupta A, et al. J Anaesthesiol Clin Pharmacol. 2011 Apr;27(2):287-8.  3. Larson B, et al. J Clin Anesth. 2004 May;16(3):230-4.  4. Roberts KW, et al. Anesthesiology. 1998 Aug;89(2):517-9.  5. Russell MB, et al. Lancet Neurol. 2011 May;10(5):457-70.  6. Greaney D, et al. Can J Anaesth. 2014 Mar;61(3):278-9.  7. Willson J, et al. Anaesthesia. 2007 Sep;62(9):956-8.  8. Mateo I, et al. Headache. 2004;44(3):265-270.
Poster Presentation

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UC Davis Project Improve Pain: A Retrospective Analysis of Pain Management Improvement Opportunities in a Children's Hospital

Background - Satisfactory pain control is associated with faster recoveries, fewer complications, increased patient satisfaction and reduced length of stay. In a recent paper, following implementation of knowledge translation (KT) initiatives at a pediatric hospital in Toronto, significant improvements in pain processes and clinical outcomes were observed. Survey data show that our parents' satisfaction with pain control at UCD children’s hospital is below goal and below the national benchmark and currently, the children's hospital does not have a comprehensive pain service. This project aims to understand the state of pain management/assessment practices at UCD Children’s Hospital, to implement knowledge translation initiatives and to propose a plan for a comprehensive pediatric pain service.

Methods - Single day retrospective chart audits were conducted to assess clinical outcomes (pain prevalence and pain intensity) and process outcomes (assessment and management practices). Each unit had varying process outcomes due to differences in the patient population and needs of each unit. EMR nursing flowsheets and chart records were analyzed to determine frequency and method of pain assessment, and when nurses choose to administer pain interventions. The information gained from these audits was used to assess deficiencies and areas of improvement for pain management. KT initiatives were implemented over several months: five 1 hour education sessions for pediatric ward nurses were held addressing pediatric pain management strategies. Process review sessions were held amongst pediatric anesthesiologists to review and update current practices and to implement a common practice to educate parents about pain management expectations. Child life specialists implemented improved pain education programs and preoperative education material was developed to improve education of families and patients prior to their surgical day. Study of the intervention will be measured via patient satisfaction surveys, as well as a repeat audit of the same clinical and process outcomes.

Results - Records of 102 pediatric inpatients in 4 different units were audited and all patients had documented pain scores. CSC had 10.5% patients with poorly controlled pain (defined as two or more moderate to severe pain scores in 24 hours) compared to 20.5% in Davis 7, 11.4% in the NICU and 35.7% in the PICU. Of patients with documented pain, 90% of children received pharmacological therapy, and 31% received either a psychological or physical pain-relieving intervention. Deficiencies included charting discrepancies using different pain scales (FLACC, NPASS, Wong Baker Faces) for the same patients and failure to chart pre/post pain scores after pain interventions.

Conclusions - The KT initiatives and improvements in pain practices have been and will continue to be implemented and survey data thus far indicates the possibility of positive impact to patient satisfaction with pain management; more data is likely needed to provide conclusive evidence of the effectiveness of this program. Improvement in quality measures is not the final aim of this project. The next steps are aimed at forming a multidisciplinary, comprehensive
pediatric pain service to provide consultation for the entire children’s hospital for acute, perioperative, chronic, and palliative pain management.

**Poster Presentation**

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ULTRASOUND ASSESSMENT OF CONTRALATERAL DIAPHRAGMATIC FUNCTION PRIOR TO INTERSCALENE BLOCK

INTRODUCTION: The interscalene brachial plexus block (ISB) is a common regional anesthesia technique for procedures involving the shoulder and upper arm. A well described and likely unavoidable complication of this block is temporary paralysis of the ipsilateral phrenic nerve. The degree of which this may affect a given patient’s pulmonary function is variable and may often go unrecognized in otherwise healthy patients. However, patients with underlying pulmonary disease may be more likely to display symptoms of dyspnea, and in severe cases respiratory failure may ensue. Therefore, proper patient selection and preoperative evaluation is crucial. One particular preoperative finding that is viewed as a contraindication to ISB is preexisting contralateral phrenic nerve palsy. We report a case of successful left ISB performed after ultrasonographic assessment of diaphragmatic function, for a patient with radiographic evidence of contralateral hemidiaphragm elevation on preoperative chest radiograph.

CASE DESCRIPTION: A 70 year old woman with chronic persistent asthma, chronic rhinosinusitis, hypertension, GERD, hypothyroidism and obesity was scheduled to undergo a left total shoulder arthroplasty. Preoperative evaluation noted a prior chest radiograph which revealed an elevated right hemidiaphragm with patchy basilar reticulation. Previous pulmonary function testing results were also reviewed and were unremarkable. Further evaluation with a bedside ultrasound was performed prior to performing planned ISB for perioperative pain management. This demonstrated appropriate right diaphragmatic excursion and pleural sliding. Subsequently a left ultrasound-guided ISB was performed and well tolerated, followed by general anesthesia and successful completion of the scheduled surgery. Post-operatively the patient had appropriate pain control and had no reports of subjective dyspnea or evidence of respiratory insufficiency.

DISCUSSION: In this case report, we suggest that point-of-care ultrasound may be used preoperatively to assess for hemidiaphragm dysfunction prior to performing ISB. Such an approach may be useful for identifying or excluding pre-existing hemidiaphragm weakness, which may impact a patients’ ability to tolerate the unilateral phrenic nerve palsy that could accompany an ISB.

Poster Presentation

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Ultrasound-guided transversus abdominis plane block: Analgesic benefits for postoperative pain control after an emergent femorofemoral bypass surgery

Background: Transversus abdominis plane (TAP) block via the single-shot or the insertion of a catheter can provide postoperative analgesia for a range of surgeries involving the anterior abdominal wall. Case presentation: We present a case of 79-year-old female patient with a complex past medical history that includes atrial fibrillation, embolic stroke, and congestive heart failure with an fraction of 31%, who underwent an emergent femorofemoral bypass and had adequate perioperative pain relief after the ultrasound-guided TAP block. Bilateral TAP block was performed with a 3.5-inch long, 21 G stimuplex needle, using 50 ml of 0.25% bupivacaine with 1:200,000 epinephrine and 2 mg of dexamethasone. Prior to her discharge from the hospital on postoperative day 7, patient required administration of only a single dose of oral PRN medication. Conclusion: TAP block, which in our case utilized 0.25% bupivacaine with epinephrine and supplemented with 2 mg dexamethasone, provided an elderly patient status post an emergent femorofemoral bypass with a great analgesic benefit, allowing the patient to consume minimal analgesics.

Poster Presentation

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Understanding inappropriate repeat administration of ondansetron in the postanesthesia care unit

Background

Postoperative nausea and vomiting (PONV) is a common and unpleasant side-effect of anesthesia which negatively affects patient satisfaction and length of stay in the postanesthesia care unit (PACU). Repeated administration of ondansetron as a rescue antiemetic after intraoperative prophylactic dosing has been shown to be ineffective in treating PONV [1]. The current guidelines from the Society for Ambulatory Anesthesiology (SAMBA) recommend that, if a prophylactic antiemetic fails, an antiemetic from another class should be given [2]. SAMBA guidelines also recommend that antiemetics given as prophylaxis should not be repeated within 6 hours. However, many providers give ondansetron both as prophylaxis and as treatment for PONV. Although ondansetron is generally well-tolerated, adverse effects include headache, elevated liver enzymes, constipation, and QT prolongation. Our study sets out to determine the rate at which antiemetics given as prophylaxis are repeated as treatment for PONV, and to explore why this occurs.

Methods

All anesthesia residents received lectures on PONV and SAMBA guidelines, and key recommendations were reiterated in July 2016. We retrospectively reviewed 5485 general anesthesia cases at the UCSF Medical Center, between July 1, 2016, and February 28, 2017. Inclusion criteria included patients >18 years old, administration of inhaled anesthetic or nitrous oxide >30 minutes, and having resident involvement in the case. Frequency of combined prophylactic and rescue ondansetron administration in the PACU was determined from the electronic medical record (EMR). This was followed by an anonymous survey sent to all UCSF anesthesia residents, focusing on attitudes toward prescribing antiemetics both as prophylaxis and as treatment for PONV.

Results

362 (87.9%) of the 412 ondansetron administrations in the PACU were inappropriately given after ondansetron had already been administered prophylactically. Of the 71 anesthesia residents surveyed, 43 responded, of whom 35 (81.4%) listed the limited PACU order set (i.e. the only antiemetic on the PACU order set is ondansetron) as a barrier to prescribing an alternative antiemetic after ondansetron was already administered prophylactically, 55.8% reported prescribing ondansetron repeatedly for patients with allergies or contraindications to alternative antiemetics, and 37.2% said the difficulty and inconvenience of adding alternative orders to the order set (due to time constraints and EMR unwieldiness) was a barrier to prescribing alternative antiemetics.

Conclusions

Despite education on PONV guidelines, many providers prescribe the same class of antiemetics (particularly ondansetron) as both prophylaxis and treatment. Understanding barriers to
optimizing antiemetic therapy is a critical first step in improving patient outcomes and potentially decreasing costs of receiving medications that confer no additional benefits. To address the barriers identified, a number of interventions, including an order set listing several options for antiemetic treatment and the addition of new classes of antiemetics to the anesthesia cart, will be enacted. Future directions involve examining the effects of these interventions, and exploring the optimal timing of ondansetron (i.e. prophylaxis vs. treatment of PONV) and efficacy of repeatedly administering antiemetics other than ondansetron.

References

Poster Presentation

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Undiagnosed Paraganglioma Unveiled during Laparoscopic Appendectomy in a Pediatric Patient

Background: Pheochromocytomas and paragangliomas are rare neuroendocrine tumors. Furthermore, only about 10-20% of these tumors are diagnosed in children, who usually present with symptoms from catecholamine hypersecretion or tumor mass effect (1, 2). We present a report of laparoscopic appendectomy in a healthy child complicated by perioperative hypertension later attributed to an undiagnosed paraganglioma.

Case Description: A previously healthy 10-year-old (30.5kg) female presented to PMD with 1-day history of headache and RLQ pain. She was sent to ED from clinic for BPs as high as 170s/130s. Patient reported headache and vomiting for 2 days 2 weeks ago and had not returned to baseline health since. She also endorsed intermittent night sweats. ROS was otherwise negative and labs only showed elevated WBC. Abdominal ultrasound in ED revealed significant right hydronephrosis and hydroureter, patent bilateral renal arteries, and acute appendicitis. TTE showed mild LVH. Patient was admitted for further hypertension work-up and acute appendicitis. Her BP improved to 120s/70s with scheduled oral isradipine. She was added on for laparoscopic appendectomy on hospital day 2. Immediately after induction using modified RSI, BP was 204/145 and she received nitroglycerine 100 mcg, additional propofol bolus, and high sevoflurane. Immediately after intubation, BP was 130s/60s. Additionally, EKG was noted to be irregular with evidence of sinus rhythm, junctional rhythm, and possible delta wave with HR in the 80s, which resolved prior to incision. Throughout the surgery, her BP remained labile and persistently elevated ranging 130s-170s/70s-120s with HR ranging 80s-100s requiring hydralazine and esmolol boluses. A vascular mass behind the uterus was later noted by surgeon. After extubation in the OR, she had persistent hypertension, tachycardia, and episodes of desaturation when attempting to wean from nonrebreather facemask; decision was made to admit patient to the PICU. Nicardipine drip was also started post-operatively with improved BP control. She was conservatively managed with oral CCB and ACEI, which only controlled her BP marginally, while undergoing further evaluations. CT urogram showed an enhancing mass, possibly arising from the adnexa, abutting the uterus and bladder wall and compressing the right distal ureter. A week later her serum and urine catecholamines, urine metanephrines and VMA returned consistent with paraganglioma. She also underwent nuclear imaging, which ruled out metastasis. Alpha and beta blockers were started and uptitrated. She returned for tumor excision 33 days later. The surgery was uneventful and pathology confirmed extra-adrenal paraganglioma. Patient continues to do well postoperatively.

Discussion: Reports of intra-operative presentation of undiagnosed pheochromocytoma and paragangliomas are relatively rare. Even fewer descriptions are found for the pediatric population. Furthermore, not all of these patients have a history of hypertension pre-operatively. Fifty percent of deaths associated with undiagnosed pheochromocytoma occur peri-operatively or during parturition. Twenty-seven percent of patients with undiagnosed pheochromocytoma died during or shortly after surgery in a case series on the topic. Though quite rare, given these facts it is always important to consider undiagnosed catecholamine secreting tumors in the event of otherwise unexplained severe intra-operative hypertension.
Poster Presentation

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**Unexpected hyperkalemia and severe lactic acidosis during routine laparoscopic nephrectomy.**

We present a 15 year old with hypotrophic right kidney due to vesicoureteral reflux and hypertension of renal etiology presenting for laparoscopic simple right nephrectomy, developing unexpected intraoperative hyperkalemia, significant lactic acidosis, and increase in serum creatinine. Induction, intravenous catheter, and arterial line placement were uneventful. Vital signs were stable. Blood pressure was maintained without pressors at about 10% below baseline (136/88 preoperatively). Four hours after incision peaked T waves on ECG prompted an arterial blood gas, which revealed serum potassium (K+) of 6.6 and lactate of 2.2. At baseline, K+ was 3.7, pH 7.37 and lactic acid 0.9. Hyperkalemia was treated with calcium chloride, albuterol, hyperventilation, bicarbonate, insulin and glucose. The potassium fell to 6, then 4.1, then to 2.6 within an hour and normalized within 8 hours. Lactic acid increased to a maximum of 10.8 about 4 hours after the hyperkalemic event, and normalized within 12 hours. The lowest pH was 7.19, resolved within 7 hours. 20 minutes after the diagnosis of hyperkalemia, the blood pressure drifted within 5 minutes from 120 systolic to 100 then briefly low 80’s, and improved rapidly with phenylephrine 300 mcg total. After discussion with surgeon, laparoscopic examination was performed, with no intestinal ischemia or injury noted. Liver function, creatine kinase, and creatinine were tested. The only abnormal result was creatinine, increased to 1.69 from 0.94 baseline, normalized within 11 hours. The patient was taken intubated to ICU due to concern for unexplained worsening lactic acidosis and extubated uneventfully the next day, with resolution of lab abnormalities. It is unclear why this routine nephrectomy patient developed hyperkalemia and then worsening lactic acidosis with renal injury. Surgery was uneventful, save for the brief (1-minute) episode of 80/40 BP.

Independently of the BP change, the right kidney was perfused retrograde through the venous system for 40 minutes while the artery was clamped and the surgical team waited for a larger clamp for the renal vein. These were the two notable events during surgery, but neither appears sufficient to produce this situation. Compression of the renal arteries might cause acute kidney failure, but patient positioning and surgical approach were normal. Postoperative Doppler study showed increased resistive indices in the interlobar arteries, so kidney perfusion may have been less than systemic pressures would indicate due to a combination of unsuspected increased resistance and intraperitoneal pressure (CO2 insufflation). Lactic acidosis has been reported after treatment with albuterol for asthma, so hyperkalemia treatment with albuterol in a hyperadrenergic state might explain the lactic acidosis [1], but not the initial hyperkalemia. Rhabdomyolysis has been described in nephrectomy cases, but laboratory values were normal [2].


**Poster Presentation**

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Unilateral Paralysis of the Hypoglossal Nerve After Orotracheal Intubation for General Anesthesia

56-year-old female with continuous intracranial hypotension secondary to nerve root cysts was scheduled for left C5-T1 hemilaminectomy. Patient has history of orthostatic headaches due to CSF leak, status post T7-9 laminectomy, L3-L5 laminectomy, dural reduction surgery, multiple fibrin glue injections, and blood patches, all of which only provided temporary relief. Her headaches were described as bitemporal and sub-occipital associated with neck pain but never revealed any focal near deficits. She also had a history of Ehlers Danlos syndrome, complicated by joint hypermobility and partial detached retina, bicuspid Aortic valve with moderate Aortic regurgitation and a PFO discovered incidentally 2 years earlier during initial workup. Patient denied any other significant medical, surgical or social history and denied any anesthetic complications during prior procedures. On arrival to the operating room, general anesthesia was induced with propofol 2.5 mg/kg, Succinylcholine 120mg and Fentanyl 50mcg. Patient was intubated with a 7.0 ETT, using a Video MAC and bougie to minimize manipulation of the neck. Patient was intubated without difficulty on the first attempt and the ETT passed through the cords without resistance. An arterial line was placed and the patient was positioned prone on a jackson table, after which all pressure points were checked regularly throughout the case. MEP and SSEP monitoring were obtained during a case and anesthesia was maintained with Desflurane, and fentanyl without neuromuscular blockade. Hemodynamic parameters were stable throughout surgery. The surgery was uneventful and duration of anesthesia was four hours. Extubation was uncomplicated and there were no immediate postoperative complications. On POD1, the patient complained of difficulty in swallowing and slurred speech. Physical examination showed right tongue deviation on protrusion. Gag reflex and taste sensation were normal. To exclude cerebrovascular diseases or internal carotid artery dissection, MRA was performed, confirming isolated right hypoglossal nerve palsy (HNP). Conservative management included speech therapy and regular neuro checks were done. Following discharge, symptoms continued to improve and there was complete recovery at 4 months. Most reported cases of HNP after airway management suggest involvement of the extra cranial section of the hypoglossal nerve, which exits the skull through the hypoglossal canal and descends caudally, along with internal carotid artery and jugular vein. At the level of the angle of the mandible it becomes superficial, passes just above the greater horn of the hyoid bone, and enters the floor of the mouth. Mechanisms such as hyperextension of the neck during intubation, endotracheal tube cuff pressure, excessive hyperextension, or head lateralization during surgery have been described as causes of this neurological damage. Although the exact mechanism of injury is unclear, the hypothesized etiology in our case was compression of the hypoglossal nerve by the ETT tube at the hyoid bone, which was further exacerbated by continuous MEP monitoring. In conclusion, anesthesiologists should be aware of the possible causes of the HNP and should take extreme care to prevent nerve injuries and other complications.

Poster Presentation
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Urgent awake fiberoptic intubation for acute airway obstruction: lessons learned in airway management

Awake tracheotomy is the airway management of choice for patients with severe dyspnea due to locally advanced obstructive head and neck squamous cell carcinoma. These patients are frequently difficult to ventilate and intubate, and tracheotomy should be performed before complete obstruction occurs. When tracheotomy is not possible in an emergent situation, other options for immediate airway control must be available and a team approach is essential. We present the case of a 56 year old male with squamous cell carcinoma of the mouth floor invading the right mandible, complicated by significant bilateral cervical lymphadenopathy. He presented to our medical center with increasing dyspnea, dysphagia, poor PO intake, and acute enlargement of a submental mass over the previous few days that was found to be necrotic and infected. He was admitted for failure to thrive and initiation of IV antibiotics. Because of his growing airway tumor leading to near complete obstruction of his airway, he was scheduled for elective awake tracheotomy with local anesthetic and monitored anesthesia care. Upon presentation to the operating room, he was in respiratory distress but still breathing spontaneously in the left lateral decubitus position. Upon positioning the patient supine, his upper airway became completely obstructed. Returning to lateral position and applying two-handed mask ventilation with a nasopharyngeal airway was only able to maintain oxygen saturation at 60%. Unable to quickly perform a tracheotomy with the patient’s lateral position and abnormal anatomy, the otolaryngologist performed a successful emergency nasal fiberoptic intubation followed by tracheotomy under general anesthesia. This case underscores the tenuous state of patients with advanced obstructive head and neck squamous cell carcinoma, and the importance of careful planning, examination of prior studies for descriptions of anatomy, and preparation for emergency airway scenarios.

Poster Presentation

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Using a Real-time, Financially-Driven Software Prototype to Prospectively Improve Operating Room Scheduling, Utilization and Efficiency

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Background: Many hard-working and intelligent researchers seek to define, understand, and optimize operating room (OR) metrics. The many factors at play have been well characterized. They include operating room fixed and variable costs, surgeon preferences, protocols for how operating rooms are scheduled, and human variables, such as scheduling and managing human resources. Our institution faces the same challenges with OR optimization as has been elsewhere defined. We have several different OR theaters, each of which has their own challenges; some with the “empty” syndrome, consisting of underutilized resources struggling to fill available OR time and others with the “overfilled” syndrome, consisting of many surgeries extending beyond regular hours and the perception that more rooms are needed. Our purpose was initially borne out of a conflict that arose between our OR coordinator and surgeons when trying to move OR cases around to perceivably increase OR efficiency. The desire was to try and quantify the effects of moving an OR case from one room to another to enable the coordinator to say, for example, “if we move this case from X to Y, then the cost savings would be Z, or another fill-in-the-blank negotiating tool. Hence, we set out to create a software tool that could integrate existing cost data and interface with the OR schedule in real-time to allow a scheduler or coordinator the ability to prospectively understand the effects of how they particularly schedule cases, to not only improve the key metrics of cost saving, but to also be more equipped to answer questions that inevitably arise during the process.

Methods: Using a prototype version of our software tool, we retroactively used our software to quantify cost savings, utilization percent changes, as well as the burden of schedule change to surgeons as we analyzed what we determined to be a typical month at one of our ambulatory surgical centers. This analysis also served the purpose of us testing and refining our software tool. Using the software, we moved cases around to increase utilization being defined as OR time used in comparison to time available. We also moved cases from block times if block time was utilized less than 25%.

Results: Utilization improved from 53.1% to 87.9% and cost savings per change ranged from $300-2000, with the average being above $500. Surprisingly, the burden to surgeons for schedule change was minimal.

Conclusions: In this application of the software and subsequent shorter analyses, the substantial benefit to optimally moving cases around is obvious. We realize it a bit idealistic to suggest this tool can always be perfectly applied. We do, however, feel that this tool can be highly valuable to schedulers, surgeons and staff by providing data as to how each moving case not only affects
one room, but the entire OR, as well, and may help provide buy-in power for surgical members who may traditionally opposed to having fluid OR scheduling.

**Poster Presentation**

**Presenting Author:** Dr. Steven Larsen University of Utah

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We need to stop; it’s status epilepticus

Background: Intraoperative seizures are rarely reported in extracranial surgeries, especially in patients with no known history of seizures. We report a case of new onset status epilepticus in a patient undergoing spine surgery under total intravenous general anesthesia. Case Description: A 60-year-old male with history of hypertension, anxiety, and biopsy proven prostate cancer, initially presented with progressive lower extremity numbness and weakness. His work up on admission included an MRI of his spine showing a pathologic compression fracture of T7 with an infiltrating epidural tumor causing moderate compression of the spinal cord. Patient was scheduled for T7 laminectomy, transpedicular decompression, and T5-T9 posterior lumbar interspinal fusion. The surgical team planned to monitor SSEPs and MEPs, therefore a total intravenous anesthetic was planned. Premedication with Midazolam was given prior to transport to the operating room. General anesthesia was induced with Fentanyl, Lidocaine, Propofol, and Succinylcholine. Patient was intubated and mechanically ventilated with tidal volumes of 500 ml and end tidal CO2 values of 32-34 mmHg. Total intravenous anesthesia was started with Propofol and Remifentanil. Immediately post-incision, propofol was uptitrated to 150 mcg/kg/min and remifentanil was increased to 0.3 mcg/kg/min and then to 0.4 mcg/kg/min. Patient tolerated incision well and remained stable for the beginning portions of the procedure. Approximately 90 minutes after induction of anesthesia, patient started showing seizure activity on EEG. No visible convulsions were noted. Additional propofol bolus was given along with Midazolam. Seizure activity persisted, so further antiepileptics of Phenytoin and Levetiracetam were given. No medications administered were able to place the patient into burst suppression. A decision was made to start pentobarbital and burst suppression was finally achieved. Discussion with the surgical team occurred and the procedure was aborted. Patient was transferred to the neurosurgical ICU and placed on continuous EEG. MRI brain with contrast was completed to investigate etiology of seizures and showed at least 5 small enhancing foci in the cerebrum and cerebellum. Patient remained on midazolam drip for 5 days along with multiple antiepileptics. Once seizure activity diminished, midazolam was fully weaned. Patient awoke and was extubated 6 days post procedure. He was transitioned to hospice care. Discussion: While intraoperative seizures under general anesthesia are a rare occurrence, prompt diagnosis and treatment are prudent to avoid long term neurological complications. Preoperative evaluation should focus on risk factors for neurologic sequelae. In this patient, with known metastatic cancer, no preoperative brain imaging was completed. The likely etiology of his seizure activity was his later discovered brain metastases. The treatment of status epilepticus intraoperatively should focus on burst suppression. In this case, both propofol and midazolam were not sufficient. Treatment was escalated to add further antiepileptic agents, with pentobarbital finally placing patient into burst suppression. The immediate recognition and treatment of his seizure activity enabled full recovery from seizures and no apparent neurologic deficits upon awakening.

Poster Presentation
When More is Better: A rare case of double epidural analgesia for abdominal surgery pain

Thoracic epidural (TEP) analgesia improves postoperative pain management, reduces pulmonary complications, reduce postoperative ileus duration and decrease length of stay after laparotomies(1,2). Reported epidural failure rate in teaching institutions is about 30% (3) necessitating a catheter replacement and/or adding additional IV analgesia. We report a case second TEP placement to improve pain management after a larger than expected laparotomy.

CASE REPORT A 59-year-old man with Lynch’s syndrome, chronic pain and ongoing polysubstance abuse admitted for a complex abdominal surgery due to synchronous colon adenocarcinoma and urothelia cancer. A pre-operative T8/9 TEP was placed and successfully tested (LOR was at 6cm and taped at the skin at 11cm). TEP was used intraoperatively using bupivacaine 0.1% at 10mL/hr along with ketamine drip (8mg/hr), which were continued post-operatively. After the 12-hour exploratory laparotomy including complete procto-colectomy, low anterior colon resection with an end-ileostomy, right nephro-ureterectomy, a partial cystectomy, and left ureteral stent via a midline incision, the patient was extubated and recovered in the PACU and started on a hydromorphone PCA. He initially had good pain, however during the course of the first night, signs of sedation and confusion were noted and the PCA and ketamine infusion were paused. A subsequent pain crisis lead to an assessment of the TEP block, performed by the APS early on POD1 which found no catheter migration, good bilateral discrimination to pinprick covering the T10-5 dermatomes only, with absent analgesia to the lower abdomen. The PCA and low dose ketamine were restarted and the TEP rate increased to 12ml/hr. Unfortunately, rectal and lower abdominal pain did not. Not wanting to risk losing analgesia above dermatome level T10, a second TEP was placed at T11-12 on POD #1 (LOR at 5cm, taped at 10cm skin) (fig 1-3). The lower dermatomal border after the test dose (45mg lidocaine) was found bilaterally at L1 level. Due to the first TEP, the rostral border could not be identified. Both epidurals were started with 0.1% bupivacaine at 6mL/hr. Pain control improved (reported VAS 3). The dermatomal spread of the combined TEPs yielded diminished sensation to pinprick from T5 to L1. Over the subsequent five days hydromorphone PCA 8hr-shift use regressed from 11.4mg to 1.2mg. Good mobilization and improved mental status and no hypotension were noted during this period. On POD #5 both epidurals were capped and later removed once good analgesia on orals was confirmed. He was discharged to home on POD #15.

DISCUSSION Dual epidural analgesia has been successfully used for esophagectomies (4,5) and spinal fusions (6) without increased adverse events. To our knowledge, this is the first case report of dual epidural analgesia for a large abdominal surgery. No adverse events were noted. Replacing a partially working epidural catheters bares the inherent risk of a second epidural failure, hence placing a second epidural catheter, even if the target region is a clearly defined anatomical region such as the abdomen, may be a safe and effective alternative. Further studies are warranted.

Poster Presentation
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