



**The Academic Anesthesiology Committee
of the MSA**

and

UMass Medical School

present

The 1st Annual

**New England Anesthesiology Residents Conference
(NEARC)**

Saturday, April 7, 2007

at

**UMass Medical School
55 Lake Avenue North
Worcester, MA 01655**



1st Annual New England Anesthesiology Resident's Conference (NEARC)
Saturday, April 7, 2007

| | | |
|-------------------|---|---|
| 7:00AM – 7:50AM | Registration and Continental Breakfast | Foyer of Amphitheater 1 2 nd floor Medical School |
| 7:50AM – 8:00AM | Welcome Stephen O. Heard, MD Professor and Chair Department of Anesthesiology UMass Medical School UMass Memorial Medical Center | Amphitheater 1 2 nd floor Medical School |
| 8:00AM – 10:00AM | Oral Presentations – Session 1 Moderator, Roman Schumann, MD | Amphitheater 1 2 nd floor Medical School |
| 10:00AM – 10:30AM | Coffee Break | Foyer of Amphitheater 1 2 nd floor Medical School |
| 10:30AM – noon | Oral Presentations – Session 2 Moderator, J. Matthias Walz, MD | Amphitheater 1 2 nd floor Medical School |
| Noon – 1:30PM | Lunch with lecture by Mark Hershey, MD President of the MSA | Faculty Conference Room Medical School Lobby |
| 1:30PM – 3:15PM | Oral Presentations – Session 3 Moderator, Iqbal Ahmed, MD | Amphitheater 1 2 nd floor Medical School |
| 3:15PM – 3:45PM | Coffee Break | Foyer of Amphitheater 1 2 nd floor Medical School |
| 3:45PM – 5:00PM | Oral Presentations – Session 4 Moderator, Mark Hershey, MD | Amphitheater 1 2 nd floor Medical School |
| 5:00PM – 7:00PM | Reception | Lazare Research Building Blaise Pavilion |

M. Iqbal Ahmed, MD FRCA
Director, Anesthesia Residency Program
Tufts-New England Medical Center
Boston, MA

Stephen O. Heard, MD
Professor of Anesthesiology and Surgery
Chair, Department of Anesthesiology
UMass Memorial Medical Center
UMass Medical School
Worcester, MA

Mark Hershey, MD, President
Massachusetts Society of Anesthesiologists
Assistant Clinical Professor
Tufts University School of Medicine
Boston, MA

Roman Schumann, MD
Assistant Professor of Anesthesia
Vice-Chair for Clinical Research
Tufts-New England Medical Center
Tufts University School of Medicine
Boston, MA

J. Matthias Walz, MD
Assistant Professor of Anesthesiology
Department of Anesthesiology
UMass Memorial Medical Center
UMass Medical School
Worcester, MA

GOAL: To provide the opportunity for residents to prepare and present research, case studies, and literature reviews.

The Massachusetts Society of Anesthesiologists, Inc. (MSA) designates this educational activity for a maximum of 6.5 AMA PRA Category 1 Credits. Physicians should only claim credit commensurate with the extent of their participation in the activity.

This activity has been planned and implemented in accordance with the Essential Areas of the Massachusetts Medical Society for Continuing Medical Education through Joint Sponsorship of the Massachusetts Society of Anesthesiologists and the University of Massachusetts Medical School.

The Massachusetts Society of Anesthesiologists is accredited by the Massachusetts Medical Society to provide continuing medical education for physicians.

SESSION 1

| | |
|--|--|
| <p>Arnel Almeda, MD Beth Israel Deaconess Medical Center</p> | <p>Review of literature and case report of a knotted pulmonary artery catheter (presented by Joshua Pal, MD)</p> |
| | <p>OBJECTIVE: To discuss the incidence and treatment of knotted pulmonary artery catheters.</p> |
| <p>Preeti Arora, MD Tufts-New England Medical Center</p> | <p>Transcutaneous carbon dioxide monitoring during laparoscopic bariatric surgery</p> |
| | <p>OBJECTIVE: To explain the use of transcutaneous carbon dioxide monitoring during laparoscopic bariatric surgery</p> |
| <p>Joshua Pal, MD Beth Israel Deaconess Medical Center</p> | <p>Duloxetine and postoperative serotonin syndrome in chronic pain patients: institutional experience</p> |
| | <p>OBJECTIVE: To explain Duloxetine and postoperative serotonin syndrome in chronic pain patients</p> |
| <p>Aparna Dalal, MD Caritas St. Elizabeth's Medical Center</p> | <p>Drug-eluting stents and anesthesia</p> |
| | <p>OBJECTIVE: To explain the implications of drug-eluting stents on anesthesia</p> |
| <p>Christine Mai, MD Boston University Medical Center</p> | <p>Persistently elevated arterial lactate as a herald of hypoxic hepatitis</p> |
| | <p>OBJECTIVE: To explain the implications of persistently elevated arterial lactate as a herald of hypoxic hepatitis</p> |
| <p>Joshua Pal, MD Beth Israel Deaconess Medical Center</p> | <p>Improved safety, reliability, and proficiency development with a novel deltopectoral approach (Cohen approach) to ultrasound-guided infraclavicular brachial plexus block</p> |
| | <p>OBJECTIVE: To explain use of deltopectoral approach (Cohen approach) to ultrasound-guided infraclavicular brachial plexus block</p> |
| <p>Christine Ralph, DO Tufts-New England Medical Center</p> | <p>Systematic isoflurane treatment for prolonged obstructive respiratory failure</p> |
| | <p>OBJECTIVE: To explain use of systematic isoflurane treatment for prolonged obstructive respiratory failure</p> |
| <p>Gerardo Rodriguez, MD Boston University Medical Center</p> | <p>Chondrolaryngoplasty ("Tracheal shaving") under general anesthesia using flexible fiberoptic video-laryngoscopy and laryngeal mask airway</p> |
| | <p>OBJECTIVE: To explain use of chondrolaryngoplasty under general anesthesia</p> |

REVIEW OF LITERATURE AND CASE REPORT OF A KNOTTED PULMONARY ARTERY CATHETER

AJ Almeda MD, M Fritsch MD, JS Pal MD, T Sarge MD, Beth Israel Deaconess Medical Center - Boston, MA

Introduction:

Knotted pulmonary artery catheters (PAC) is a rare but known complication of their placement. Since 1954, there are approximately 71 case reports of knotted PACs and central venous catheters. Understanding how the knots can occur may reduce the incidence of their occurrence. To date, the topic has received little attention in the anesthesia literature. The aim of this paper is to present an additional case, and review why knotting occurs.

Presentation of the case:

A 75-year-old male suffering from 3-vessel coronary artery disease underwent 3-vessel coronary artery bypass graft (CABG). After induction of anesthesia, an 8.5F introducer with a 4-lumen VIP thermodilution flow-directed, balloon-tipped pulmonary artery catheter was successfully introduced percutaneously via the right internal jugular vein. Appropriate tracings were observed for the central venous pressure (CVP), and right ventricular (RV) pressure. Although several attempts were required, the catheter was successfully advanced into the pulmonary artery (PA) at a distance of 56cm, as noted by a PA pressure tracing and trans-esophageal echocardiography (TEE). Approximately fifteen minutes later, an RV trace was noted, and so the PAC was advanced 2cm to obtain an appropriate tracing. After arrival to ICU, an RV trace was noted again, at which time the PAC was re-advanced and re-secured at 60cm. Per standard protocol, portable chest radiograph was obtained in the early post-operative period demonstrating a complete coil in the RV. When the line was deemed unnecessary, attempts were made to remove the catheter.

Upon attempted removal, significant resistance was felt at 20cm at the opening of the cordis introducer. Removal was then attempted by withdrawing both the cordis and PAC simultaneously. Resistance was still felt at the level of the skin at the neck at 12cm. The patient was taken to the OR the following day for removal of the PAC under fluoroscopy and if necessary venotomy. Fluoroscopic techniques were unable to undo the knot, and so the patient required a right internal jugular vein venotomy. The patient was eventually discharged on post-operative day six without additional complication.

Discussion:

Knotted of the PAC is a rare but important complication to keep in mind for the anesthesiologist. PACs are long, small-caliber, flexible devices that for these reasons can predispose to knotting. Coiling in the right atrium or right ventricle is seen as a necessary step in knot formation. If a PA tracing is not obtained after advancing an appropriate distance, the catheter needs to be withdrawn to the vena cava where the catheter can straighten. If the catheter falls out of the PA and an RV tracing is seen, the catheter should also be withdrawn before advancing it back to the PA. It is reasonable to assume that the attempts to put the catheter back into the PA only tightened the coiling of the catheter. Upon re-advancement, the tip of the catheter likely went through the loop to close the knot. Although TEE may be useful to see the position of the tip of a catheter, it may not be sufficient to detect coiling. Fluoroscopy may elucidate further coiling mechanisms.

1. Karanikas ID, Polychronidis A, Vrachatis A, Arvanitis DP, Simpoulos CE, Lazarides MK. "Removal of Knotted Intravascular Devices. Case Report and Review of the Literature" *European Journal of Vascular and Endovascular Surgery*. 2002 Mar; 23: 189-194.
2. Bossert T, Gummert JF, Bittner HB, Barten M, Walther T, Falk V, Mohr FW. "Swan-Ganz catheter-induced severe complications in cardiac surgery: right ventricular perforation, knotting, and rupture of a pulmonary artery" *Journal of Cardiac Surgery*. 2006. May-June; 21(3): 292-5.

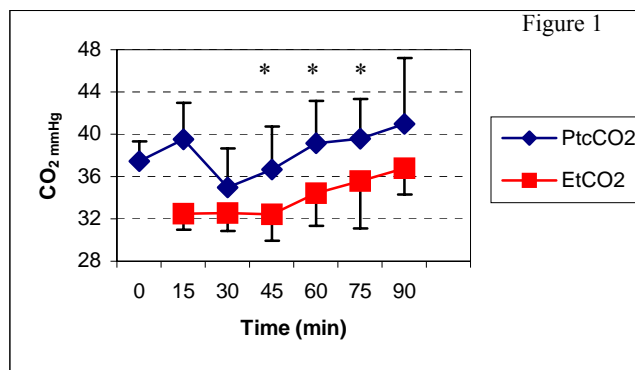
TRANSCUTANEOUS CARBONDIOXIDE MONITORING DURING LAPAROSCOPIC BARIATRIC SURGERY.

P. Arora, MD., V. Chung, BS, C. D'Ambrosio, MD., M. S. Cepeda, MD, PhD,
R. Schumann, MD. Tufts-New England Medical Center, Tufts University School of Medicine, Boston, MA

Introduction: Compared to end-tidal CO₂ (et-pCO₂) measurements, novel non-invasive transcutaneous pCO₂ (tc-pCO₂) monitors offer better correlation with arterial pCO₂ (a-pCO₂) during general anesthesia (1,2). Obesity and CO₂ insufflation for surgery independently increase the a/et-pCO₂ difference (3), with a potential for hemodynamic complications if unrecognized. To examine the difference between et-pCO₂ and tc-pCO₂ and to determine its change over time we conducted a prospective observational study in a high-risk population.

Methods: Following IRB approval and written informed consent, patients undergoing laparoscopic gastric bypass surgery (lap GB) using CO₂ insufflation to 15 cmH₂O, received standard general anesthesia (GA) including propofol, fentanyl and succinylcholine during induction and sevoflurane in oxygen with vecuronium and additional opioid for maintenance of anesthesia. A combined carbon dioxide-oxygen saturation ear-clip monitor (SenTec AG, Terwil, Switzerland) was used for continuous tc-pCO₂ monitoring. End-tidal and tc-pCO₂ values were recorded every 15 minutes for 90 minutes. Differences in et- and tc-pCO₂ were analyzed by Wilcoxon signed-rank test. A p<0.05 was statistically significant. Values reported as means ± Standard Deviation (SD).

Results: Seven patients (5f,2m), 41 ± 10 years old, with a BMI of 51 ± 11 underwent lap GB under GA lasting 155 ± 20 minutes. Figure 1 shows the means and SD of all pCO₂ values during 90 minutes. * = statistically significant difference in mean values. Unilateral T-bars represent SD of means. Transcutaneous pCO₂ was consistently higher than et-pCO₂. At 90 minutes both values had not reached a plateau.



Discussion:

As expected, tc-pCO₂ was higher than et-pCO₂ at all time points. An early higher et-/ tc-pCO₂ difference may reflect the complex physiologic changes at induction of GA. In severely obese patients undergoing lap GB no unexpected tc-pCO₂ elevations occurred during the study period, however a plateau for pCO₂ was not reached at 90 minutes of anesthesia. A large SD for tc-pCO₂ measurements may represent a high interindividual variability for this value under GA as previously reported (3). This novel, easy to apply tc-pCO₂ monitor, offers potential advantages for intraoperative ventilation monitoring and should be explored in the postoperative environment where non-invasive pCO₂ monitoring may not be routinely available.

- References:** 1. Nakamura A, Kanai M, Mizushima A et al. The accuracy of transcutaneous carbon dioxide monitoring during laparoscopic surgery. *Masui* 2003;52:846-51
2. Griffin J, Terry BE, Burton RK et al. Comparison of end-tidal and transcutaneous measures of carbon dioxide during general anaesthesia in severely obese adults. *Br J Anaesth* 2003;91:498-501
3. Frei FJ, Konrad R. The arterial-end-tidal CO₂ partial pressure difference during anesthesia. *Anaesthesist* 1990;39:101-6

DULOXETINE AND POSTOPERATIVE SEROTONIN SYNDROME IN CHRONIC PAIN PATIENTS: INSTITUTIONAL EXPERIENCE

J Pal MD, D Shah MD, S Nabel
Beth Israel Deaconess Medical Center - Boston, MA

Introduction: Serotonin syndrome (SS) is a potentially fatal complication of serotonergic drugs. Meperidine, tramadol, and methadone have been shown to inhibit serotonin (5-HT) reuptake and are associated with SS, and case reports link oxycodone, amitriptyline, ephedrine, and venlafaxine with SS(1,2,3). It has been postulated that different mechanisms for increasing synaptic 5-HT (excess precursors, increased release, reduced reuptake or decreased metabolism) may act synergistically to increase the risk for SS. Venlafaxine and duloxetine both exhibit selective reuptake inhibition for norepinephrine and 5-HT. Therapeutic ephedrine-induced release of stored catecholamines is common intraoperatively. To date there are no case series examining the association of duloxetine and SS in the postoperative period.

Methods: A retrospective chart review of all computerized anesthesia records at a tertiary care center revealed 15 patients on long-acting opioids that were treated with duloxetine, received ephedrine intraoperatively, and were given perioperative opioids. Four patients also had concomitant TCA and duloxetine therapy. One patient (treated with meperidine postoperatively) had concomitant therapy with trazodone, tramadol, and duloxetine. Boyer criteria was used to assess for presence of SS.

Results: None of the patients had evidence of postoperative serotonin syndrome.

Conclusion: At our institution, duloxetine has not been associated with postoperative serotonin syndrome in patients with long-standing opioid therapy.

References:

1. Boyer E. W., Shannon M. "The Serotonin Syndrome" N Engl J Med 2005; 352:1112-1120, Mar 17, 2005.
2. Perry NK "Venlafaxine-induced serotonin syndrome with relapse following amitriptyline." Postgrad Med J. 2000 Apr;76(894):254-6.
3. Jahan A. "Duloxetine and Drug Interactions" SAMBA Talks 2006 Sept Vol 6(4):2.

BRIEF REVIEW: CORONARY DRUG-ELUTING STENTS AND ANESTHESIA

AR. Dalal MD, S D'Souza MD, MS. Shulman MD
Caritas St. Elizabeth's Medical Center

Purpose: Anesthesiologists managing patients with drug-eluting stents (DES) face the challenge of balancing the risks of bleeding vs perioperative stent thrombosis (ST). This article reviews DES and the influence of antiplatelet medications related to their use. A perioperative management algorithm is suggested. Novel P2Y12 antagonists currently under investigation, including cangrelor and prasugrel are considered, as well as their potential role in modification of perioperative cardiovascular risks and management of patients with DES.

Source: A PubMed search of the relevant literature over the period 1985–2005 was undertaken using the terms “drug-eluting stent”, “coronary artery stent”, “bare metal stent”, “antiplatelet medication”, “aspirin”, “clopidogrel.”

Principle findings: Delayed re-endothelialization may render both sirolimus-eluting and paclitaxel-eluting stents susceptible to thrombosis for a longer duration than bare metal stents. Stent thrombosis may be associated with resistance to antiplatelet medication. In patients with a DES, a preoperative cardiology consultation is essential. Elective surgery should be postponed if the duration between DES placement and noncardiac surgery is less than six months. For semi-emergent procedures, both aspirin and clopidogrel should be continued during surgery unless clearly contraindicated by the nature of the surgery. If the risk of bleeding is high, then modification of antiplatelet medications should be considered on a case-by-case basis.

Conclusion: A profound increase in the number of patients with DES requires anesthesiologists to be familiar with their associated antiplatelet medications, and strategies for risk modification of ST and possible hemorrhagic complications in the perioperative setting.

PERSISTENTLY ELEVATED ARTERIAL LACTATE AS A HERALD OF HYPOXIC HEPATITIS

C.L. Mai, MD, G.P. Miller, MD, R.J. Azocar, MD
 Affiliation: Boston University Medical Center, Boston, MA

Abstract:

Case Presentation

A 66 year old woman with a history significant for CAD (s/p angioplasty and a right coronary artery stent 10 months prior), peripheral arterial disease, hypertension, and pulmonary embolism 28 years ago was admitted with acute onset of bilateral lower extremity ischemia. She underwent aortobifemoral bypass with Gore-Tex™ graft and aortic thrombectomy under general anesthesia.

The intraoperative course was characterized by an estimated blood loss of 1500 ml, for which she received 5 liters of crystalloid, 2 units of pack red cells, and 500 ml of cell saver. However, Phenylephrine was needed to maintain mean arterial pressure above 60 mmHg during the case and at the time of admission to the ICU. Aggressive fluid resuscitation continued and vasopressors were stopped at 12 hours post-op. Despite improved hemodynamics, the arterial lactate level was 6.7 and continued to increase to 7.1 by 8 hours post-operatively. A transthoracic echo was obtained to rule out cardiac failure as the cause of the persistently elevated lactate. The exam revealed normal left ventricular size and function but a dilated right ventricle and overall mild to moderate depressed RV function. Cardiac enzymes at this point revealed ischemia with a troponin I of 0.3. Liver function test, which were normal preoperatively, showed markedly elevated transaminases: AST 3, 894; ALT 3, 152, with normal bilirubin and alkaline phosphatase.

Throughout post-operative day 1, her condition worsened with profound metabolic acidosis unresponsive to aggressive management. Coagulation studies at this point showed INR 4.22 (elevated from a value of 1.21 at the end of surgery), a lactate of 10.7, and transaminases were: AST 10, 549 and ALT 18, 458. Although the patient was not on Coumadin, her INR continued to rise, suggesting liver synthesis malfunction. Within several hours, lactate increased to > 14 and INR > 13.3, despite continued fluid management and attempts at correcting the coagulopathy (Fig. 1). She progressed into multi-system organ failure and arrested on post-op day 2.

Discussion:

Although considered infrequently in a differential diagnosis, hypoxic hepatitis (also known as ischemic hepatitis or “shock” liver) is not uncommon with a large series reporting 0.9% of their ICU patients developing the condition. There are four clinical conditions that have been identified as risk factors for the development of the syndrome: cardiac failure, chronic respiratory failure, acute exacerbation of respiratory failure, and circulatory shock (non-cardiogenic causes). It seems that the combination of venous congestion and arterial hypoxemia in most cases explains the development of hepatocellular dysfunction, whereas inability of the liver to extract and use oxygen is the cause in septic shock. In our patient, we hypothesize that right ventricle dilation and dysfunction were the culprit in the development of hypoxic hepatitis.

Classically, the syndrome is characterized by a striking elevation of the transaminases with mild elevation or normality of other hepatic markers. However, in this case the lack of correction of the arterial lactate despite aggressive fluid resuscitation and improved hemodynamics led us to consider this entity which was confirmed by the striking elevation of transaminases and coagulopathy.

Conclusion:

Persistently elevated lactate despite appropriate resuscitation in a patient with risk factors for developing hypoxic hepatitis should guide the clinician to consider the possibility of this entity.

References:

Henrion, J, Schapira, M, Luwaert, R, Colin, L, Delannoy, A, Heller, F. “Hypoxic Hepatitis. Clinical and Hemodynamic Study in 142 Consecutive Cases.” *Medicine*. Nov. 2003. vol 82(6); pp. 392-406

Strassburg, C. “Shock Liver.” *Best Practice & Research Clinical Gastroenterology*. 2003. vol 17(3); pp. 369-381

Seeto, R, Fenn, B, Rockey, D. “Ischemic Hepatitis: Clinical Presentation and Pathogenesis.” *The American Journal of Medicine*. Aug. 2000. vol 109; pp. 109-113

IMPROVED SAFETY, RELIABILITY, AND PROFICIENCY DEVELOPMENT WITH A NOVEL DELTOPECTORAL APPROACH (COHEN APPROACH) TO ULTRASOUND-GUIDED INFRACLAVICULAR BRACHIAL PLEXUS BLOCK

JS Pal MD, R Cohen MD.

Beth Israel Deaconess Medical Center - Boston, MA

Introduction: Ultrasound (US) guidance for infraclavicular block improves efficiency and patient safety, both significant concerns with new trainees. Infraclavicular and axillary blocks have been associated with vascular puncture, patchy anesthesia, neurological injury, pneumothorax, and patient discomfort(1). We describe a novel US-guided approach (Cohen approach) designed to provide the efficacy of the infraclavicular block with the safety of the axillary approach, and present a series of 14 consecutive cases performed pre-operatively by the same resident practitioner.

Methods: All patients were adults scheduled for GA for surgery of the elbow, forearm, or hand. A 38mm 13-6MHz linear probe was placed into the axilla in sagittal orientation. In all patients this probe placement easily identified the axillary artery in short axis with three adjacent hyperechoic brachial plexus cords. Maximizing patient comfort with full arm adduction or abduction up to 45 degrees did not alter image quality. A 20g 120mm insulated B-bevel block needle was attached to a nerve stimulator set at 0.4mA and inserted into the pectoralis major in the deltopectoral groove adjacent to the superior aspect of the sagittally oriented probe with a trajectory parallel to the face of the probe and perpendicular to the US beam. The axillary artery was initially targeted, then the needle was directed to each cord. A total volume of 30-40cc of 0.375% bupivacaine with epinephrine was injected adjacent to the cords until a "doughnut" sign of hypoechoic anesthetic was visible adjacent to all cords. Muscle twitch was not a goal. However, if elicited, we confirmed the minimal stimulation required for twitch response by progressively decreasing the stimulation. The needle was withdrawn slightly prior to injection if muscle twitch could be elicited below 0.3mA, resistance to injection felt, or paresthesia reported.

Results: 100% of patients tolerated the block well, had rapid sensory blockade onset, were pain-free, and required minimal or no intraoperative and postoperative opioids. No vascular punctures, local anesthetic toxicity, pulmonary symptoms, or persistent neurological symptoms resulted.

Discussion: The practitioner developed progressive efficiency resulting in completion of the last five blocks in less than three minutes after needle insertion, suggesting that proficiency develops safely and quickly with this approach. With arm adduction, the axilla "held" the probe in correct orientation, facilitating coordination between needle and probe for easy visualization of the needle tip along its trajectory, resulting in less time lost regaining critical views of the "target" and needle tip. Advantages include absence of pleura in the needle trajectory, patient comfort with flexible arm positioning, no reliance on specific muscle twitches, and fewer needle passes. We are prospectively investigating the feasibility of catheter placement, additional blockade of intercostobrachial and antebrachial cutaneous nerves for tourniquet pain, how rapidly other practitioners develop proficiency, applicability to the pediatric population, and meaningful anesthesia outcomes.

1. Borgeat A, Ekatodramis G, Dumont C. An evaluation of the infraclavicular block via a modified approach of the Raj technique. *Anesth Analg.* 2001 Aug;93(2):436-41

SYSTEMATIC ISOFLURANE TREATMENT FOR PROLONGED OBSTRUCTIVE RESPIRATORY FAILURE

C. Ralph, D.O., S. Gandhi, M.D., R. Schumann, M.D. Tufts-New England Medical Center, Tufts University School of Medicine, Boston, MA.

Introduction: The potent inhalational anesthetics, including Isoflurane, have unique bronchodilating properties. Their use to critically improve status asthmaticus early, when standard medical management failed, is well documented (1). Successful Isoflurane treatment initiated as late as 9 days into a prolonged obstructive respiratory crisis in a patient with asthma has not been previously described. We report one such case and discuss its implications.

Case: A 52 year-old woman with a history of asthma, 30 pack-years of smoking and depression was admitted to the hospital with worsening shortness of breath during an upper respiratory tract infection. Despite intensive medical therapy with albuterol/atrovent by metered dose inhaler, flovent, solumedrol, antibiotics, supplemental oxygen, and bi-level positive pressure non-invasive ventilation, she developed pneumonia with respiratory failure requiring tracheal intubation and mechanical ventilation. Theophylline, montelukast and a 24-hour trial of magnesium sulfate were added to her treatment without sustained improvement in airway resistance (AR) and static lung compliance (CL). Severe hypertension (210/90 mmHg) on intubation day (ID) 3 despite midazolam (12 mg/hr) and fentanyl (400 mcg/hr) sedation, likely secondary to her sympathomimetic medications necessitated their dose reduction. Ventilator dyssynchrony exacerbating the patient’s bronchospasm was treated with intermittent neuromuscular blockade (vecuronium infusion of 0.1 mcg/kg/hr) and escalating fentanyl (max 900 mcg/hr) and midazolam (max 32 mg/hr) sedation. In collaboration with the anesthesiology service, propofol (100 mcg/kg/min) was added on ID 8 to reduce the fentanyl/midazolam sedation dose, and isoflurane treatments were started on ID 9. Isoflurane in oxygen and air was administered (Datex-Ohmeda Aestiva 5 anesthesia ventilator, Madison, WI) on 3 consecutive days (ID 9 – 11) for 2.5, 3 and 2.25 hours respectively at end-tidal concentrations between 0.2 and 2 end-tidal vol. %. Following the first treatment, that included an endo-tracheal tube exchange, bronchoscopy and a brocho-alveolar lavage, a dexmedetomidine infusion (0.6 mcg/kg/hr) was added to the sedation; propofol, fentanyl and midazolam infusions were reduced (40 mcg/kg/hr, 50 mcg/hr and 0.5 mg/hr respectively), and the neuromuscular blockade was discontinued. Table 1 summarizes the patients pre- and post isoflurane treatment pulmonary parameters as measured by a Puritan-Bennett 840 ICU ventilator (Nellcor-Puritan-Bennett Corp., Carlsbad, CA). Sustained improvement of AR, CL and obstructive symptoms allowed the patient’s extubation on ID 13, followed by an uneventful rehabilitation.

Discussion: This case illustrates a successful 3-day course of isoflurane and advanced sedation management in a patient with sustained obstructive respiratory failure following 9 days of conventional medical management without resolution. In addition to their ability to reverse acute bronchospasm, inhalational anesthetics should be considered as a treatment modality in patients with prolonged obstructive respiratory failure, although the exact mechanism of their unique bronchodilating properties have not been identified. As a recent concept, repeated Isoflurane administration has been used for solid organ ischemic preconditioning at the cellular level (2). Is it possible, that an unidentified physiologic respiratory effect, other than acute bronchodilation and longer lasting, is associated with isoflurane’s repeated administration such as in our case? Our experience emphasizes the benefits of a multidisciplinary intensivist approach to selected complex medical patients.

| TABLE 1 PARAMETERS | ISOFLURANE | | | | | |
|-----------------------------------|------------|-------|-------|-------|-------|-------|
| | DAY 1 | | DAY 2 | | DAY 3 | |
| | PRE | POST | PRE | POST | PRE | POST |
| Airway resistance (cmH2O/L/sec) | 5.85 | 6.34 | 6.28 | 4.9 | 3.9 | 2.9 |
| Static lung compliance (ml/cmH2O) | 17.2 | 16 | 19 | 29 | 39 | 45 |
| Stacking (cmH2O) (Auto Peep) | 7 | 3 | 2 | 0 | 0 | 0 |
| Peak airway Pressure (cmH2O) | 32 | 32 | 34 | 25 | 26 | 20 |
| Respiratory rate | 16 | 16 | 14 | 10 | 10 | 8 |
| I:E ratio | 1:3.2 | 1:3.2 | 1:3.5 | 1:2.6 | 1:3.5 | 1:1.7 |
| Tidal volume (ml) | 480 | 440 | 550 | 580 | 820 | 680 |

References: 1. Arerugi 2005; 54: 18-23. 2. Am J Physiol Heart Circ Physiol 2004; 286: H 1603-7

CHONDROLARYNGOPLASTY (“TRACHEAL SHAVING”) UNDER GENERAL ANESTHESIA USING FLEXIBLE FIBEROPTIC VIDEO-LARYNGOSCOPY AND LARYNGEAL MASK AIRWAY.

G. Rodriguez MD*, J.H. Spiegel MD #

*Boston Medical Center, Department of Anesthesiology, Boston, MA

#Boston Medical Center, Department of Otolaryngology – Head and Neck Surgery, Boston, MA

Introduction: Chondrolaryngoplasty for prominent thyroid cartilage is performed to reduce the prominent appearance of the laryngeal thyroid cartilage at the thyroid notch¹. It is commonly done for male-to-female transgender patients, though natal male and women patients occasionally seek the procedure to improve the appearance of the neck. Successful results of the procedure greatly depend on the extent of thyroid cartilage excision for aesthetic purposes and avoidance of pitch alteration due to vocal cord disruption at the anterior commissure. Chondrolaryngoplasty can be performed under either local anesthesia with sedation or general anesthesia with endotracheal intubation²; however, both techniques have particular limitations for the surgeon and the anesthesiologist. We describe a surgical and anesthetic technique involving external translaryngeal needle insertion under general anesthesia, using flexible fiberoptic video-laryngoscopy (FFVL) and laryngeal mask airway (LMA).

Study Design: Case series, retrospective review.

Methods: Between February 2005 and August 2006, 31 healthy adults, ASA physical status I or II, underwent chondrolaryngoplasty under general anesthesia. Post-induction, FFVL was performed via inserted LMA, localizing the anterior commissure prior to translaryngeal needle insertion. We review the outcomes of both anesthetic and surgical procedures of 31 patients who underwent chondrolaryngoplasty by a single surgeon.

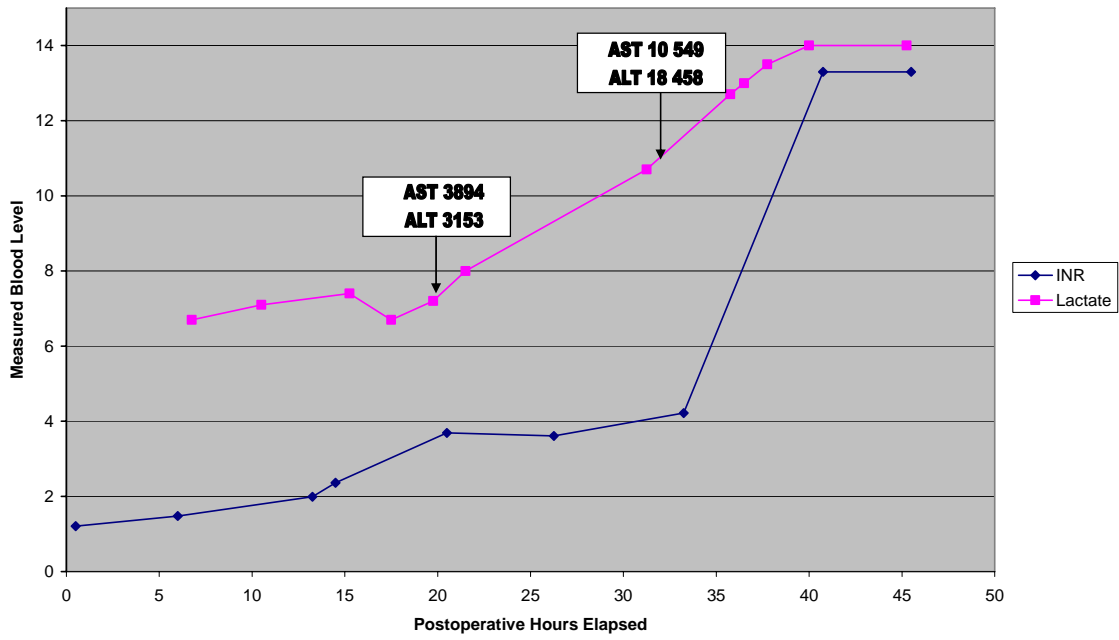
Results: The surgical results were successful without any vocal changes. One patient experienced a transient episode of laryngospasm³ that was noted by FFVL and rapidly reversed.

Conclusions: The LMA in conjunction with FFVL under general anesthesia is a safe anesthetic approach to chondrolaryngoplasty with translaryngeal needle insertion. Our technique allows for maximal cosmetic result with minimal risk of vocal disruption, in addition to rapid detection ventilatory compromise through direct vision of the airway.

References:

1. Wolfort FG, et al. Chondrolaryngoplasty for appearance. *Plastic and Reconstructive Surgery* (1990) v. 86, no. 3, p. 464-470.
2. Conrad K, Yoskovitch A., Endoscopically facilitated reduction laryngochondroplasty. *Arch Facial Plast Surg.* (2003) 5(4): 345-8.
3. Sasaki CT, Suzuki M. Laryngeal spasm: A neurophysiologic redefinition. *Ann Otol Rhinol Laryngol* (1977) v. 86, p. 150-157.

FIGURE 1. POST-OPERATIVE LACTATEMIA AND COAGULOPATHY



Session 2

Chad Anderson, MD
Tufts-New England
Medical Center

Bispectral index (BIS™) monitoring and end-tidal isoflurane concentrations during anesthesia for liver transplantation

OBJECTIVE: To explain use of bispectral index during anesthesia for liver transplantation

Lisa Banta, MD
Tufts-New England
Medical Center

The impact of clonidine and fentanyl added to caudal bupivacaine on peri-operative hemodynamic parameters and analgesic requirements in pediatric patients

OBJECTIVE: To explain the impact of clonidine and fentanyl added to caudal bupivacaine on peri-operative hemodynamic parameters and analgesic requirements in pediatric patients

Arvind Chitkara, MD
Tufts-New England
Medical Center

Anesthetic management of an octogenarian with hemophilia A for combined carotid endarterectomy and CABG

OBJECTIVE: To explain anesthetic management of an octogenarian with hemophilia A for combined carotid endarterectomy and CABG

Jana Hudcova, MD
Beth Israel Deaconess
Medical Center

Postoperative pulmonary embolism in a three year old with Klippel-Trenaunay syndrome

OBJECTIVE: To describe postoperative pulmonary embolism in a three year old with Klippel-Trenaunay syndrome

Gustavo Lozada, MD
Tufts-New England
Medical Center

Is intrathecal anesthesia safe in spondyloepiphyseal dysplasia congenita?

OBJECTIVE: To discuss whether intrathecal anesthesia in spondyloepiphyseal dysplasia congenita is safe

Jocelyn Park, MD
Dartmouth Hitchcock
Medical Center

A woman with Hunters Syndrome with complicated intraop course

OBJECTIVE: To describe the case of a woman with Hunters Syndrome who had a complicated intraop course

BISPECTRAL INDEX (BIS™) MONITORING AND END-TIDAL ISOFLURANE CONCENTRATIONS DURING ANESTHESIA FOR LIVER TRANSPLANTATION

C Anderson, MD, J Hudcova, MD, M Cepeda MD, PhD, R Schumann MD
 Tufts-New England Medical Center, Tufts University School of Medicine, Boston, MA

Introduction: Limited information is available for BI spectral index (BIS) depth of anesthesia monitoring during liver transplantation (LT) despite frequent use during LT at large volume liver transplant centers (1). Titration of volatile anesthetics to BIS levels has been shown to decrease anesthetic requirements during general anesthesia (2-3). We conducted a retrospective analysis to compare possible effects of BIS monitoring on isoflurane use during anesthesia for LT and to report BIS values during different stages of LT.

Methods: Following institutional review board approval, records of 45 patients undergoing LT using an isoflurane/air/oxygen and opioid based anesthetic were analyzed. Demographic data collection included age, BMI, MELD score, and time to extubation. 23 BIS monitored patients were compared to 22 controls. Pre anhepatic, anhepatic and post anhepatic end-tidal isoflurane concentrations (etISO) were compared, as well as BIS values for each of these LT stages using the t-test; p values <0.05 were considered statistically significant.

Results: There was no significant difference in demographics, or time to extubation between groups. The mean BIS was 39±5. The values between pre anhepatic, anhepatic and post anhepatic stage were 38.6±5, 37.5±6 and 38.9±7 respectively (ns). Neither the etISO for the different LT stages, nor its percent change between stages was significantly different between BIS and control group (Table I). For the entire study population etISO was significantly different between pre anhepatic, anhepatic and post anhepatic phase (p=0.004 and p=0.022 respectively).

| TABLE 1 | % End-tidal Isoflurane | | | |
|----------------|------------------------|---------|------|---------|
| | BIS | Control | All | p Value |
| Pre anhepatic | 0.64 | 0.68 | 0.65 | 0.78 |
| Anhepatic | 0.52 | 0.62 | 0.57 | 0.32 |
| Post anhepatic | 0.63 | 0.73 | 0.67 | 0.29 |
| All | 0.59 | 0.66 | 0.62 | 0.36 |

Discussion: In our study BIS values for depth of anesthesia monitoring are not significantly different between 3 examined stages of LT. Isoflurane as one component of anesthesia was not administered differently between groups and respective LT stages. Intraoperative BIS monitoring did not change the time to extubation. However, for the entire cohort, the isoflurane dose was significantly reduced during the anhepatic stage revealing a distinct BIS-independent anesthesia practice pattern. To extend or confirm and these initial results a larger scale study on BIS utility in LT is desirable.

References:

- Schumann, R. Intraoperative Resource Utilization in Anesthesia for Liver Transplantation in the United States: A Survey. *Anesth Analg* 2003;97:21-28
- Song DJ, Joshi GP, White PF. Titration of volatile anesthetics using bispectral index facilitates recovery after ambulatory anesthesia. *Anesthesiology* 1997; 87: 842-848
- Bannister C, Brosius K, Sigl J et al. The Effect of Bispectral Index Monitoring on Anesthetic Use and Recovery in Children Anesthetized with Sevoflurane in Nitrous Oxide. *Anesth Analg* 2001;92:877-881

THE IMPACT OF CLONIDINE AND FENTANYL ADDED TO CAUDAL BUPIVACAINE ON PERI-OPERATIVE HEMODYNAMIC PARAMETERS AND ANALGESIC REQUIREMENTS IN PEDIATRIC PATIENTS.

Lisa Banta MD, R. Schumann MD and A. Bilge MD, PhD

Tufts-New England Medical Center, Floating Hospital for Children, Tufts University School of Medicine, Boston, MA

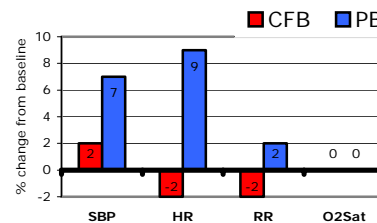
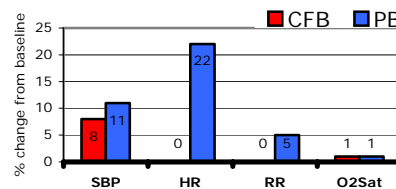
Introduction: Opioids and alpha-2 agonists are frequently added to local anesthetic solutions for postoperative pain control in children receiving caudal and lumbar epidural blocks. For surgical procedures below the umbilicus, caudal or lumbar epidural blocks supplement general anesthesia. The addition of clonidine, an alpha-2 agonist, as well as fentanyl to a local anesthetic, such as bupivacaine, enhances postoperative analgesia as reported in the literature (1-3). To determine a possible influence of clonidine and fentanyl added to caudal bupivacaine on peri-operative hemodynamics and analgesic requirements, we conducted a retrospective chart review.

Methods: Following Institutional Review Board approval, we reviewed the charts of pediatric patients receiving caudal or lumbar epidural analgesia in addition to general anesthesia for lower abdominal, pelvic and lower extremity procedures, between January 2003 and October 2005. Patients received either a solution of plain bupivacaine 0.25% (PB group) or a mixture of clonidine, fentanyl and bupivacaine 0.25% (CFB group) as a single caudal or lumbar epidural injection prior to surgical incision. Data collection included patient demographics, baseline and postoperative PACU vital signs, and intra- and postoperative analgesic requirements. Differences in these parameters between PB and CFB groups were analyzed using the student T-test and the chi-square test. A p value < 0.05 was considered statistically significant.

Results: Charts of 49 patients met the inclusion criteria. There were 15 patients (20% female, 80% male) in the PB group and 34 patients (29% female, 71% male) in the CFB group. Patient ages ranged from 10 months to 8 years in the PB group and from 1 month to 16 years in the CFB group. The mean dose of either clonidine or fentanyl added to bupivacaine in the CFB group was 2 mcg/kg for each added medication. Eighty-seven percent of patients in the PB group required intra-operative opioids versus 50% in the CFB group. (p=0.015). There was a significant increase (22%) in heart rate from baseline in the PB group at the time of PACU arrival compared to no change (0%) from baseline in the CFB group (p = 0.003; 95% CI: -35.2 to -7.9). There was no significant difference in postoperative changes in systolic blood pressure, oxygen saturation and respiratory rate from baseline between the two groups.

Table 1. DEMOGRAPHICS

| GROUP | CFB | PB |
|--------------------------------|-------------------------------|------------------------------|
| Number of patients | 34 | 15 |
| Age (years, mean ± SD) (range) | 5.26 ± 5.12 (1 mo – 16 yo) | 4.00 ± 2.94 (10 mo– 8 yo) |
| Weight (kg, mean ± SD) | 20.33 ± 15.50 | 14.46 ± 4.50 |
| ASA status (number) | | |
| ASA I | 15 | 8 |
| ASA II | 17 | 7 |
| ASA III | 2 | 0 |
| Sex | | |
| M | 71% | 80% |
| F | 29% | 20% |



ABSTRACTS

Discussion: In this pediatric population, a caudal/lumbar epidural solution of clonidine, fentanyl and bupivacaine administered for intra- and post-operative analgesia resulted in less intra-operative systemic opioid requirement and better postoperative hemodynamic stability compared to plain bupivacaine. Our study suggests an intra-operative opioid sparing effect of neuraxial local anesthetic solutions supplemented with fentanyl and clonidine. Despite the small number of patients in each group and demographic heterogeneity, these results are intriguing. Further systematic study in randomized controlled trials is warranted to confirm efficacy and safety of mixed epidural solutions in children. Future studies should also address their effects on length of PACU and hospital stay.

References:

1. Lee JJ, Rubin AP. BJA 1994; 72: 258-262.
2. de Beer DAH, Thomas ML. BJA 2003; 90 (4): 487-498.
3. Ansermino M, Basu R, Vandebeek C, Montgomery C. Paediatric Anaesthesia 2003; 13: 561-573.

ANESTHETIC MANAGEMENT OF AN OCTAGENARIAN WITH HEMOPHILIA A FOR COMBINED CAROTID ENDARTERECTOMY AND CABG

A. Chitkara M.D., R. Schumann M.D., B. Dave M.D., Tufts-New England Medical Center, Tufts University School of Medicine, Boston, MA

Introduction: Hemophilia A (HeA) is an X-linked inherited coagulation abnormality causing inadequate factor VIII (F-VIII) activity. Its incidence in the US is approximately 0.01%, and clinical manifestations include excessive bleeding following trivial injuries. Cardiac and vascular surgery in patients with HeA requires a detailed strategy for hemostasis perioperatively to prevent medical bleeding. Although there have been recent reports of perioperative management in cardiac surgical patients with this disorder^{1,2}, a consensus or guideline of perioperative HeA management in cardiac surgery has not been established. We report our approach to a patient presenting for combined carotid endarterectomy (CEA) and CABG.

Case: An 81-year-old man with a history of HeA, hypertension, hypercholesterolemia, arthritis, prostate hyperplasia, allergic rhinitis and remote smoking presented for CABG and right CEA. He had undergone an uneventful hernia repair and dental extractions in the past with F-VIII bolus administration and p.o. aminocaproic acid respectively. His HeA work-up excluded presence of F-VIII inhibitors and showed a F-VIII half-life of 8 hours. Following his admission for acute coronary syndrome with a new LBBB and a non-ST-segment elevation MI, he underwent cardiac catheterization revealing surgically amenable significant multivessel coronary artery disease. The patient received 50 units/kg of recombinant F-VIII (rF-VIII) q 12hours x 2 doses using the following formula: *Calculated dose of r-FVIII (units) = [(Target serum level – endogenous serum level) x body weight (kg)]/ 2*. The procedure was uneventful, and rF-VIII was then continued at 25units/kg q 12hrs x 6. A carotid duplex study confirmed an 80 – 90% right carotid stenosis, and an echocardiography showed an LV ejection fraction of 55% with mild hypertrophy. To achieve a F-VIII activity of 80%-100% during the planned surgery, a continuous infusion of rF-VIII at 4-units/ kg/ hour was started 12 hrs prior to the surgery, and continued into postoperative period. The F-VIII activity before induction of general anesthesia was > 100%. The patient underwent an uneventful CEA and coronary revascularization x 5 on cardiopulmonary bypass without signs of unusual bleeding and being continued at the same infusion rate of 4-units/kg/hour. In addition to rF-VIII, aminocaproic acid 5gms bolus followed by 1gm/hour was also administered during surgery. Surgery lasted for a duration of 413 minutes, with bypass time of 120 minutes. Following the first 72 hours postoperatively, the target F-VIII activity then was 50-80% until postoperative day (POD) 7, also achieved by continuous infusion. The patient recovered uneventfully and was transferred to a cardiac rehabilitation program on POD 7. An activity level of at least 50% from POD 8 – 21 was maintained using intermittent rF-VIII administration as needed. rF-VIII was discontinued on POD 22.

Discussion: A F-VIII activity level of $\geq 100\%$ is recommended prior to elective surgery². However, postoperative bleeding may occur despite adequate plasma F-VIII levels³. No commonly accepted guidelines for patients with HeA undergoing cardiovascular surgery currently exist. Options include the administration of cryoprecipitate (contains 5-10 U of F-VIII/ml), specific F-VIII concentrates, recombinant F-VIII and additional danazol. The bolus doses were based on F-VIII plasma level, determined 2hours and 6 hours after a dose. Our hourly rF-VIII infusion rate of 4-units/ kg/ hour to obtain > 100% activity immediately perioperatively was calculated based on the F-VIII plasma level, determined twice daily. Our successful management of a geriatric patient with (HeA) presenting for combined CEA/CABG emphasizes the benefits of close perioperative collaboration between hematology, anesthesiology and surgical care teams. Further clinical study is needed to develop a treatment algorithm that is safe and effective for cardiac surgical patients with this rare coagulation defect.

References:

1. Eren, A et al. Thoracic cardiovascular surgery 2006 Apr;54(3):212-4
2. Mackinlay, N et al. Haemophilia, 2000 Mar;6(2):84-8
3. Kasper CK et al. JAMA 1985;253:1279-83

POSTOPERATIVE PULMONARY EMBOLISM IN A THREE YEAR OLD WITH KLIPPEL-TRENAUNAY SYNDROME

J. Hudcova, MD, D. Talmor, MD, Department of Anesthesia, Critical Care and Pain Medicine, Beth Israel Deaconess Medical Center and Harvard Medical School, Boston, MA.

Introduction: Klippel-Trenaunay syndrome (KTS) is a rare congenital anomaly characterized by venous and lymphatic abnormalities, cutaneous capillary malformations and hypertrophy of soft tissue and bone. KTS is usually isolated to one extremity; however any part of the body may be affected. Deep venous thrombosis (DVT) with a pulmonary embolism (PE) has been described in the literature (1); though children have a lower rate of thromboembolic episodes (2). We report a life threatening PE in a child after radical resection of the malformation involving right calf and adjacent tissues.

Case: 3 year old boy, 22 kg, with KTS involving right lower extremity, pelvis and genitalia was admitted to the ICU after resection of his right lower extremity malformation. The operation lasted 8.5 hours and was complicated by major blood loss (estimated blood loss \geq two blood volumes). Patient remained intubated because of extensive volume resuscitation with blood products and crystalloids. Enoxaparin, which was given as a long term prophylaxis prior to surgery and discontinued the day before operation, was restarted on postoperative day (POD) 1 at a dose of 10 mg subcutaneously twice a day. Weaning off the ventilator started on the POD 2; however on the POD 3 it was complicated by a sudden episode of agitation, desaturation to 55%, and drop of end tidal CO₂ from low forties to 24 mmHg. Oxygenation slowly improved to 90% after administration of 100% oxygen and higher PEEP (16 mmHg). Arterial blood gas revealed pCO₂ of 75 mmHg and pO₂ of 62mmHg. Immediate pulmonary CT angiography showed a large filling defect in the right main pulmonary artery (PA) and a number of smaller defects in the peripheral PA branches. Pulmonary arteriogram confirmed a large thrombus in the right PA and a successful mechanical-chemical thrombectomy was done as well as inferior vena cava (IVC) filter placement. Systemic anticoagulation with unfractionated heparin was initiated and heparinization was monitored with a goal to keep heparin levels at 0.3 – 0.5 units/mL. Trans-thoracic echocardiogram (TTE) confirmed dilated right ventricle with elevated PA pressures. The patient was started on inhaled nitric oxide (iNO). Gas exchange significantly improved; however his condition was complicated by extensive bleeding from the surgical wound after reaching therapeutic anticoagulation and patient required multiple blood transfusions. Heparin was discontinued until level dropped to $<$ 0.05 units/L. Bleeding subsided and patient was weaned off the iNO. Unfractionated heparin was restarted prophylactically and at the same time treatment with coumadin was initiated. After coumadin reached therapeutic level, heparin was discontinued. Follow up TTE confirmed good biventricular function with PA pressures of 1/3 of systemic pressures. Patient was successfully extubated. Perfusion scan was repeated prior to discharge of the patient from the ICU and showed good perfusion of all lung units.

Discussion: KTS is a rare disorder with an incidence of 1/27, 500 newborns. Surgical intervention in KTS is reserved only for major limb discrepancies (2) or for bleeding involving any of the internal organs. All patients with KTS are at high risk of DVT and PE and require long term anticoagulation. Our patient developed massive PE despite of prophylactic anticoagulation with low molecular weight heparin which was interrupted only for 24 hours. Massive intraoperative blood product transfusion as well as dilutional effect of infused crystalloids might have affected the balance between coagulation factors and anticoagulants. This, together with immobilization and residual venous malformations predisposed our patient to a clot formation. Widespread hospital resources contributed to a good patient outcome. Preoperative IVC filter placement in a patient with extensive malformation scheduled for radical surgery might be an option to consider.

References:

1. Huiras EE, Banes CJ, Eichenfield LF, et al. Pulmonary thromboembolism associated with Klippel-Trenaunay Syndrome. *Pediatrics* 2005; 116(4): e596-600
2. Kihiczak GG, Meine JG, Schwartz RA, Janniger CK. Klippel-Trenaunay syndrome: A multisystem disorder possibly resulting from a pathogenic gene for vascular and tissue overgrowth. *Int J Dermatol* 2006; 45(8): 883-90

IS INTRATHECAL ANESTHESIA SAFE IN SPONDYLOEPIPHYSEAL DYSPLASIA CONGENITA?

GA Lozada, MD, R Schumann, MD, V Steinbok, MD

Tufts – New England Medical Center Department of Anesthesia, Boston, MA

Introduction: Spondyloepiphyseal dysplasia congenita (SDC) is a rare form of dwarfism. Its incidence may be 1-2 per million live births¹. Anesthetic and obstetric management of patients with SDC for labor and delivery can be challenging due to their dysmorphic and disproportional anatomic features, often affecting the airway as well as the vertebral column. Spinal anesthesia for cesarean section (CS) is controversial in patients with dwarfism and has not been described in patients with SDC. We report a case of subarachnoid anesthesia for elective CS in a patient with this condition.

Case Report: A 40-year-old woman, 49.5 kg, 3'11", G1P0, presented at 39 weeks gestation for elective CS secondary to cephalopelvic disproportion. She had SDC and a history of GERD. Physical exam revealed disproportionate dwarfism, a Class II Mallampati airway, and mild lumbar lordosis. Except for some flattening in the height of the thoracic and lumbar vertebrae, radiologic lumbar spine imaging was completely normal. Bupivacaine 6.75 mg with dextrose and morphine 200 mcg were injected intrathecally at the L3-4 interspace, resulting in a T6 sensory level. Ephedrine 10 mg and 900 cc of Ringers Lactate, IV, were administered during the case, and the patient remained hemodynamically stable. A healthy neonate was delivered uneventfully, with Apgar scores of 8 and 9 respectively. The patient reported excellent pain control in the PACU. Her postoperative course was unremarkable and she was discharged on POD#3.

Discussion: SDC is different from other, more frequent forms of dwarfism, such as achondroplasia and osteogenesis imperfecta. Important anesthetic implications of SDC include possible atlantoaxial instability from odontoid hypoplasia, kyphoscoliosis, laryngotracheal stenosis, and platyspondyly.^{1,2} In contrast to other variants of dwarfism, in this patient with SDC the preoperative radiologic and orthopedic lumbar spine evaluation revealed mild lordosis and insignificant vertebral body flattening but no other anatomic abnormality. Based on these results, we determined that our patient was an appropriate candidate for single dose spinal anesthesia. Following accepted height adjusted dosage guidelines³, a successful subarachnoid block for her elective CS was administered with an excellent outcome. In the presence of a preoperative evaluation confirming normal lumbar spine anatomy, patients with SDC should not be precluded from the benefits of spinal anesthesia for elective or urgent cesarean section.

References:

1 Anesthetic Implications of Congenital Anomalies in Children. New York: Appleton-Century-Crofts, 1990:9-22

2 Anesthesiology 1990; 73: 739-759

3 Clinical Anesthesia Procedures of the Massachusetts General Hospital. Lippincott Williams & Wilkins 2007;255

A WOMAN WITH HUNTERS SYNDROME WITH COMPLICATED INTRAOP COURSE

JA Park, MD

CA-2 Resident, Department of Anesthesiology, Dartmouth Hitchcock Medical Center

Introduction: This presents the case of a mid-forties year old female with a history of mucopolysaccharoidosis type II with long standing tracheostomy who presented with a TE fistula, eventually managed with oral intubation, endobronchial stents and bilateral intraoperative pneumothoraces over three successive operative procedures.

Case Presentation: Our patient is a mid-forties female with a long history of type II mucopolysaccharoidosis with significant tracheomalacia and long-term Montgomery T tube used as an airway stent s/p a remote pericardial patch for tracheal support to relieve inspiratory stridor. She was transferred to our tertiary care hospital with increased secretion and difficulty passing her normal sized suction catheter. She was stable on humidified air. Surgical plan for the next morning involved bronchoscopy and tracheostomy change.

In the OR she was found to have a tracheo-esophageal fistula with difficulty providing bronchoscopic confirmation of tracheal versus esophageal location. In the end, she was orally intubated with a 6.0 cuffed ett, grade II view, which was placed .5cm above the carina and covering the presumed fistula location and transferred to the ICU overnight.

Her second visit to the OR was for possible repair of tracheo-esophageal fistula and tracheostomy revisions. Ecmo was available in the room and lines were placed to allow us to utilize it quickly if needed. A consult with pulmonology allowed an attempt prior to the operation to place an endobronchial stent to cover the fistula. This involved sharing the airway with Pulmonology and moving the ETT in concert with their placement. A stent was placed over the fistula but after deployment had moved and in removing it was briefly lodged in the airway, totally obstructing ventilation. After removal, she was re-intubated orally and sent to the ICU again while more stents were obtained.

During her third visit to the OR two stents were deployed successfully covering the fistula and providing support up to the very edge of her tracheostomy. She recovered and was discharged, returning shortly thereafter for difficulty with secretions and plugging. An operative plan was formed which included continuing the stents up and over her tracheostomy thus closing it off. During this procedure, once again bronchoscopy was performed and stents deployed. Near the end she had increased peak pressures and was difficult to ventilate. She was found intraoperatively to have bilateral pneumothoraces and chest tubes were placed.

Discussion: This case raises several interesting issues including the utility of stents in benign disease, difficulties with deployment and long-term complications, anesthetic implications of mucopolysaccharoidosis.. It also is a representation of the technical difficulty that can be seen with ventilation and securing the airway when you have multiple providers working in concert on the airway. There must be free lines of communication so that everyone is responsible and working in tandem to maintain ventilation. There are end-of-life issues in the continued airway manipulation of this chronically ill woman.

References:

1. Morehead JM, Parsons, DS, "Tracheobronchomalacia in Hunter's Syndrome", *Int J Pediatr Otorhinolaryngol*, 1993 Apr; 26 (3): 255-61.
2. Madden, BP, Loke TK, Sheth, AC, "Do Expandable Metallic Airway Stents have a role in the Management of Patients with Benign Tracheobronchial Disease?", *Ann Thoracic Surgery*, 2006; 82: 274-8.
3. Tuschi et al, Mucopolysaccharoidosis Type II in Females: A case report and review of the literature. *Pediatric Neurology*, Vol 32, No 4,

Session 3

Antonio Aponte-Feliciano, MD
UMass Memorial
Medical Center

Methadone induced QT interval prolongation in a patient with Torsade de pointes in a chronic pain patient

OBJECTIVE: To explain methadone induced QT interval prolongation in a patient with Torsade de pointes

Konstantin Balonov, MD
Boston University
Medical Center

Open lung concept in intensive care medicine

OBJECTIVE: To explain the open lung concept in intensive care medicine

Aparna Dalal, MD
Caritas St. Elizabeth's
Medical Center

Case Report: Cardiac arrest during labor: Thrombus in PFO

OBJECTIVE: To explain cardiac arrest during labor

Kendrick Joyce, MD
UMass Memorial
Medical Center

Case Report: Awake craniotomy in a patient with COPD and OSA

OBJECTIVE: To explain the use of awake craniotomy in a patient with COPD and OSA

Andrew Cocchiarella, MD
UMass Memorial
Medical Center

Case Report: Compartment syndrome following heparin and TPA for middle cerebral artery thrombosis

OBJECTIVE: To explain the problem of compartment syndrome following heparin and TPA for middle cerebral artery thrombosis

William Rittinger, DO
UMass Memorial
Medical Center

Anesthetic management for resection of carcinoid tumor of the lung: A case presentation

OBJECTIVE: To explain anesthetic management for resection of a carcinoid tumor of the lung

Maksim Zayaruzny, MD
UMass Memorial
Medical Center

Unusual suspect: *Aeromonas caviae* infection in the surgical ICU

OBJECTIVE: To explain *Aeromonas caviae* infection in the surgical ICU

METHADONE INDUCED QT INTERVAL PROLONGATION AND TORSADE DE POINTES IN A CHRONIC PAIN PATIENT

A Aponte-Feliciano MD, Diana Kouznetsov, MD

University of Massachusetts, Medical School, Department of Anesthesiology and Critical Care. Worcester, Massachusetts.

Abstract:

Introduction

Methadone is a synthetic opioid that is used in the management of chronic pain and has been implicated in the development of the prolonged QT syndrome.¹ Torsade de Pointe (TdP) is a life threatening cardiac arrhythmia that is typically associated with prolongation of the QT interval and bradycardia.^{2,3}

Case Report

A chronic pain patient treated with methadone presented with QT interval prolongation and TdP. The patient was evaluated for electrolytic abnormalities, and underlying cardiac disease. Medications were thought to be risk factors for the development of QT prolongation and TdP as suggested by literature reviewed.³ Based on the current evidence of bradycardia and QT prolongation progressing to TdP, methadone and atenolol were discontinued. After discontinuation of the methadone, the QT normalized. A hydromorphone PCA was started then converted to fentanyl patch and oxycodone for breakthrough pain which successfully treated the pain syndrome.

Discussion

Methadone can induce TdP through two mechanisms: a QT interval prolongation associated with bradycardia³, or by inhibiting the cardiac potassium channel hERG.¹ There was a TdP case report caused by a large dose of methadone in a patient with presumably normal QT interval at baseline prior to his presentation at the hospital.² There was another case report in a patient who presented with prolonged QT while taking metoprolol, methadone and doxepin.³

References

1. Kornick CA, Kilborn MJ, Santiago-Palma J, Schulman G, Thaler HT, Keefe DL, Katchman AN, Pezzullo JC, Ebert SN, Woosley RL, Payne R, Manfredi PL. QTc interval prolongation associated with intravenous methadone. *Pain*. 2003 Oct;105(3):499-506
2. Almekhi A, Malas AM, Yousufuddin M, Rosencrance JG. Methadone-induced torsade de pointes in a patient with normal baseline QT interval. *W V Med J*. 2004 Jul-Aug;100(4):147-8.
3. Rademacher S, Dietz R, Haverkamp W. QT prolongation and syncope with methadone, doxepin, and a β -blocker. *Ann Pharmacother*. 2005 Oct;39(10):1762-3.

OPEN LUNG CONCEPT IN INTENSIVE CARE MEDICINE

K Balonov, MD, CA-1

Boston Medical Center, Department of Anesthesiology

Introduction:

This review addresses the current view of ARDS pathophysiology and physiological background of lung protective strategy. The rationale behind open lung maneuvers and steps to accomplish an open lung are presented.

1. Radiological presentations of the ARDS, thoracic CT scan in ARDS patients and development of “baby lung” concept.
2. “Baby lung” and protective ventilation strategy. Ventilation in prone position.
3. Behavior of alveoli in ARDS patients, PV curve in normal and collapsed units
4. Historical development and physiological principles of the Open Lung Concept. Traditional approach to open lung ventilation.
5. APRV mode of mechanical ventilation: another approach to open lung ventilation.
6. Radiological presentation of the open lung strategy.

Conclusion:

The guidelines for protective lung ventilation and open lung maneuvers are presented.

References:

1. Gattinoni L, Pesenti A: The concept of “baby lung”. Intensive Care Med 2005, 31:776-784
2. Lachmann B: Open up the lung and keep the lung open. Intensive Care Med 1992, 18:319-321
3. Habashi NM: Other approach to open-lung ventilation: Airway pressure release ventilation. Crit Care Med 2005, 33 (Suppl.): S228-S240

CASE REPORT: CARDIAC ARREST DURING LABOR:THROMBUS IN PFO.

A Dalal MD, Shulman S MD *, Vellayapan U MD *, Robelen GT MD *, Evans J DO *, Tewari V MD *, Falzon MKMD #.

* Department of Anesthesiology and Pain Medicine, # Department of Obstetrics and Gynecology, Caritas St. Elizabeth's Medical Center, Boston, MA 02135.

We report a case of a 34yr G3P1, 5 days past due date with no known drug allergies and no significant past medical history.

The patient received oxytocin for augmentation of labor. Shortly after spontaneous rupture of membranes, the fetal heart rate dropped from 123 to 90 bpm. A few seconds later, the patient complained of chest heaviness and became unresponsive. No pulse was felt. External cardiac massage was started. Pt was taken immediately to the OR for C- Section. Pulses reappeared and were weak. The patient regained responsiveness. She was induced with ketamine and succinylcholine and intubated. The baby was delivered with Apgar scores of 1, 4 and 6 at 1, 5 and 10 minutes

The patient received several blood products to correct deranged clotting parameters. A presumptive diagnosis of amniotic fluid embolism (AFE) was made. A TEE was performed which showed thrombus in right atrium (RA) passing thru patent foramen ovale (PFO) into left atrium, PFO with significant shunt fraction, dilated pulmonary artery (PA) and RA enlargement.(Fig. 1)

Once the C-Section was completed, the patient was taken to the cardiac OR as there was a clearly defined risk of thromboembolism with a potential risk of stroke. The RA was opened and a clot was seen heading towards a PFO. 2 cylindrically shaped fragments 2.8 x 0.3 cms and 1.5 x 0.2 cm diameter were removed. The PFO was closed. The PA was explored and no clots were found. Pathology of the fragments was reported as early organizing thrombus containing few squamous? cells consistent with amniotic fluid thromboembolus.

The patient was transferred to ICU and discharged 10 days later.

Discussion.

Amniotic fluid emboli may contain amniotic fluid, fetal cells, hair, or other debris, which may cause cardiorespiratory collapse. The incidence is low (1 / 20,000 pregnancies).(1) but the morbidity and mortality is high. Cardiac arrest occurs in 80% of pts and the maternal mortality is >61% (2).

The pathophysiology involves an anaphylactic reaction to fetal antigens. Initially, there is vasospasm of the pulmonary vasculature, with increased PA and RA pressures. Left ventricular failure may occur. This may be associated with massive hemorrhage, uterine atony and DIC(3).

We hypothesize that the mechanism of cardiac arrest in this patient may have been a combination of mechanical obstruction to the pulmonary circulation by the thromboembolus and an anaphylactic reaction from circulating amniotic fluid producing circulatory collapse.

References:

1. Clark SL, Hankins GDV, Dudley DA, et al. Amniotic fluid embolism: analysis of the national registry. In: Transactions of the Thirteenth Annual Meeting of the American Gynecological and Obstetrical Society. Am J Obst Gynecol 1995; 172:1158-1169.
2. Martin SR, Foley MR. Intensive care in obstetrics: an evidence-based review. Am J Obstet Gynecol. 2006 Sep;195(3):673-89.
3. Ayoub CM, Zreik TG, Dabbous AS, Baraka AS. Amniotic fluid embolus: can we affect the outcome? Curr Opin Anaesthesiol. 2003 Jun;16(3):257-61.

CASE REPORT: AWAKE CRANIOTOMY IN A PATIENT WITH COPD AND OSA

K. Joyce, MD

UMass Medical School

Introduction: The objective of this study is to discuss a case in which a neurosurgical patient with chronic lung disease provided an anesthetic dilemma for choice of anesthetic technique.

Case

The patient was scheduled for a craniotomy to drain a new cystic lesion in his frontal lobe. The patient had a history of frontal lobe tumor resection, small cell lung CA, chronic lung radiation therapy, radiation pneumonitis, chronic pleural effusions, and obstructive sleep apnea.

The anesthetic method chosen was sedation with local anesthetic per the surgeon with intraoperative CPAP therapy via the patient's home CPAP machine.

Discussion

The results of the case suggest the combination of intraoperative CPAP therapy, local anesthesia and sedation to be a viable option in patients with chronic lung disease and obstructive sleep apnea. Future research evaluating the use of intraoperative CPAP with obstructive sleep apnea patients with chronic lung disease may prove this technique to be valuable.

CASE REPORT: COMPARTMENT SYNDROME FOLLOWING HEPARIN AND TPA FOR MIDDLE CEREBRAL ARTERY THROMBOSIS

A. J. Cocchiarella, M.D., S. Shaikh, M.D. University of Massachusetts Medical School, Worcester, MA

Introduction: Bleeding complications following anticoagulation and thrombolysis in acute ischemic stroke are well documented. Rare among these, however, is the occurrence of compartment syndrome. We present a case of compartment syndrome following the use of ASA, heparin and tPA for middle cerebral artery thrombosis.

Case Report: A 59 year old male with a history of untreated hypertension and hyperlipidemia was transferred from an outside facility where he had presented with sudden onset of dizziness followed by slurred speech and weakness of the left face, arm and leg. Of note, the patient had fallen on his left side prior to arrival, though he had not sustained any serious injuries, and in particular, had not sustained any head trauma. By the time the patient arrived at our institution for neurological evaluation, his symptoms had largely resolved. The patient denied any history of similar symptoms and review of systems was otherwise negative. His only medication prior to arrival was ASA 81mg p.o. daily. Neurological exam revealed a middle aged male who was alert and oriented with fluent speech. Pupils were equal, round and reactive to light and accommodation. Fundoscopic exam revealed sharp disc margins. Visual fields were intact. A mild left facial droop was noted, but the remainder of the cranial nerve exam was normal. Strength was found to be 5/5 bilaterally in both the upper and lower extremities, but a pronator drift was noted on the left. Sensory exam was intact and reflexes were symmetric and normal. An initial head CT was normal, ruling out hemorrhagic stroke. Brain MRI revealed an area of acute ischemic change in the distribution of the right lenticulostriate artery. Brain MRA revealed high grade stenosis involving the distal portion of the M1 segment of the right MCA and reduced caliber of major branch vessels distal to the stenosis. The patient was then started on a heparin drip. On hospital day 2, a cerebral angiogram was performed and revealed a thrombus in the M1 segment of the right MCA. During the procedure, the patient again developed left arm weakness. A phenylephrine drip was started to maintain SBP >140 and the symptoms subsequently resolved. The patient then underwent intra-arterial tPA therapy and angioplasty of the M1 segment of the right MCA. The procedure was tolerated well and the patient was subsequently transferred to the ICU where his neurological exam remained unchanged. The phenylephrine drip was continued to maintain SBP >140mmHg. The patient was started on Lipitor and continued on ASA and a heparin drip, with a target aPTT of 60-80. Laboratory data on hospital day 2 included aPTT values of 140, 96 and 66. Hematocrit was 42.2%. Overnight, the patient developed progressively worsening left hip pain and by the morning of hospital day 3 had developed paresthesias in his left toes. Physical exam revealed a markedly edematous left thigh as well as a large posterior thigh ecchymosis. He was again noted to have decreased left side strength (3/5). A total of 6L of crystalloid had been infused overnight and the hematocrit had fallen to 28.7% on the morning of hospital day 3. Packed red blood cells were transfused and orthopedics consult was obtained. A diagnosis of compartment syndrome was made and the patient was taken emergently to the operating room for left thigh fasciotomy and evacuation of hematoma. Following the procedure, the patient had complete resolution of the left thigh symptoms. The etiology of the stroke was subsequently investigated and remained undetermined. Follow-up head CT on hospital day 9 revealed small cortical and lacunar infarcts in the distribution of the right MCA. On hospital day 14, the patient was discharged on Aggrenox 200/25, Lipitor and Pepcid. On follow-up exam four months after discharge, the patient had residual left upper extremity weakness, 2-3/5. Left lower extremity strength was intact at 5/5.

Discussion: The most important therapy in the management of acute ischemic stroke is restoration of blood flow to the ischemic area and penumbra.¹ Intravenous thrombolytic therapy with TPA has been in use since its approval in 1996. Criteria for its use include time since symptom onset less than three hours. Intra-arterial thrombolysis at the site of occlusion is an experimental treatment that may offer an expanded time window for treatment.² Anticoagulation is of unproven benefit in the management of acute ischemic stroke. Despite a lack of evidence, however, heparin and heparinoids are still frequently used.¹ Aspirin given within 48h of acute ischemic stroke seems to reduce death and disability, but the use of aspirin in conjunction with thrombolytics might increase the risk of bleeding.¹ Many potential bleeding complications following thrombolysis are well documented. To our knowledge, however, this is only the second case report documenting compartment syndrome following thrombolytic therapy.³ Though this patient was largely asymptomatic by the time he was initially evaluated at our institution, it is likely his waxing and waning neurological symptoms and subsequent permanent weakness were, in part, secondary to the occult blood loss occurring in his thigh. The bleeding, and subsequent fall in hematocrit from 42.2 to 28.7, may have further compromised oxygen delivery to the ischemic penumbra. A heightened awareness of the potential for occult bleeding, and possible compartment syndrome, is warranted in ischemic stroke patients known to have fallen who are receiving anticoagulation and TPA.

References:

1. Khaja, A. M., Grotta, J. C. Established treatments for acute ischaemic stroke. *Lancet* 2007, 369: 319-27.
2. Lisboa, R. C., Jovanic, B. D., Alberts, M. J. Analysis of the safety and efficacy of intra-arterial thrombolytic therapy in ischemic stroke. *Stroke* 2002. 33: 2866-71.
3. Yip TR, Demaerschalk BM. Forearm compartment syndrome following intravenous thrombolytic therapy for acute ischemic stroke. *Neurocritical Care* 2005, 2: 47-8.

ANESTHETIC MANAGEMENT FOR RESECTION OF CARCINOID TUMOR OF THE LUNG: A CASE PRESENTATION

W Rittinger, DO; JM Walz, MD, FCCP

Department of Anesthesiology, University of Massachusetts Memorial Healthcare, 55 Lake Avenue North, Worcester, MA 01655

Background: Carcinoid tumors are well-differentiated neuroendocrine tumors arising from the embryologic primitive gut which are frequently located in the gastrointestinal tract. Bronchial carcinoids are rare, accounting for about 1-2% of all lung neoplasms. The incidence of carcinoid tumors appears to be greater than previously recognized and more patients will require anesthesia for surgical resection¹.

Presentation of case: The patient is a 25 yr old male who was referred from Southern Illinois where he was evaluated for recurrent pneumonia and suspected right endobronchial carcinoid tumor (diagnosed by immunohistochemistries following a bronchial biopsy). During central venous catheter placement for VATS he developed a hypertensive crisis with SBP up to 300mmHg, and experienced severe bronchospasm. The subsequent work up for the hypertensive episode revealed no evidence of pheochromocytoma, but the urine was positive for 5-HIAA, suggestive of carcinoid tumor. The preoperative workup at UMASS included an MRI, PET scan (negative for carcinoid) and pulmonary function tests (PFT- FEV 2.16; 42% predicted, diffusion capacity 64%), a trans-thoracic echocardiogram (TTE, normal EF no valvular abnormalities, no FWMA). An Octreoscan was performed which revealed a small intense focus just to the right of the midline adjacent to or within the lower mediastinum and mild diffuse radiotracer uptake in a wedge shaped region at the right lung base. On the day of surgery, the non-selective serotonin antagonist Cyproheptadine was administered orally. An infusion of Octreotide at 100mcg/hour was started preoperatively. The patient was transferred to the holding area where a 16 g PIV, Left radial A-line, Right IJ TLC and a thoracic epidural catheter placed at T7 were performed. GA with DLT was induced and maintained on Sevoflurane, and Fio₂> 90%. Bronchoscopy performed post induction identified the mass just distal to the right bronchus intermedius, the surgeon was unable to pass scope past the tumor. An episode of severe bronchospasm intraoperatively was treated with hand ventilation and a bolus dose of Octreotide 100 mcg, otherwise unremarkable intraoperative course. Surgical management consisted of a right thoracotomy, decortication, right lower bilobectomy, extensive mediastinal lymphadenopathy and latissimus dorsi muscle myoplasty. Over a liter of purulent material was drained from the surgical area. At the end of the case, the DLT was removed over a tube exchange catheter and replaced with an 8.0 ETT. The patient was subsequently transferred to the SICU in stable condition. Post-op pain control was facilitated with epidural infusion of bupivacaine and fentanyl 0.1% and 4mcg/ml. The pathology report obtained postop confirmed the diagnosis of endobronchial carcinoid tumor with severe obstructive pneumonia and abscess extending to the hilum.

Discussion: Discuss management with emphasis on substances released by tumor: amine and neuropeptide hormones including serotonin, histamine, prostaglandins, corticotrophin and kallikrein. Symptoms of carcinoid crisis: cutaneous flushing, diarrhea, heart disease (pulmonic stenosis, tricuspid regurgitation, and SVT), bronchoconstriction, hypotension, hypertension, abdominal pain, hepatomegaly, hyperglycemia, and hypoalbuminemia. The somatostatin analogue, Octreotide used in the preparation and management of surgery. Octreotide scanning can be used for diagnostic purposes and to verify complete resection of tumor. Ketanserin, an H1 receptor antagonist, used preoperatively to attenuate serotonin-induced vasoconstriction and bronchoconstriction. The difference between typical and atypical carcinoid tumors in regards to their location, metastases and patient survival. Brief discussion of thoracic epidural for pain control.

- References:** 1. Dierdorf, Stephen F. "Carcinoid tumor and carcinoid syndrome." *Current opinion in anesthesiology* 16.3 (2003):343-7.
2. Rea, Federico. "Outcome and surgical strategy in bronchial carcinoid tumors: single institution experience with 252 patients." *European Journal of Cardio-thoracic Surgery* 31 (2007):186-191.
3. Bhatia, P. D. "A case of Bronchopulmonary carcinoid tumor: the role of octreotide scanning in localization of an ectopic source of ACTH." *Journal of Hospital Medicine* 2006;:312-316.

UNUSUAL SUSPECT: *AEROMONAS CAVIAE* INFECTION IN THE SURGICAL ICU

M Zayaruzny, MD and JM Walz, MD, FCCP

Department of Anesthesiology, Division of Critical Care Medicine, UMass Medical Center, Worcester, MA

Introduction. *Aeromonas* sp. are Gram negative rods found principally in soil or fresh and contaminated water. Three of the 14 *Aeromonas* species described, *A. hydrophyla*, *A. caviae*, and *A. veronii*, are generally responsible for the *Aeromonas* infections in humans. (1) The scope of clinically significant infection caused by the *Aeromonas* sp. includes gastroenteritis, (2) peritonitis, meningitis, pneumonia and empyema, soft tissue infection, and bacteremia. While single case reports of *Aeromonas* infections in otherwise healthy patients have been published, (3) they are most frequently found among the patients with underlying chronic liver disease, hematologic malignancies, and other neoplasms. Few large series of *Aeromonas* sp. infections have been published in the literature. A report of 104 episodes of *Aeromonas* bacteremia from Taiwan found the crude fatality rate within 2 weeks after onset to be 30%, with 43% of patients having a concomitant focus of infection. Another report of 75 cases of *Aeromonas* sp. bacteremia from Spain reported a 30-day case fatality rate of 24%. (4) While the majority of *Aeromonas* infections are reported to be community acquired, few have been ascribed to a discrete event. *Aeromonas* bacteremia resulting from aspiration of water by near-drowning victims has been previously described in several case-reports; one case report describing a fatal *Aeromonas* infection following a prick wound while boning a fresh water fish. Our case report describes a patient with *Aeromonas caviae* sepsis following exposure to a fresh water ornamental pond.

Case. A 62 year old male with a past medical history significant for hypertension (HTN), sleep apnea, and cardiomyopathy, fell 25 feet from a tree into an ornamental pond. On admission the patient was hemodynamically stable, had a Glasgow Coma Scale score of 15, and was complaining of right hip pain. Initial evaluation revealed several orthopedic injuries, including right femoral neck fracture, right sacral ala fracture, left superior and inferior pubic rami fractures, right radius fracture, as well as a right pulmonary contusion, a 6 cm laceration over the right temporal region of the patient's head, and a simple laceration just distal to the left knee. On hospital day 1 the patient's respiratory status deteriorated, necessitating an admission to the Surgical Intensive Care Unit and increasing levels of supplemental oxygen. Chest x-rays on hospital day 1 showed increased opacification of the right lower lobe, suggesting the possibility of aspiration. The patient remained afebrile and stable until 3:30 pm of hospital day 3, when he developed sudden onset of shaking chills, elevated temperature to 38.6 degrees Celsius (C°), and a heart rate of 114 BPM, elevated from the baseline of 80-85 BPM. Endotracheal intubation, central venous and peripheral arterial catheterization were immediately performed. After samples of peripheral and central venous blood, protected bronchial specimen brush (PSB), and urine were sent for culture and sensitivity testing, and the patient was empirically started on Ceftazidime 1 gm i.v. every eight hours. Within two hours the patient's temperature reached 40C°, and peaked at 40.5C° by 9 pm. Concurrently, the mean arterial pressure (MAP) decreased from the baseline of 100-110mmHg to 48mmHg (SPB 90mmHg) despite aggressive fluid resuscitation. Cardiac enzymes were obtained which revealed a peak troponin level of 6.94, consistent with non-ST elevation myocardial infarction. Culture results of blood and sputum revealed infection due to gram-negative rods, eventually identified as *Aeromonas caviae*. The rest of the patient's hospital course was unremarkable. He remained on mechanical ventilation for 24 hours, was successfully extubated and subsequently underwent cardiac catheterization which showed no significant coronary artery disease. After his orthopedic injuries were addressed, the patient was discharged to an inpatient rehabilitation facility.

Discussion. *Aeromonas* sp. infection is a rare cause of gram negative sepsis in an ICU. None of the previous reports in the literature described a case of *Aeromonas caviae*-related sepsis in the United States. The onset of sepsis in our case was heralded by the shaking chills, which were appropriately recognized as a sign of infection, even in the setting of relatively mild hyperthermia (38.6 C°) and unchanged blood pressure. However, while the appropriate antibiotics were ordered with 75 minutes of the initial symptoms, they were not administered until 8 pm, 4.5 hours after the patient met the criteria for the Systemic Inflammatory Response Syndrome (SIRS). Our case serves as a reminder that a high index of suspicion and prompt and decisive action of the medical personnel are instrumental in assuring patient recovery. Current international guidelines recommend initiation of empirical antimicrobial therapy within one hour of presentation with severe sepsis or septic shock (*surviving sepsis campaign*). More recently, Kumar and colleagues demonstrated that effective antimicrobial administration within the first hour of documented hypotension was associated with increased survival to hospital discharge in adult patients with septic shock. In the same report, Kumar et al noted that despite an overwhelming evidence of the benefits of early antibiotic administration, only 50% of the patients in their series of 2700 cases received effective antimicrobial therapy within six hours of documented hypotension. Such delays in treatment, despite the best available evidence, may negatively impact the therapeutic efficacy in a variety of conditions such as coronary syndromes and cerebrovascular accidents. Further investigations are needed in the area of health care delivery systems to improve the integration and communication between the physician at the bed-side and various ancillary services responsible for the delivery of prescribed antibiotics.

References

1. Ko WC, et al. *Aeromonas* Bacteremia: review of 59 episodes. Clin Infect Dis 1995; 20: 1298-304
2. Steinberg JP, et al. Other Gram-negative bacilli. In: Mandel G, et al. Principles and Practice of Infectious Diseases. Vol 2, Philadelphia: Chirchill Livingstone; 2000. pp 2461-2

ABSTRACTS

3. Goncalves JR, et al. *Aeromonas hydrophila* fulminant pneumonia in a fit young man. *Thorax* 1992; 47: 482-3
4. Ko WC, et al. Clinical Features and Therapeutic Implications of 104 Episodes of Monomicrobial *Aeromonas* Bacteremia. *J. Infect* 2000; 40: 267-73

Session 4

Preeti Arora, MD
Tufts-New England
Medical Center

Anesthetic management of a patient with end-stage pulmonary disease and cor pulmonale for emergency appendectomy

OBJECTIVE: To explain anesthetic management of a patient with end-stage pulmonary disease and cor pulmonale for emergency appendectomy

Suzanna Gill, MD
Tufts-New England
Medical Center

Complex neuroanesthesia for a patient with cervical spinal cord compression in the presence of a pheochromocytoma

OBJECTIVE: To explain complex neuroanesthesia for a patient with cervical spinal cord compression and a pheochromocytoma

Theo Matheos, MD
UMass Memorial
Medical Center

Durability of antiseptic central venous catheters as a function of duration of catheterization: silver/carbon/platinum versus minocycline/rifampin

OBJECTIVE: To explain the durability of antiseptic central venous catheters as a function of duration of catheterization

Vishal Raizada, DO
UMass Memorial
Medical Center

Easy laryngoscopy with difficult intubation

OBJECTIVE: To explain an easy laryngoscopy with difficult intubation

Bruce Vrooman, MD
Boston University
Medical Center

Preoperative versus postoperative bolusing of preoperatively-placed continuous femoral nerve block catheters for patients undergoing unilateral total knee arthroplasty

OBJECTIVE: To explain preoperative versus postoperative bolusing of preoperatively-placed continuous femoral nerve block catheters for patients undergoing unilateral total knee arthroplasty

ANESTHETIC MANAGEMENT OF A PATIENT WITH END-STAGE PULMONARY DISEASE AND COR PULMONALE FOR EMERGENCY APPENDECTOMY

P. Arora, MD., R. Schumann, MD. Tufts-New England Medical Center, Tufts University School of Medicine, Boston, MA

Introduction: Noncardiac emergency surgery in patients with severe pulmonary hypertension secondary to end-stage pulmonary disease carries a high mortality risk (1,2). Anesthetic management and selection of a feasible surgical approach for these patient is extremely challenging to the care team. We describe the successful management of a patient with cor pulmonale due to crippling pulmonary disease presenting for emergency appendectomy.

Case: This 77-year-old man, 5' 7", 100 kg, had a smoking history (30 pack-years), obstructive sleep apnea treated with nocturnal CPAP of 8 and a diagnosis 18 months prior of severe COPD, emphysema, pulmonary fibrosis, and pulmonary arterial hypertension by echocardiogram (EC) and right heart catheterization. Pulmonary function tests documented a DLCO of 24% predicted and an FEV₂₅₋₇₅ of 17% predicted at that time. During 6 months prior to surgery the patient had declined from an NYHA Classification II to Class IV, now requiring 15 l of O₂ non-rebreathing mask to achieve a resting SpO₂ of 93%. Home medications included oxygen, tiotropium MDI and sildenafil. A bedside transthoracic EC showed new RV dilation and reduced systolic function, PAP > 60 mmHg, LV septal flattening and an EF of 65%. Physical exam revealed diffuse wheezing on auscultation, orthopnea and dyspnea when talking. The pO₂ on 15 l O₂ was 96 mmHg. With standard ASA intraoperative monitoring and following insertion of an arterial and a central line, general anesthesia was induced with etomidate, propofol, midazolam, lidocaine, fentanyl and atracurium and maintained with isoflurane in oxygen (FiO₂ of 1.0). Despite high FiO₂, albuterol MDI and inhalational anesthetic administration, the pulmonary wheezing persisted, and the intraoperative SpO₂ fluctuated between 85 and 89% with a pO₂ of 57 mmHg. Correct endotracheal tube placement was confirmed repeatedly by auscultation. Dobutamine 3-5 mcg/kg/min was used to maintain adequate hemodynamic parameters. A PFO was excluded intraoperatively by negative transesophageal EC agitated saline study. The patient tolerated the 70 minute laparoscopic emergency appendectomy with CO₂ inflation pressures of ≤ 12 mmHg. Extubation was successful despite an SpO₂ of 85% on 100% O₂, with postextubation improvement to 97% after several minutes on CPAP. The patient had an uneventful recovery continuing CPAP postoperatively, and was weaned off dobutamine.

Discussion: Anesthetic management in patients with extreme chronic progressive disease states, such as described in our case, remains highly individualized and inspires debate. We avoided pulmonary artery catheterization for our case management, employed transesophageal EC as needed, and pursued minimally invasive surgery as tolerated, to minimize the need for postoperative opioids and their potential side effects, including respiratory depression for our severely compromised patient. Complex physiological alterations due to changing from spontaneous up-right to supine positive pressure ventilation and abdominal insufflation under anesthesia likely contributed significantly to VQ mismatch with subsequent continuous decreased arterial oxygenation intraoperatively. This understanding triggered our decision to attempt immediate postoperative extubation, to return our patient as much as possible to his preoperative pulmonary baseline. Although alternative anesthetic and surgical techniques are available, our strategy, carefully considering the patient's presenting pathophysiology, resulted in a good outcome.

References:

1. Ramakrishna G, Sprung J, Ravi BS, Chandrasekaran K, McGoan MD. Impact of pulmonary hypertension on the outcomes of noncardiac surgery. Predictors of perioperative morbidity and mortality. JACC 2005; 45: 1991-9.
2. Minai OA, Venkateshiah SB, Arroliga AC. Surgical intervention in patients with moderate to severe pulmonary arterial hypertension. Conn Med 2006; 70: 239-43

COMPLEX NEUROANESTHESIA FOR A PATIENT WITH CERVICAL SPINAL CORD COMPRESSION IN THE PRESENCE OF A PHEOCHROMOCYTOMA

S. Gill, MD, P. Xiao, MD, R. Schumann, MD

Department of Anesthesia, Tufts-New England Medical Center, Tufts University School of Medicine, Boston, MA

Introduction: The presentation of a patient diagnosed with a pheochromocytoma for urgent surgery unrelated to this finding is rare (1), and perioperative management recommendations have not been established. We describe the unique challenge of a patient with a known pheochromocytoma requiring an anesthetic for neurosurgery that would prevent a hypertensive crisis yet also facilitate monitoring of somato-sensory and motor evoked potentials (SSMEPs).

Case: A 50-year-old man, 5'6", 75kg, with a history of Neurofibromatosis Type I, hypertension and smoking presented one day before urgent neurosurgery with progressive gait disturbance and loss of lower extremity strength due to C1/C2 bilateral neurofibromas causing cervical spinal cord compression. Two years prior, he had undergone a right adrenalectomy for a pheochromocytoma. A year and a half following this surgery, a work-up for recurrent symptomatic hypertension (250/130 mm/Hg) revealed another pheochromocytoma (urinary metanephrines 1571mcg, normal 26-230mcg; urinary normetanephrines 1487mcg, normal 44-540mcg; vanillylmandelic acid 7.5mg, normal <=6.0mg; plasma normetanephrine 245pg/ml, normal 18-111pg/ml; plasma metanephrine 63pg/ml, normal 12-60pg/ml). An MIBG scan suggested its location in the left adrenal gland, but had not yet been confirmed by a 6-fluorodopamine PET-scan. The patient's preoperative medications included nifedipine, metoprolol and terazosin maintaining blood pressure (BP) values of 150/90 mm/Hg. The preoperative evaluation including routine laboratory values, an EKG and a chest x-ray were within normal limits, except non-specific ST-T wave changes. The surgical plan required the patient to be in the prone position, the cranium fixed in Mayfield pins and avoidance of neuromuscular blockade to allow SSMEP monitoring. On the day of surgery, following anxiolysis with midazolam 2mg, dexmedetomidine 1mcg/kg load followed by 0.2mcg/kg/hr, fentanyl 50mcg, and remifentanyl 0.025 mcg/kg/min, the patient received a right radial arterial line and a left femoral central line in the operating room. After preoxygenation, propofol 200mg, fentanyl 50mcg, remifentanyl 50mcg, lidocaine 100mg, vecuronium 2mg and phentolamine 3mg were administered for induction of general anesthesia. During mask ventilation, the left nares was prepared, followed by uneventful naso-tracheal intubation. Transient hypertension (170/90 mm/Hg) was treated with esmolol 50mg, remifentanyl 50mcg, fentanyl 50mcg, and nitroglycerin. Maintenance of anesthesia was achieved with isoflurane (0.5% end-tidal concentration) in oxygen and air, dexmedetomidine (0.25-0.5mcg/kg/hr) infusion, remifentanyl (.05-0.18mcg/kg/min) infusion, fentanyl (500mcg total) and hydromorphone (1.2mg total). Following an abrupt rise in BP to 170/90 mm/Hg after the 1st hour of surgery, coinciding with a Bispectral index (BIS) value of 70, a propofol infusion (20-40mcg/kg/min) was added to the anesthetic and continued throughout the nine-hour procedure with BPs remaining 110/60 mm/Hg and BIS values between 40-50. The SSMEP monitoring was unimpaired by the anesthetic and showed excellent signal strength throughout. The anesthetic plan included continued postoperative intubation to avoid possible airway compromise after lengthy neck surgery in the prone position. However, the patient participated in a basic neurological evaluation confirming a neurologically unimpaired state at the end of the procedure. To achieve a timely emergence from anesthesia isoflurane was replaced with sevoflurane at 2 hours, and propofol and remifentanyl were discontinued at 60 and 20 minutes prior to the end of surgery respectively. The postoperative course was complicated by hypertension difficult to control. The patient was extubated on postoperative day (POD) 1 but required reintubation the following day due to pneumonia associated respiratory failure. He was successfully extubated on POD 6, and discharged home on POD 11 on clonidine, terazosin, metoprolol and nifedipine, awaiting further pheochromocytoma localization studies.

Discussion: This case illustrates the complexity of an anesthetic that accommodates difficult neurosurgical positioning and monitoring requirements in the presence of a pheochromocytoma. Because inhalational anesthetics interfere with effective intraoperative neurophysiologic monitoring, intravenous anesthetic techniques using propofol with or without ketamine have been recommended (2). In the presence of a pheochromocytoma, use of ketamine may be unwise, and lengthy high dose propofol use in an unparalyzed patient carries the risk of the propofol infusion syndrome, insufficient blood pressure control and delayed awakening. We employed multiple anesthetic agents simultaneously for a carefully balanced general anesthetic to successfully reconcile the conflicting anesthetic goals of unimpaired spinal cord monitoring and adequate anesthetic depth for blood pressure control in our complicated patient. Even when the intraoperative management is very successful, the postoperative period requires unrelenting attention and may remain challenging in patients with a coexisting pheochromocytoma.

References:

1. Goel S, Johar N, Abraham M. Anesthesia for emergency craniotomy in a patient with von Hippel Lindau disease with pheochromocytoma. *J Neurosurg Anesthesiol* 2005; 17: 173-4.
2. Jameson LC, Sloan TB. Monitoring of the brain and spinal cord. *Anesthesiol Clin* 2006; 24: 777-91.

DURABILITY OF ANTISEPTIC CENTRAL VENOUS CATHETERS AS A FUNCTION OF DURATION OF CATHETERIZATION: SILVER/CARBON/PLATINUM VERSUS MINOCYCLINE/ RIFAMPIN

T Matheos MD, A Orquiola MD, Matthias Walz MD, Janice Adams, Stephen O. Heard, MD
University of Massachusetts Medical School, Department of Anesthesiology, Worcester, MA

PURPOSE: Three types of antiseptic or antibiotic impregnated central venous catheters (CVCs) are commercially available. Only one study has examined the durability of these catheters (chlorhexidine/ silver sulfadiazine vs minocycline/rifampin (MR)). We hypothesized that CVCs coated with MR have a longer antimicrobial activity as a function of duration of catheterization compared to silver/carbon/ platinum (SPC) CVCs.

METHODS: The UMMS Human Subjects Committee approved this study. Insertion of antiseptic CVCs was rotated on a monthly basis in the surgical intensive care unit. When CVCs were removed, the catheters were flushed and cut in 1 cm segments to be used for modified Kirby-Bauer testing. Bacteria isolates (*S. aureus*, *S. epidermidis*, *E. coli*, enterococcus and *P. aeruginosa*) were obtained from the hospital microbiology laboratory, grown to 1.5 MacFarland standard and plated onto blood agar plates. The CVC segments were imbedded at right angles into the agar. The plates were incubated at 37[degrees]C for 24 hours. The zone of inhibition (ZOI) of bacterial growth was measured with a caliper. Data were analyzed using a general linear model (Statistica, Tulsa, OK). The null hypothesis was rejected for $p < 0.05$.

RESULTS: Forty-two SPC and 47 MR catheters were recovered from patients. Baseline activity against the test organisms was significantly higher with the MR CVCs than the SPC CVCs. Inhibition of bacterial growth persisted for a much longer duration of time with the MR CVCs than with the SPC CVCs with the exception of *P. aeruginosa* (Figure, organism: *S. epidermidis*).

CONCLUSION: Antimicrobial activity of MR CVCs against the common organisms causing catheter-related bloodstream infections (CRBSI) persisted for a longer period of time as a function of duration of catheterization compared to SPC CVCs.

CLINICAL IMPLICATIONS: These data predict better clinical efficacy of MR CVCs compared to SPC CVCs in the prevention of CRBSI.

EASY LARYNGOSCOPY WITH DIFFICULT INTUBATION

Vishal Raizada, DO

University of Massachusetts, Worcester, MA

Case:

44 yo female, admitted for Calciphylaxis and pain management.

PHx: ESRD, HTN, Asthma(steroid dependant), spina bifida, seizure disorder, chronic line sepsis.

Patient had parathyroidectomy done one month previous. Patient complaining of hoarseness, cough with SOB and CP POD#2. Also, had RLL infiltrate and effusion. Transferred to MICU. Patient became more short of breath over week time and hypotensive.

Anesthesia called emergently at intubate. Patient was in notable distress, obtunded.

Maintaining SpO2 in high 80's with NRB. Patient preoxygenated, SpO2 increased to mid-90's. Etomidate IVP given. Mac 3 grade 1 view, unable to pass 7.0 Ett.

Attending called for. Able to mask ventilate with some difficulty and SpO2 dropped to high 80's. Attending arrived, succinylcholine give IVP, unable to intubate with 6.5 Ett. Subsequent Ett tubes tried finally 4.5 placed. Difficult to bag ventilate patient, SpO2 had poor waveform and patient had poor pulses.

Surgery called stat to place trach. Decided to take patient to OR because patient had an airway. Patient coded on-route to OR. No pulse. SpO2 unreadable.

Patient given Epinephrine and Atropine. Chest compressions preformed. Regained pulse and SpO2 still unreadable. On arrival to OR patient was placed on vent, ASA monitors applied. Trach was started. In OR patient had no readable SpO2 with poor end-tidal CO2. As trach was finishing patient went into Vtach to Vfib to PEA.

Patient had chest compressions, given Epi and Bicarbonate. Cause of death was secondary to acute cardiac arrest due to acute respiratory failure due to tracheal stenosis.

Discussion:

Patient had what appeared to be calcified vocal cords. Autopsy was not done, however we were unable to even break the cords with a stylet in our intubation attempts.

Calciphylaxis usually occurs in patients with ESRD and hyperthyroidism.

Most common sites of extra osseous calcification are on vessels, articular and periarticular tissues, skin, and eyes. Soft tissue calcification is reported in 20 – 100% ESRD patients.

Metastatic calcification of the true vocal cords as a cause of hoarseness. (Belsler, R.B. et al. Ann Otol Rhinol Laryngol. 103:1994, 849-51)

PREOPERATIVE VERSUS POSTOPERATIVE BOLUSING OF PREOPERATIVELY-PLACED CONTINUOUS FEMORAL NERVE BLOCK CATHETERS FOR PATIENTS UNDERGOING UNILATERAL TOTAL KNEE ARTHROPLASTY

B Vrooman, MD, CA-3 at Boston University Medical Center (BUMC), Albert Woo, MD, CA-3 at BUMC. Robert Bode Jr., MD. Abdel Mehio, MD. Pam Badger, RN.

Boston University Medical Center Anesthesiology Residency Program. New England Baptist Hospital Institutional Review Board (NEBH IRB).

Introduction: Total knee arthroplasty results in considerable postoperative pain that has been controlled in the past by a variety of measures. Continuous femoral nerve blocks (CFNB) have somewhat recently been added to the regional techniques to control postoperative pain. Controversy exists regarding whether preemptive analgesia results in improved postoperative pain control or hospital length of stay. From our experience and review of previous anesthesia records, we believe that a preoperative block may decrease intraoperative narcotic requirement by 40%. We do not expect a difference in length of stay. We intend to determine if a decrease in intraoperative narcotic utilization will affect patient outcome such as physical therapy condition, pain scores, postoperative narcotic use, and length of stay.

Regarding risks and benefits for CFNB, Capdevila et al performed a prospective analysis on continuous peripheral nerve blocks in hospital wards after orthopedic surgery. The conclusion was that continuous peripheral nerve block is an effective technique for postoperative analgesia. Minor incidents and bacterial colonization of catheters are frequent, yet with no adverse clinical consequences in the large majority of cases.¹ Seet et al. compared the 3-in-1 CFNB of differing concentrations to patient controlled intravenous morphine for post total knee arthroplasty analgesia and knee rehabilitation. This article showed that a CFNB with a catheter demonstrated an opioid-sparing effect.²

Methods: 100 ASA physical status I-II total knee arthroplasty patients will be randomly allocated to one of two analgesia groups: those receiving continuous femoral nerve blocks with a bolus injection before the surgery (Group A) and those receiving the bolus afterwards (Group B). All patients will have the femoral nerve catheters placed before surgery and will undergo general anesthesia. Written informed consent will be obtained during preoperative interview, and participants will be instructed in the use of the visual analog pain scale and the use of a PCA infuser. Patients will be premedicated in the usual fashion before surgery. A computer will randomly assign patients into either Group A or Group B. The information containing the assigned group will be placed inside a sealed envelope labeled with the patient's medical record number. Members from our well-trained catheter insertion anesthesia team will perform the procedure after operative site and patient name band checking. Group A will then receive a 30 cc 0.375% bupivacaine with 1:400,000 epinephrine bolus. Anesthesiologists who take care of these patients intraoperatively will not know whether the patient belonged to group A or group B. General anesthesia will be induced in the usual fashion. When surgery completes and prior to the patient being transported to the PACU, members of our team will be informed and they will check the envelope again. If the patient belongs to group B, he/she will receive a 30 cc 0.375% bupivacaine with 1:400,000 epinephrine bolus. Patient will then be given a morphine PCA to cover breakthrough pain. This is currently the standard of care at NEBH. The information on the amount use will be collected on a daily basis. Postoperative pain scores will be collected as per New England Baptist Hospital PACU protocol/procedure. Patient with a PCA has vital signs and pain scored every 2 hours in the first 24 hours postoperative period. After the first 24 hours, vitals and pain scores are collected every 4-6 hours. Intraoperative and postoperative narcotic requirements and pain scores, physical therapy records for strength and range of motion, length of stay, adverse events, and demographic data will be collected for analysis. They will be collected on a daily basis. The sample size of 100 was determined with the following power analysis: t-test. $\alpha = 0.05$, $\beta = 0.8$, $\delta = 0.8$, difference in mean = 0.4. N=80. The NEBH IRB has approved our research proposal on January 8, 2007.

Results: At this point, fourteen patients have been randomized and have received CFNB placement as described above. Analysis of the collected data is pending.

Discussion: Pending

References:

¹ Capdevila, X et al. Continuous Peripheral Nerve Blocks in Hospital Wards after Orthopedic Surgery: A Multicenter Prospective Analysis of the Quality of Postoperative Analgesia and Complications in 1,416 Patients. *Anesthesiology* 2005 November; 103(5):1035-45.

² Seet E, Leong WL, Yeo AS, Fook-Chong S. Effectiveness of 3-in-1 Continuous Femoral Block of Differing Concentrations Compared to Patient Controlled Intravenous Morphine for Post Total Knee Arthroplasty Analgesia and Knee Rehabilitation. *Anaesthesia and Intensive Care* 2006 February; 34(1):25-30.

ACKNOWLEDGEMENTS

Thank you to the following who were instrumental in making this program happen:

Massachusetts Society of Anesthesiologists (MSA)

Mark Hershey, MD

Beth Arnold, MSA

Barbara Kennealy, MSA

Marguerite Eckhouse, UMass Medical School

CORPORATE SPONSOR

We gratefully acknowledge the unrestricted educational grant from Organon USA.

