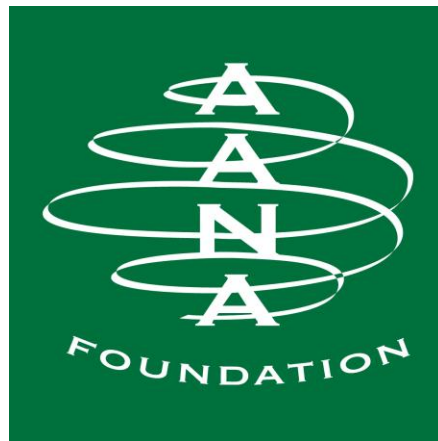


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2014 Poster Abstracts

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Research Oral Poster Abstracts

A1

A Comparison of Epidural Strategies for Labor Analgesia

Johnnie M. Holmes, CRNA, PhD; LT Katherine M. Kidde, BSN; LT Meredith K. Tverdosi, BSN
Uniformed Services University of the Health Sciences

Introduction: Epidural analgesia has been considered the optimal technique for control of labor pain for decades. There is no conclusive evidence for the most effective dosing strategy that minimizes drug consumption while maintaining effective analgesia. Dosing is highly variable among anesthesia professionals. The purpose of this study was to compare the effectiveness of three epidural infusion strategies for labor analgesia to test the hypothesis that a lower basal rate with a higher patient controlled bolus will result in lower drug consumption than the other two comparison regimens.

Methods: This was a prospective, single-blinded, clinical comparison of 120 women desiring epidural analgesia. Subjects were randomized to one of three infusion regimens of a standard solution of 0.125% bupivacaine with 2mcg/ml fentanyl: 1) 4mL/hr basal rate with 12mL patient controlled boluses every 20 minutes; 2) 7mL/hr basal rate with 8mL patient controlled boluses every 15 minutes; 3) 10mL/hr basal rate with 5mL patient controlled boluses every 10 minutes. Pain and mobility were assessed every 2 hrs. After delivery, length of total infusion and total amount of analgesic solution infused were measured.

Results: Mean hourly analgesic volumes for groups 1, 2 and 3 was 12.3 (SD 3.2), 14.5 (SD 4.9), and 15.7 (SD 4.4), respectively. ANOVA with planned contrasts showed group 1 had significantly less analgesic consumption than group 3 ($p < 0.05$). Mean Verbal Numeric Rating Scale (VNRS) scores at time 0 for groups 1, 2 and 3 were 7.29 (SD 2.1), 7.430 (SD 2.16), 6.36 (SD 2.58), respectively. Following epidural placement, VNRS scores on average ranged from 1 to 4; there was no statistical significance between groups ($p > 0.05$). Median Modified Bromage scores were 0-1 across all times except at 4 hours; group 2 and 3 demonstrated significantly greater motor blockade than group 1 ($p = 0.005$).

Conclusions: This analysis shows no difference in pain scores, requests for supplemental analgesia, or epidural pump delivery/demand data. Mean hourly analgesic volume and modified Bromage scores appear to indicate that an epidural dosing regimen of 4 mL/hr continuous infusion with a 12 mL bolus every 20 minutes may be more effective at reducing the amount of motor blockade and drug consumption while providing comparable analgesia.

A Study of Relationships Among Three Assessment Methods for Nurse Anesthetists

Nicholas W. Gabriel, CRNA, PhD; Bernadette M. Henrichs, CRNA, PhD; Mary A. Blegen, RN, PhD; Susan A. Chapman, RN, PhD

University of California at San Francisco

Introduction: Currently, nurse anesthetists are not required to recertify by performance assessment in a simulated environment. No studies have been published regarding the relationships between written exams, self-assessments, or performance assessment in a simulated environment of nurse anesthetists. This study examined the relationships between written exam scores, self-assessment scores, and performance scores in a simulated environment. By using this assessment format, this study determined if these 3 assessment methods provide similar competency and performance measures of nurse anesthetists.

Methods: The study took place in the simulation lab at the University of California Davis Medical Center. The sample of nurse anesthetists was from area hospitals. Research design was a correlational study. Means, frequencies, inter-item reliabilities, paired sample t-tests, and one-way analysis of variance were used. Reliability was assessed using inter-rater reliability and by calculating the generalizability coefficient based on the 8 scenarios and 2 raters. Correlations with performance, self-assessment, and written exam scores were calculated. Correlation between other study variables was calculated and analyzed.

Results: Data were collected on 18 participants. The mean age was 43.90. Mean years of experience were 8.5 years; prior exposure to simulation comprised 72% of the participants. The mean score for preassessment was 6.50. The 30-item written exam had a mean score overall 67.22. The total mean percentage score of the 8 scenarios was 77.28%. A correlation of .496, with a significance level of $p = .03$, was found between pre/post assessment scores. Poststudy data demonstrated an interrater reliability of .844. No correlations were found among the variables except written exam and performance scores. Age, experience, workplace, and simulation exposure had no correlations with written exam, self-assessment, and performance scores.

Conclusions: The overall findings showed no significant correlations between the written examination, self-assessment, and performance assessment. The only statistically significant correlations found were between written exam and performance scores; and pre/post self-assessment scores. The variables age, workplace, years of experience, and prior exposure to simulation showed no correlation with written examination, self-assessment, and performance scores. Future studies with more participants and scenarios are needed.

Comparative Resuscitative Methods for Venlafaxine Toxicity in a Swine Model

LT Nicole B. Ioset, BSN; CPT Brooke L. Kahl, BSN; CPT Jason P. Aitken, BSN; CPT Abisai Negron, BSN; Don Johnson, RN, PhD; LTC(ret); Joseph O'Sullivan, CRNA, PhD

US Army Graduate Program in Anesthesia Nursing

Introduction: Venlafaxine is a commonly prescribed antidepressant that is associated with a high rate of suicides. Overdose can lead to cardiovascular collapse that is difficult to resuscitate with traditional ACLS protocols. Anecdotal evidence has suggested that lipid emulsion infusion therapy has been successful in the treatment of antidepressant overdose. No studies have determined the optimal combination of lipid rescue and ACLS therapy for treatment of antidepressant overdose.

Methods: This study was a prospective, experimental, between subjects design, with a swine model investigating the effectiveness of drug combinations administered with CPR. Subjects were randomly assigned to 1 of 8 groups containing 7 subjects. The groups tested were: CPR only and CPR with the following drug combinations: epinephrine alone, vasopressin alone, lipid alone, epinephrine and vasopressin, epinephrine and lipid, vasopressin and lipid, and epinephrine, vasopressin, and lipid.

Results: The group yielding the greatest survivability was the combination of lipid emulsion with vasopressin, with 5 subjects out of 7 surviving. The utilization of vasopressin alone yielded a survivability of 4 subjects. Epinephrine alone had 3 subjects survive. There was no difference between the remaining groups (epinephrine and vasopressin, epinephrine and lipid, vasopressin and lipid) each having 2 survive. Epinephrine, vasopressin and lipid emulsion group had the poorest outcome where all 7 subjects expired.

Conclusions: Based on the results of this study, it might be wise to use lipid emulsion and vasopressin as the ACLS protocol when treating venlafaxine overdose since this combination was effective 71% of the time when treating overdose.

Source of Funding: Financial grant from Tri-Service Nursing Research Program, Bethesda, Maryland.

Development of a Traumatic Brain Injury Assessment Score Using Novel Biomarkers Discovered Through Autoimmune Profiling

John E. Buonora, CRNA, PhD; Michael Mousseau, BA; Lawrence Latour, PhD; Ramon Diaz-Arrastia, MD, PhD; Harvey Pollard, MD, PhD; Sandro B. Rizoli, MD, PhD; Andrew J. Baker, MD; Shawn G. Rhind, PhD; Gregory P. Mueller, PhD

US Army Graduate Program in Anesthesia Nursing

Introduction: At present, there is no effective method to objectively assess mild traumatic brain injury (mTBI). The underlying hypothesis for this investigation was that brain-specific autoantibodies can be used to identify proteins that will serve as circulating biomarkers for the assessment of mTBI. The goals of this research were to identify novel brain proteins targeted by TBI-induced autoantibodies and to determine if these proteins contribute to a circulating biomarker signature useful in the diagnosis and assessment of mTBI.

Methods: Patient blood samples were from 2 separate ongoing studies (cohort 1: mild to moderate; cohort 2: moderate to severe). Subjects were adults admitted to an emergency room with a diagnosis of head injury. Admission plasma samples were obtained from cohort 1 (n = 154) and 2 to 7 days postinjury. Cohort 2 (n = 106) had plasma samples obtained at admission, 6, 12, and 24 hours postinjury. Immunosorbent electrochemiluminescent assays were developed for 2 of the novel biomarker proteins (peroxiredoxin 6, cyclin-dependent kinase 5) and 6 established neuropathology biomarkers. Study samples were interrogated against the newly established panel of biomarkers.

Results: The mean plasma values of 5 of the candidate TBI biomarker proteins in cohort 1 (mild/mod) were significantly ($p = <0.03$ to <0.0001) elevated at both admission and 2 to 7 days postinjury compared with controls. The mean plasma values of 5 of the candidate TBI biomarker proteins in cohort 2 (moderate/severe) were significantly ($p = <0.01$ to <0.001) elevated at admission, 6, and 12 hours postinjury compared with controls. The summation of the fold-changes observed in the plasma levels of 5 biomarkers differentiated control samples from both the mild to moderate cohort and the moderate to severe, with scores of 5, 17, and 32, respectively.

Conclusions: This research has 2 major outcomes that are medically relevant in the mTBI research. First, it demonstrates that autoimmune profiling can be used to identify novel biomarkers for TBI. Second, this investigation demonstrates for the first time that a profile of biomarker responses can form the basis for a diagnostic assessment score that is sensitive for the detection of mTBI and can be standardized across clinical settings.

Source of Funding: TriService Nursing Research Program, Center for Neuroscience and Regenerative Medicine, Defense Medical Research and Development Program, and Uniformed Services University of Health Sciences.

Differential Expression of Phosphorylated Mitogen-Activated Protein Kinase (pMAPK) in the Lateral Amygdala of Mice Selectively Bred for High and Low Fear

Jennifer L. Coyner, CRNA, PhD; Jennifer L. McGuire, PhD; Robert J. Ursano, MD, PhD; Clarissa Parker, PhD; Abraham Palmer, PhD; Luke R. Johnson, PhD

US Army Graduate Program in Anesthesia Nursing

Introduction: Posttraumatic stress disorder (PTSD) is a medical condition affecting military and civilian populations. While its etiology remains poorly understood, PTSD is characterized by high and prolonged fear response. A known requirement for the long-term storage of fear memory is the phosphorylation of mitogen-activated protein kinase (pMAPK) in the lateral amygdala (LA), a subnucleus of the amygdala. One important biological unknown is whether individuals expressing high or low conditioned fear memory consolidate the memory differently. A strategy for investigating this question is to examine the regional expression of pMAPK in the amygdala in animals that exhibit high and low fear.

Methods: Using a mouse model selectively bred to exhibit high and low fear, we used Pavlovian fear conditioning to examine pMAPK expression in the LA in these divergent lines of mice. Then, using immunohistochemistry, we quantified pMAPK-expressing neurons in the LA at baseline and at 1 hour following fear conditioning. We then used a selective inhibitor of the phosphorylation of MAPK prior to fear conditioning and examined its effects on fear memory strength and the quantity of pMAPK-expressing neurons in the dorsolateral amygdala (LAd).

Results: Data indicate that following Pavlovian fear conditioning, high fear mice have more pMAPK-expressing neurons in the LAd, a discrete subregion of the LA. Pharmacologic inhibition of pMAPK reduces contextual and cued fear memory in high fear mice and reduces contextual but not cued fear memory in low fear mice. Additionally, we found a dramatic decrease in pMAPK-expressing neurons in the LAd of high fear mice in which MAPK phosphorylation was pharmacologically inhibited.

Conclusions: These data suggest that reduced fear memory strength is due in part to decreased pMAPK in the LAd. Our findings suggest that increased plasticity in the LAd, a discrete subregion of the lateral amygdala, is a component of higher conditioned fear responses. This begins to explain at the cellular level how different fear responders may encode fear memories differently. Ultimately, this understanding may help to identify novel ways for both identifying and treating individuals who have developed fear-related disorders such as PTSD.

Source of Funding: This research was funded by a Tri-Service Nursing Research Program Graduate Research Award and was conducted exclusively at the Uniformed Services University.

Effects of Intraosseous and Intravenous Administration of Hextend on Time of Administration and Hemodynamics in a Swine Model

James Dial, RN, MSN; Jake Ard, BSN; Timothy Yourk, BSN; Ellen Burke, BSN; Craig Paine, BSN; Brian Gegel, CRNA, DNAP; James Burgert, CRNA, DNAP; Don Johnson, RN, PhD

US Army Graduate Program in Anesthesia Nursing

Introduction: Hemorrhage is the leading cause of death in military and civilian trauma. Rapid vascular access is essential for resuscitation. Vascular access is difficult and very time consuming for patients in shock. Many civilian experts and the military recommend that a 500-mL bolus of Hextend be administered via an intravenous (IV) 18-gauge needle or via an intraosseous (IO) needle as an initial treatment for patients in hypovolemic shock. The purposes of this study were to compare the time of administration of Hextend and the hemodynamics of IV and IO routes in a class II hemorrhage swine model.

Methods: This was a prospective, experimental study. Adult swine were assigned to humerus IO (n = 9), IV (n = 9), and control group (n = 9). Swine were anesthetized, and 30% of their blood volume (class II hemorrhage) was exsanguinated. Vital signs and hemodynamic data were collected before and after the hemorrhage. After the hemorrhage, 500 mL of Hextend was administered via either the IO humerus or IV route with the aid of a pneumatic pressure bag at 300 mm Hg. The control group received the same treatment with the exception of Hextend administration. Data were then collected every 2 minutes.

Results: Multivariate analysis of variance (MANOVA) showed no significant differences in the groups relative to blood volume, hemodynamics, vital signs, end tidal carbon dioxide, weight, or the amount of hemorrhage ($p > 0.05$) indicating the groups were equivalent on these parameters. There was no significant differences in the time to administer Hextend for the IO group (8 minutes, 57 seconds), and IV group (9 minutes, 53 seconds) ($p = .78$). A Repeated MANOVA indicated there were no significant differences between the IV and control and the IO and control ($p > 0.05$), but there were significant differences between both the IO and IV compared with the control relative to vital signs and hemodynamics ($p < 0.05$).

Conclusions: We found no significant difference in hemodynamics and vital signs between the IO and IV routes of administration, but there were differences between IO and IV versus control groups. The IO was faster than the IV route. Therefore, IO is an appropriate option for administration of Hextend to patients in shock.

Effects of L-theanine on Posttraumatic Stress Disorder Induced Changes in Rat Brain Gene Expression

CPT Robert J. Edwards, BSN; CPT William L. Townsend, BSN; MAJ Stephanie K. Martinson, BSN; MAJ Jason C. Washington, BSN; CPT Robert S. Revels, BSN; CPT Jessica M. Wojcicki, BSN; CPT Damali A. Crawford, BSN; CPT Joshua L. Kemper, BSN; CPT Geno M. Herron, BSN; CPT Bethany Rankin, BSN; George A. Ceremuga, BS; Gina Padron, BS; MAJ Michael W. Bentley, CRNA, PhD, MSN; COL(ret); Tomás E. Ceremuga, CRNA, PhD, MSN

US Army Graduate Program in Anesthesia Nursing

Introduction: Posttraumatic stress disorder (PTSD) is characterized by the occurrence of a traumatic event that is beyond the normal range of human experience, i.e., war zone stress. Future PTSD treatment may include medications specifically targeted for the molecular mechanisms of PTSD. In the United States, nearly 1 in 5 adults report taking herbal products to treat illnesses. L-theanine is the amino acid found in green tea primarily responsible for its flavor and relaxation effects. When concomitantly administered with midazolam, L-theanine was shown to have a synergistic anxiolytic effect. There are no studies evaluating the potential therapeutic properties of herbal medications on gene expression in PTSD.

Methods: We evaluated gene expression in PTSD-induced changes in the amygdala and hippocampus of Sprague-Dawley rats. The 80 rats were assigned to PTSD-stressed and nonstressed groups that received either saline, midazolam, L-theanine, or L-theanine + midazolam. Amygdala and hippocampus tissue samples were harvested and sent to SABiosciences for gene analysis using the RT2 Profiler PCR Array. One-way ANOVA was used to detect significant difference between groups in the amygdala and hippocampus.

Results: Eighty-eight genes were investigated in this study. Data analysis showed a number of significant differences in gene expression of specific genes pertaining to neurotransmitter systems in both the hippocampus and amygdala. Of the 88 genes examined, 17 had a large effect size greater than 0.138. Of these, 3 genes in the hippocampus and 5 genes in the amygdala were considered to be significant ($p < 0.05$) between the groups.

Conclusions: RT-PCR analysis revealed significant changes between groups in several genes implicated in a variety of disorders ranging from PTSD, anxiety, mood disorders, and substance dependence. This study lays the foundation for future studies to interrogate and investigate the translation of these genes into proteins and the potential for these proteins to act as sites for pharmacologic therapeutic intervention.

Source of Funding: This study is funded by TriService Nursing Research Program and was conducted at the US Army Institute of Surgical Research.

Effects of the ResQPod on Maximum Concentration and Time to Maximum Concentration of Epinephrine in a Porcine Cardiac Arrest Model

CPT Jason Brzuchalski, RN, BSN; MAJ Maxwell Hernandez, RN, MS; CPT Jacqueline Rushton, RN, BSN; CPT Jessica Stone, RN, BSN; CPT Libby Beck, RN, BSN; Sabine Johnson, MS; Michael Loughren, CRNA, PhD; Don Johnson, RN, PhD

US Army Graduate Program in Anesthesia Nursing

Introduction: The ResQPod, an impedance threshold device (ITD), was developed to augment cardiac output during cardiopulmonary resuscitation (CPR). If an ITD used with CPR does increase venous return and cardiac output, then the use of such a device should increase the maximum concentration (C_{max}) of epinephrine in the plasma and decrease the time to maximum concentration (T_{max}). The purpose of this study was to determine the effect of the ResQPod on kinetics of epinephrine in swine undergoing CPR for cardiac arrest.

Methods: This was a prospective, experimental design. Twelve swine were randomly assigned to 1 of 2 groups: CPR with the ResQPod and CPR without the use of the ResQPod. Pigs were administered potassium chloride by intravenous (IV) route to achieve cardiac arrest. Pigs were allowed to stay in arrest for 2 minutes. After 2 minutes of CPR, epinephrine was administered by IV push. Blood samples were collected at 0, 0.5, 1, 1.5, 2, 2.5, 3, 4, 5, 7.5, and 10 minutes after the injection of epinephrine. The analysis of epinephrine in the plasma was performed by the high performance liquid chromatography.

Results: A multivariate analysis of variance indicated that there were no significant differences in the 2 groups relative to the preintervention data (heart rate, arterial blood pressure, cardiac output, stroke volume, size, and mean arterial pressure) ($p > 0.05$) indicating the groups were equivalent on those parameters. The C_{max} with the ResQPod group was less compared with the group without the ResQPod. However, there were no statistically significant differences between the groups relative to either C_{max} and/or T_{max} ($p=0.276$).

Conclusions: If the ResQPod enhanced delivery of epinephrine to the central circulatory system during CPR, the device would increase venous return and cardiac output. This in turn would decrease the time to maximum plasma concentration of the circulating epinephrine. It should enhance delivery of drug from the periphery more effectively and increase plasma concentrations. However, enhanced cardiac output would also increase distribution resulting in lower plasma concentrations. Also, it would increase liver blood flow, thereby increasing metabolism resulting in lower plasma levels of the parent drug.

Source of Funding: TriService Nursing Research.

Pharmacokinetic and Analgesic Properties of Inhaled Remifentanil

Tatjana Bevans, CRNA, MSN; Cassandra Deering-Rice, PhD; Derek Sakata, MD; Chris Reilly, PhD
University of Utah, Departments of Pharmacology and Anesthesiology

Introduction: Anesthesia practice could benefit from availability of a conveniently deliverable, noninvasive, short-acting, highly efficacious, and easily titratable analgesic/sedative. Remifentanil is clinically advantageous due to its rapid elimination profile. Dosing via spontaneous respiration would inherently and safely control duration and level of analgesia via patient minute ventilation. For the first time, patients could benefit from an inhaled opioid for routine, but uncomfortable, clinical procedures.

Methods: Using a whole-body rat exposure chamber, a dose-response relationship was established for inhaled remifentanil. Aerosol concentrations (0-2 mg/mL) were compared using a tail flick meter to objectively measure analgesic response. Fixed exposure time (5 min) was used to quantify the depth of analgesia. Pharmacokinetic analysis was performed to quantitate remifentanil and metabolites in rat blood using liquid chromatography/mass spectrometry. Blood sample esterase activity was immediately ceased by mixing blood with n-butyl chloride, followed by remifentanil and metabolite extraction for analysis.

Results: Inhaled remifentanil produced a dose-dependent increase in analgesia in rats. Statistical difference in pain responses occurred using 500 and 750 mcg/mL aerosol concentrations compared to saline control ($p < 0.01$, $n=4$, ANOVA with Bonferroni's multiple comparison testing). Statistical difference was also found between saline control and 1 and 2 mg/mL ($p < 0.001$, $n=4$). One milligram per milliliter was found to be the dose of maximal analgesic response using the tail flick meter. Onset of action was rapid (2 min) with recovery within 5 minutes after cessation of the aerosol delivery. Remifentanil, the de-esterified metabolite (GI-90291), and the N-dealkylated metabolite (GI-94219) were detectable in rat blood drawn 5 minutes after pulmonary exposure to remifentanil using LC/MS2.

Conclusions: Remifentanil is bioavailable and efficacious via inhalation. Rats achieved maximal analgesia within 2 minutes of a 5-minute exposure period to an aerosol concentration generated from 1 mg/mL solution. Recovery occurred within 3 to 5 minutes after exposure. Remifentanil and metabolites were detectable and quantifiable in rat blood following pulmonary exposure using LC/MS2. Rats appeared unaffected by repeated exposures, as body weights were comparable among control and exposed animals. The animals continued to socialize and behave normally. No deaths or apparent illness occurred. Histology appeared normal.

Source of Funding: Funding graciously provided by Leland O. and Avanelle W. Learned Endowed Professorship in Anesthesiology (through Derek Sakata, MD) and a grant from the Department of Anesthesiology, University of Utah.

Preventive Cosopt for Rising Intraocular Pressure During Steep Trendelenburg Position Surgery

Bonnie L. Molloy, CRNA, PhD, APRN

Bridgeport Anesthesia Associates

Introduction: Elevated intraocular pressure (IOP) and venous congestion during laparoscopic surgery in steep Trendelenburg position (Lap ST) may produce a low perfusion state in the eye leading to ischemic events. The literature cites the importance of early IOP reduction since even brief 30 to 40 minute episodes of acute IOP elevations can lead to retinal cell ganglion (RCG) dysfunction, optic nerve damage, and potential visual loss. The purpose of the study was to evaluate a preventive intervention, dorzolamide/timolol ophthalmic solution (Cosopt®) eye drops, on reducing IOP elevation, in Lap ST procedures.

Methods: A randomized experimental study design was used to test the effect of Cosopt eye drops on reducing IOP during robotic Lap ST surgery. Patients were recruited, consented, and randomized to 2 groups: (1) Cosopt group received 1 drop in each eye after induction and (2) control group received 1 drop of balanced salt solution. Research assistants were blinded as to which solution was administered. IOP levels were measured at baseline (supine position) and every 30 minutes thereafter in Lap ST position. Independent t-test was used to compare IOP levels between the 2 groups at each time point.

Results: A total of 90 patients, 42 males and 48 females, were recruited in the study. Forty-six patients were randomly assigned to the Cosopt intervention group and 44 patients were assigned to the control group. There was no difference in the baseline IOP levels between the 2 groups. Patients' IOP levels were significantly lower in the Cosopt group than the control group at all 30-minute time points measured throughout the surgery. Examples: 120-minute Cosopt: 24.03 ± 6.83 vs control, 30.88 ± 7.59 mm Hg, $p < 0.001$, and 180-minute Cosopt: 26.46 ± 7.98 vs control, 35.00 ± 8.80 mm Hg, $p < 0.05$. Covariates in elevated IOP of both groups were advanced age (> 62) and high BMI (> 35). The effect size of the Cosopt treatment on IOP reduction was medium to large.

Conclusions: Cosopt® drops significantly reduce IOP of patients who undergo lengthy laparoscopic surgery in the ST position when given preventively before the surgery for a 3-hour duration of time. Additionally, Cosopt® treatment is recommended in lengthy, prone, spine procedure patients since incidence of ischemic optic neuropathy has been cited as highest in this population. In summary, indications for use would be all lengthy, head down position procedures with advanced age, high BMI, diabetes, and glaucoma patients being at higher risk of elevated IOP and RCG dysfunction with potentials for visual loss.

Source of Funding: AANA Foundation Postdoctoral Fellowship Grant.

The Effect of Intravenous Acetaminophen on Postoperative Opioid Medication Requirements Following Cesarean Delivery

Rose E. Fontana, BSN; Courtney L. Henderson, BSN

Webster University

Introduction: Cesarean delivery is one of the most common surgeries performed in the United States. Postoperative pain is a major problem facing new mothers that can interfere with mother-infant bonding. Opioids are currently the first line of treatment but have many unwanted adverse effects. A multimodal analgesic approach is an effective method to control pain after cesarean delivery. This study looked at the use of intravenous (IV) acetaminophen as part of a multimodal analgesic regimen to provide better postcesarean pain control. The purpose of this study was to determine if the administration of IV acetaminophen led to a decrease in postcesarean opioid requirements.

Methods: A retrospective analysis of 147 charts was performed. The nonacetaminophen group (n=65) received a multimodal analgesic regimen that included spinal anesthesia with 0.75% bupivacaine, 0.1 mg of intrathecal morphine, and 10 to 15 mcg of intrathecal fentanyl, as well as a transversus abdominis plane block with 20 to 30 mL 0.5% ropivacaine, and IV ketorolac every 6 hours. The acetaminophen group (n=82) received the same protocol with the addition of 1g of IV acetaminophen every 6 hours for the first 24 hours. The subjects' total opioid consumption for the initial 24-hour postoperative period was totaled and converted to IV morphine equivalents. The groups were then compared.

Results: The mean total morphine use for the nonacetaminophen group was 3.33 mg with a standard deviation of 3.72 mg. The mean total morphine use for the acetaminophen group was 3.07 mg with a standard deviation of 4.03 mg. A 1-tailed t-test showed there was no significant difference in the nonacetaminophen group compared with the acetaminophen group (p=0.3456).

Conclusions: Due to the results of this study, Phelps County Regional Medical Center has modified its postcesarean delivery pain management protocol to no longer include IV acetaminophen. A future study to determine the effects of IV ketorolac may provide beneficial results as our incidental findings suggest ketorolac, as a part of a multimodal pain management regimen, does decrease postoperative morphine consumption. Intravenous acetaminophen provides no significant decrease in morphine consumption in the initial 24-hour postoperative period when compared with a nonacetaminophen multimodal pain regimen. Therefore, the null hypothesis was accepted.

The Effect of Ultrasound Guidance and Vessel Transduction on Central Venous Catheter Placement Complications

Jennifer A. Cooley, RN, BSN; Karin M. Langford, RN, BSN; Katherine J. Ojalvo, RN, BSN; Daniel R. Brown, MD, PhD; Daryl J. Kor, MD; Jeff T. Mueller, MD; Gregory A. Wilson, RRT; Darrell R. Schroeder, MS; Mary S. Marienau, CRNA, PhD; Gregory A. Nuttall, MD

Mayo Clinic College of Medicine, School of Health Sciences Master of Nurse Anesthesia

Introduction: In 2011, it was mandated by Mayo Clinic Rochester that ultrasound guidance (USG) and pressure transduction is to be used for all elective internal jugular central lines placed in the operating room by anesthesia personnel. Our clinical experience suggested the hypothesis that the use of USG and pressure transduction decreases complications during central venous catheter (CVC) placement. Several complications are known to be associated with CVC placement. The primary outcome of this retrospective study is to identify changes in patient safety after the institution of this policy.

Methods: Analysis was completed on charts of patients with CVC placement in the operating room at Mayo Clinic Rochester during a 6-year period between 2006 and 2012 who met inclusion criteria. Data was collected from each line form including date, time, site, type of line, observations, ultrasound usage, and occurrence of complications. Additional chart reviews were done to collect patient specific information. Multiple logistic regression analysis included a single observation for each patient, with the dependent variable indicating whether or not the patient had any placement related complication.

Results: A total of 27,933 CVC lines were placed in 22,816 patients. There were 454 placement related complications observed in 445 patients. Female gender ($p=.007$) and high ASA status ($p=.023$) are associated with an increased risk for complications. The use of ultrasound did not result in a statistically significant reduction in complications, but the rate of complications declined as the use of USG increased. Pressure transduction decreased the rate of severe complications ($p=0.009$); there were 20 incidents where transduction prevented arterial dilation. Among patients with internal jugular CVC lines, the rate of thrombotic events was significantly higher ($p=0.008$) for those with multiple (6/3,407) vs single lines (8/17,185) on the same side.

Conclusions: The rate of USG increased from 55.9% in 2006 to 91.4% in 2012; the corresponding rate of complications declined from 2.7% to 0.8%. While not statistically significant, the trend shows improvement in patient safety with the implementation of the policy mandating USG and pressure transduction. The use of transduction reduced the rate of serious complications, which supports the use of transduction for all CVCs placed despite the use of USG. This research demonstrates that routine placement of multiple catheters on a single side should be avoided due to the association with thrombotic events.

The Effects of QuikClot Combat Gauze on Hemorrhage Control in the Presence of Hemodilution and Hypothermia

CPT Sheri Bates, BSN; CPT Sofyia Nukalo, MSN; CPT Amy Staub, BSN; 1LT Aaron Hines, BSN; 1LT Taylor Leishman, BSN; 1LT Jennifer Michel, BSN; 1LT Dusti Sikes, BSN; Brian Gegel, CRNA, DNAP; James Burgert, CRNA, DNAP; Don Johnson, PhD

US Army Graduate Program in Anesthesia Nursing

Introduction: Bleeding is the leading cause of death from trauma. Fluid resuscitation in these patients may cause hemodilution and secondary hemorrhage. Also, hypothermia may interfere with coagulation. Nurse anesthetists may be the most qualified in prevention of hemorrhage particularly in a mass casualty scenario. The purposes of this study were to compare the effectiveness QuikClot Combat Gauze (QCG) to a control group on hemorrhage in a hemodiluted, hypothermic model, and to determine the effects of IV volume resuscitation on rebleeding using an experimental design.

Methods: Swine were assigned to QCG (n = 13) or control (n= 13). Subjects were anesthetized; a temperature of $\leq 34.0^{\circ}\text{C}$ was induced; 30% of their blood volume was exsanguinated. A 3:1 replacement of lactated Ringer's solution was administered. Femoral artery and vein were transected and allowed to bleed for 1 minute. QCG was placed into the wound followed by standard wound packing. The control group underwent the same procedures without QCG. After 30 minutes, blood loss was calculated. For subjects achieving hemostasis, up to 5 liters of IV fluid was administered or until bleeding occurred.

Results: A multivariate analysis of variance determined there were significant differences in hemorrhage over a 5-minute period and the amount of resuscitation fluid administered before rebleeding occurred ($p = .001$). The amount of hemorrhage in the QCG (mean = 30 ± 99) was less compared with the control (mean = 404 ± 406) ($p = .004$). Eleven of the 13 QCG swine had hemostasis compared with 4 of the 13 in the control group. A chi-square test indicated that the QCG group had significantly fewer failures than the control group ($p = 0.018$). Also, the amount of resuscitation fluid administered before rebleeding was significantly more in the QCG group (mean = $4,115 \pm 1,387$ mL) compared to the control group (mean = $846 \pm 1,864$ mL) ($p = .001$).

Conclusions: If the ResQPod enhanced delivery of epinephrine to the central circulatory system during CPR, the device would increase venous return and cardiac output. This in turn would decrease the time to maximum plasma concentration of the circulating epinephrine. It should enhance delivery of drug from the periphery more effectively and increase plasma concentrations. However, enhanced cardiac output would also increase distribution resulting in lower plasma concentrations. Also, it would increase liver blood flow, thereby increasing metabolism resulting in lower plasma levels of the parent drug.

Source of Funding: TriService Research Program.

The Noncompete Clause and the CRNA: An Assessment of Knowledge, Perception, and Experience

Briana K. Meseroll, CRNA, MS, BSN; Nathaniel M. Apatov, CRNA, PhD, MSN, MHS

Old Dominion University

Introduction: Mounting economic pressures on healthcare organizations and the challenge to maintain competitive advantage have resulted in many healthcare entities requiring their practitioners to enter into noncompete clauses (NCCs). Many student nurse anesthetists and practicing CRNAs are unaware of the NCC in employee contracts. CRNAs are often surprised by the implication of signing a noncompete clause could have on their future abilities to successfully advocate for themselves and their profession, in order to best meet the needs of the population they serve.

Methods: This cross-sectional causal comparative study was completed using a nationwide survey distributed to practicing and student nurse anesthetists through an anonymous web-based questionnaire.

Results: Of the 242 practicing CRNAs, 147 (60.7%) were employed without a noncompete clause and surprisingly, over 9% of practicing CRNAs were unaware if they had such provision in their contract for employment. The knowledge level of the nurse anesthetist respondents was remarkably low (average score of 55.3%). There was a significant difference in knowledge level between independent CRNAs and that of group practice CRNAs ($p=0.007$), as well as practicing CRNAs versus student nurse anesthetists ($p=0.006$). Independent CRNAs have had more experience with declining positions, changing positions, and loss of employment due to noncompete clauses. Most CRNAs feel the noncompete clause is not applicable to anesthesia practice.

Conclusions: There is a significant knowledge gap in the nurse anesthesia community surrounding the noncompete clause. Student nurse anesthetists entering the healthcare market and CRNAs who lack the knowledge of NCCs could lead to limitations for future employment or job loss. Business-minded CRNAs who have a practical knowledge of key terms, concepts, and legal implications of NCCs are in a better position to bargain and negotiate against objectionable provisions. Educational programs as well as resources should be developed to better prepare CRNAs to make knowledgeable decisions when signing an NCC.

Source of Funding: Funding for this project was made possible by the Doctoral and Palmer Carrier Fellowships provided by the AANA Foundation.

Evidence-Based Oral Poster Abstracts

A15

A Certified Registered Nurse Anesthetist Policy Brief Identifying Barriers and Solutions for an Opt-Out in Nevada

Phyllis Kantor, CRNA, DNP; Lorraine Jordan, CRNA, PhD, FAAN; Joseph Burkard, CRNA, DNSc
Samuel Merritt University

Introduction: Nurse anesthetists have been giving anesthesia in the United States for nearly 150 years providing safe, high-quality, and cost-effective anesthesia care to 32 million patients each year (AANA, 2013). In some states, CRNAs are the sole anesthesia professionals in 100% of rural hospitals. The availability of CRNAs ensures anesthesia access for thousands of patients in these communities making it more feasible for the community to employ and retain surgical services (AANA, 2013; Skillman et al, 2012). This policy brief explores present barriers to CRNA anesthesia care in rural Nevada that includes geographic barriers and the opposition from the American Society of Anesthesiologists.

Literature Review: Research published in the health policy journal, *Health Affairs*, established that there is “no harm found when nurse anesthetists work without supervision by physicians” (Dulisse and Cromwell, 2010). A Lewin Group study by Hogan et al (2010) published in *Nursing Economic\$* found that nurse anesthesia care is the most cost-effective model for anesthesia services. Furthermore, the Institute of Medicine recommended that APRNs be allowed to practice to the full extent of their education and training to ensure patient access to high quality healthcare, as well as controlling mounting healthcare costs (Institute of Medicine, 2011).

Results: Based on Nevada’s CRNA membership list as of 2012, there were 72 practicing CRNAs in Nevada. The findings of the study indicated that 94% of Nevada’s CRNAs feel qualified to practice without the supervision requirement at 74%. The most common concern echoed among the Nevada CRNA constituency was lack of funds to support a political process that would lead to an opt-out policy, noting that the California Association of Nurse Anesthetists (CANA) spent \$1 million for its legal battles. CANA provided extensive detail of the importance of our national organization and the vital role it plays in assisting state organizations, not only financially but also in the political process on Capitol Hill.

Conclusions: According to Lorraine Jordan, CRNA, PhD, AANA senior director of research, no prior research studies have been undertaken comparing the 17 opt-out states before and after opt-out was sanctioned making this capstone project significant. Future studies on this topic are crucial to clarify the limitations of current knowledge garnered from this capstone project. In order to accurately represent and evaluate the state of affairs for practicing rural CRNAs, it’s essential that their voices be heard. Numerous outcomes studies have demonstrated no significant difference in the quality of anesthesia care provided between CRNAs and anesthesiologists, consequently practice barriers ought to be eliminated.

Source of Funding: Tuition funding was obtained from the primary researcher’s employment with UnitedHealth Group/Southwest Medical Associates in the amount of \$11,000. In addition, federal political director’s expenses are provided when attending meetings associated with the AANA Health Policy and Advocacy efforts in Washington, DC.

Student Registered Nurse Anesthetists: The Impact of Structured High-Fidelity Simulation on Anesthesia Ready Time

Michele M. Ballister, CRNA, DNP

Medical University of South Carolina

Introduction: Students attending the Anesthesia For Nurses (AFN) Program at a large academic medical center are limited in their clinical training experiences. This is due to the nonresearched perspectives of local anesthesia departments that new clinical students decrease operating room (OR) efficiency because they require too much instruction.

Literature Review: In accordance with the Iowa Model of Evidence-Based Practice to Promote Quality Care, a 6-week structured high-fidelity simulation (HFS) program was inserted into the current AFN curriculum for the class of 2014 prior to students' first clinical rotation. The structured course promoted basic anesthesia skill proficiency through the assimilation of previously taught and tested skills: anesthesia machine check, medication preparation, airway equipment preparation, and anesthesia induction.

Results: The Anesthesia Ready Time (ART), the time the anesthesia providers declared that the surgical team may begin the procedure, was noted in the electronic medical record for every surgical case. Using this timestamp, the elapsed time in minutes from when a patient entered the OR and the ART was calculated to compare clinical performance of the class of 2014 to the class of 2013 at the same point within the training program. It was anticipated that structured HFS would decrease the elapsed time and therefore provide a foundation to counter the argument that new anesthesia students negatively impact OR efficiency. The mean elapsed ART for both groups was between 10 and 30 minutes.

Conclusions: While structured HFS did not impact student anesthetist ARTs, results indicated that student performance was within the standard operating procedure for the OR at a level I trauma center.

Research General Poster Abstract

A17

A Comparison Between 18-Gauge Blunt Fill Needle, 18-Gauge Beveled Needle, and Blunt Plastic Cannula Access Device on Potential Rubber Stopper Coring Contamination

Amy Calcote, RN, BSN; Racheal Davis, RN, BSN; W. Patrick Monaghan, PhD, CLS, SBB; Debran L. Harmon, CRNA, MSN; Radha Pyati, PhD

University of North Florida

Introduction: Medications used in anesthetic practice are supplied in glass/plastic medication vials with rubber stoppers that are penetrated to aspirate the contents. Coring is when a portion of the rubber stopper is sheared off as the needle is inserted (Chaudhry and Serdiuk, 2013). In 2010, Heitz and Bader found that coring could potentially lead to inflammatory processes, embolization, and latex sensitization. The purpose of this study is to compare the amount of coring observed when using each access devices. An objective FlowCAM measures the amount and size of rubber particles injected into the vial.

Methods: The supplies used included a FlowCAM digital imaging particle analyzer/flow cytometer equipped with a 4x microscope objective and 300-micron flow cell. Sterile 20-mL samples of preservative free 0.9% sodium chloride vials, with a core made of gray butyl rubber, were used in the experiments. Three separate groups of 10 samples each were assessed for macroscopic and microscopic cored particles. Particle counts were performed and pictures were recorded with the Visual Spreadsheet Software used in conjunction with the FlowCAM actions.

Results: A total of 30 trials were performed. Each of the samples revealed particles and were captured by the FlowCAM and recorded with its software. The shape and characteristics of the particulate matter recorded with the FlowCAM were similar to intentional coring of rubber stoppers conducted during a preliminary lab day using macroscopic and microscopic visualization. At this time, final statistics of collected data are being conducted.

Conclusions: This study clearly shows that microscopic rubber particulates are frequently cored from the rubber stopper of medication vials. The subsequent withdrawal of these solutions for intravenous injection may expose patients to being injected with this particulate matter. It is not definitely known what happens in vivo as a result of these particles being introduced intravenously, but one can reason that injection of particulate matter in the intravenous system can put a patient at risk for untoward immunologic reactions.

An Evaluation of CRNA Management of Patients with Cardiac Implantable Electronic Devices

Pamela M. Perkins, RN, BSN

Lourdes University

Introduction: There are a growing number of patients with cardiac implantable electronic devices (CIEDs), which increases the chance that anesthesia providers will encounter them in the perioperative setting. These patients possess a high risk of cardiac arrhythmia, which could prove fatal. The purpose of this project is to determine if anesthesia providers routinely perform in accordance with the recommendations provided in the practice advisory developed by the ASA regarding this patient population.

Methods: A 28-question survey was developed using the ASA recommendations as a guide. The survey was developed with the assistance of the online survey tool, "SurveyMonkey®." Questions were formatted as multiple choice and short answer, and a demographic assessment was included on the survey to identify trends in relationship to the respondents. Prior to deployment of the survey, a small pilot was conducted to determine content validity and reliability. After IRB approval was obtained, the AANA deployed the survey to a random group of 2,000 CRNAs.

Results: Of the 2,000 CRNAs invited, 57 chose to participate in the study, a 2.8% response rate. Demographics revealed the following: (1) CRNAs were from 29 states; (2) The majority were working at either a large urban facility or community hospital; (3) 77% were medically directed; (4) 73% were master's degree prepared; (5) 46% were unfamiliar with the ASA practice advisory regarding CIEDs; (6) 65% were unable to name 3 ways of identifying the type of device implanted; (7) 47% were unable to identify interrogation as the best way to determine device function; (8) 63% of respondents indicated that their facility had some type of guideline in place for management of these patients, with 73% screening for CIEDs in preoperative area; and (9) 1 respondent reported having experienced an adverse CIED event.

Conclusions: The literature indicates it is vital to be able to determine the presence of a device, the type of device, and its function in order to provide the highest level of safety and quality of care for the patient. Based on the responses, there is a knowledge deficit regarding these devices and their management, as well as a need for continuing education. Every attempt was made to find a trend in conjunction with the demographic data, however, no trend exists. The presence or absence of knowledge in this area as well as practice patterns are random and spread throughout the demographic.

Source of Funding: The McKesson Research Grant.

Best Practice Use of the Laryngeal Mask Airway

Diana L. Hathaway, RN, BSN

University of North Florida

Introduction: In the late 1980s, the laryngeal mask airway (LMA) was developed by Dr. Archie Brain and has since been accepted for use as an alternative to mask ventilation, a rescue device after failed intubation, and a conduit for intubation. Although widely used in the medical field, many providers suppose the safe use of the LMA is limited to a 2-hour time frame. The aim of this study was to gather statistical data on whether or not anesthesia providers in a tertiary community hospital follow current evidence-based practice by utilizing the LMA for procedures lasting longer than 2 hours.

Methods: A retrospective review of cases at a tertiary community hospital with patients who underwent orthopedic surgery between December 1, 2013 and January 31, 2014 was completed. Two groups were identified for this study, those who received an LMA as an airway device, and those who did not. After differentiating these groups, utilizing the inclusion and exclusion criteria for use of an LMA, the patients who were eligible for use of the LMA, but did not receive it, will be identified.

Results: Of the 89 patients who underwent orthopedic surgery between the dates of December 1, 2013 and January 31, 2014, 53 of them met study criteria. Of these 53 patients, 21 of them were intubated with an ETT and 32 received an LMA as an airway device. Of the patients intubated with an ETT, only 3 patients (14%) met the exclusion criteria to not receive an LMA. There was a noteworthy difference between the amount of patients who did not meet exclusion criteria but were still intubated ($p < 0.024$). There was also a significant difference noted between the surgical times in the ETT vs the LMA patients ($p > 0.001$).

Conclusions: Preliminary results of this study indicate that while patients may fit the inclusion criteria for an LMA, the airway was managed with an endotracheal tube instead. The results of this study highlight how even though anesthesia is an evidence-based practice, it appears many providers may not utilize the evidence regarding the best practice utilization of the LMA.

Changes in Red Blood Cell Transfusion Practice During the Past 2 Decades: A Retrospective Analysis of Adult Hip Fracture Patients

Craig T. Ailts, RN, BSN; Andrea N. Berube, RN, BSN; Jackie M. Materi, RN, BSN; Tiffany M. Thornton, RN, BSN

Mayo Clinic College of Medicine, School of Health Sciences Master of Nurse Anesthesia

Introduction: In the United States, nearly 14 million units of red blood cells (RBCs) are transfused annually. Allogeneic blood transfusion carries the risk of hemolytic, allergic or febrile reactions; immunomodulation; and transmission of infectious microorganisms. There is a practice trend toward fewer RBC transfusions, a lower transfusion trigger, and a lower dismissal hemoglobin. We hypothesized patients undergoing surgical treatment of hip fractures would receive fewer RBCs, have a lower transfusion trigger, a lower mean discharge hemoglobin, and no statistically significant difference in morbidity and mortality.

Methods: After Mayo Clinic IRB approval, adult patients undergoing surgical repair of a hip fracture were identified from Mayo's database. A retrospective chart review was completed. Patients were stratified into 2 epochs: 1980 to 1985 (early, n=302) or 2008 to 2013 (recent, n=301). Baseline patient and procedural characteristics were compared between epochs using chi-square or Fisher exact tests for nominal variables and rank sum test for continuous variables. These methods were used to compare postoperative outcomes between the 2 epochs. Two-tailed $p < 0.05$ was considered statistically significant.

Results: Statistical data provided sufficient evidence to reject the null hypothesis. Over time, allogeneic RBC administration significantly decreased ($p < 0.05$). Patients in the recent practice group were older, had greater numbers of preoperative coexisting diseases (i.e., hypertension, coronary artery disease, diabetes mellitus, renal disease, and respiratory dysfunction), a lower transfusion trigger and a lower dismissal hemoglobin concentration ($p < 0.01$ for each variable). In the recent practice group, perioperative hemoglobin concentrations were significantly lower than the early practice group, yet no significant difference in major morbidity or mortality was observed.

Conclusions: In this retrospective analysis, significantly lower acceptable perioperative hemoglobin concentrations were observed in older patients despite having substantially worse baseline comorbidity. The early practice group received a disproportionately larger quantity of allogeneic RBCs, yet no significant difference was found in perioperative morbidity and mortality.

Source of Funding: This work was supported by the Department of Anesthesiology with no direct financial support.

Comparison of Endotracheal Cardiac Output Monitor to Thermodilution Under Hemorrhagic and Hypothermic Conditions

Maureen P. Reilly, CRNA, PhD; Normalynn Garrett, CRNA, PhD; Marthe J. Moseley, RN, PhD
South Texas Veterans Health Care System

Introduction: While resuscitation methods remain controversial, maintenance of an airway and hemodynamic stability influences the overall outcome of an injured individual. The pulmonary artery catheter (PAC) is the gold standard for determination of vascular volume status, but its use is often limited. Remote locations pose a special challenge not only for placement but also the need for peripheral equipment associated with its use. Moreover, complications from insertion may include cardiac arrest. The purpose of this study was to determine agreement of the CONMED endotracheal cardiac output monitor to the PAC under hemorrhagic and hypothermic conditions.

Methods: After induction of anesthesia with midazolam, instrumentation, and 10-minute stabilization, animals were hemorrhaged to a mean arterial pressure of 30 mm Hg. Cardiac output and mean pulmonary artery pressure (MPAP) measurements were recorded under hemorrhagic conditions for 3 hours. Animals were then subjected to hypothermic conditions (mean temperature, 34.10°C) and the same measurements taken. For all experiments, anesthesia was maintained with isoflurane in air by a CRNA so as to mitigate the influence of anesthesia on outcome measures.

Results: Power analysis (G*Power 3.1) suggested 8 animals would be sufficient for comparisons. Bland-Altman plots were constructed (SAS) including computation of plot differences, bivariate regression calculations, and percentage error. Excellent agreement was found for MPAP ($R > 0.9$), suggesting that the endotracheal cardiac output monitor (ECOM) is an acceptable tool for measuring MPAP. Fair agreement was found for CO under hemorrhagic conditions but no agreement under hypothermic conditions. Whereas ECOM produced reliable readings throughout temperature changes, thermodilution cardiac output values became increasingly variable as the temperature decreased.

Conclusions: The results suggest that the ECOM may be an acceptable apparatus for measuring MPAP, especially under austere conditions where endotracheal intubation is easily accomplished. The lack of agreement regarding CO values under hypothermic conditions may have occurred because thermodilution technique requires a temperature difference to calculate CO and assumes temperature in the aorta is stable. Under hypothermic conditions this may not be true. We plan to compare the ECOM with the more commonly used continuous cardiac output monitoring devices next.

Source of Funding: This study was funded by the CONMED Corporation, Utica, New York, and the 59th Clinical Research Division, Lackland Air Force Base, Texas.

Comparison of Multimodal Pain Regimens After Cesarean Delivery

Elizabeth A. Dixon, RN, BSN; Kristen E. Gregory, RN, BSN; Lisa M. Guerrini, RN, BSN; Kyle D. Jennings, RN, BSN; Edilberto Moreno, MD; Ahmed Abdelaziz, MD

University of Michigan-Flint/Hurley Medical Center

Introduction: Analgesia after cesarean delivery is important to facilitate maternal care of the neonate. Factors associated with improved recovery times are enhanced pain control, early ambulation, and early return of bowel function. The authors hypothesized that optimizing a successful pain regimen through scheduled administration of intravenous (IV) acetaminophen as an adjunct to a narcotic subarachnoid block (SAB) will provide improved postoperative outcomes compared with a pain regimen consisting of a nonnarcotic SAB, ketorolac, and postoperative morphine patient controlled analgesia (PCA).

Methods: The study was conducted using a prospective chart review with subjects divided into 2 groups. Group 1 received a multimodal pain control regimen including a nonnarcotic SAB, ketorolac administration, and morphine PCA. Group 2 received a narcotic SAB and IV acetaminophen every 6 hours during the initial 24-hour postoperative period. Measured outcomes included patient reported pain levels that were recorded every 6 hours for the first 24 hours, return of bowel function, and time to initial ambulation.

Results: No statistically significant differences were noted between the 2 groups in: trend in pain over the first 24 hours ($p=0.687$), pain at 24 hours (5 ± 3.6 vs 4.3 ± 4.2 ; $p=0.781$), time to return of bowel function (median hours 19.8 ± 2.8 vs 22 ± 5.3 ; $p=0.413$), or time to initial ambulation (median hours 14.8 ± 6.1 vs 8.5 ± 0.8 ; $p=0.209$). Group 2 had significantly lower pain scores during initial ambulation (5 ± 2.9 vs $0.3 \pm .5$; $p=0.02$).

Conclusions: No significant differences were noted in the trend in pain over 24 hours, pain at 24 hours, or time to return of bowel function. There is an apparent trend toward decreased time to ambulation for group 2, who received a narcotic SAB and IV acetaminophen. A significant difference exists in pain on initial ambulation, with lower pain scores exhibited in group 2. Additional research, particularly with an increased sample size, is required for further evaluation of the potential differences in multimodal pain control methods.

Compliance of Safety IV Catheter Usage Among Anesthesia Providers for Venous Cannulation Following Didactic and Hands-On Experience: A Comparative Survey

Klinton R. Stephens, RN, BSN; Lauren E. DeLuca, RN, BSN; Sabrina L. Duda, RN, BSN; Marlea A. Judd, CRNA, DNP; Mary E. Shirk Marienau, CRNA, PhD

Mayo Clinic College of Medicine, School of Health Sciences Master of Nurse Anesthesia

Introduction: Needlestick injuries remain an ongoing problem despite the implementation of safety intravenous (IV) catheters. The purpose of this study was to explore current knowledge and usage of safety IV catheters among Mayo Clinic College of Medicine Master of Nurse Anesthesia students and Core Clinical Educator Group members. The ultimate goal of this study was to increase usage of safety IV catheters among nurse anesthesia students and core educators, which is anticipated to reduce the incidence of needlestick injuries and diminish the risk of associated blood-borne infections.

Methods: Safety needle use surveys were sent out to 80 participants via RedCap. Face-to-face education sessions were held with respondents. Each session included a PowerPoint presentation, which discussed needlestick literature and anesthesia providers' needlestick statistics. Brands of safety IVs were showcased for hands-on trial on mannequin arms. Following the education session, preferred features and brands of safety IVs were identified via a survey. Shortly after the education session, a RedCap survey was sent to participants to assess changes in personal biases and types of needles used in practice.

Results: Preeducation education survey results included 53 responses (19 CRNAs, 34 SRNAs). The posteducation survey resulted in 54 responses (19 CRNAs, 35 SRNAs), which included 2 partial completions. The response rate for the surveys was 66.25% (preeducation) and 67.5% (posteducation), respectively. According to preeducation survey results, SRNAs were more likely to use a safety IV catheter ($p=0.0094$) and were more comfortable with their use ($p=0.035$) compared with CRNAs. Of attendees at the educational session, 95.3% found the product trials either "helpful" or "very helpful." Of these same attendees, 83.1% also stated that they would be "very likely" or "quite likely" to use one of the safety catheter products, if it were available for use.

Conclusions: The preeducation survey identified current use, encouragement to use, and knowledge anesthesia providers have regarding safety IVs at our institution. The educational/hands-on session was well attended by research participants and others, resulting in increased exposure to use of safety needles, awareness of the importance of their use, and leadership support for use. Based on the education/hands-on survey, 2 safety IVs were identified for clinical trials. As a result of this study, anesthesia leadership has implemented additional measures to promote increased use of safety IV catheters.

Source of Funding: This work was supported by the Division of Anesthesiology, Mayo Clinic College of Medicine with no direct financial support.

Cricoid Pressure: Are Providers Doing it Right?

Samuel T. Floyd, RN, BSN; Michele L. Woodrum, RN, MSN; Gerard T. Hogan, CRNA, DNSc; Patrick Monaghan, Ph.D, CLS, SBB

University of North Florida

Introduction: Cricoid pressure (CP) for rapid sequence induction (RSI) remains a standard of anesthesia care. There is much controversy over the appropriateness of this maneuver. This research study seeks to discover whether practitioners are administering an appropriate level of force consistent with current recommendations.

Methods: All anesthesia providers at the Florida Association of Nurse Anesthetists (FANA) spring conference in February 2014 were asked to participate in a brief survey that culminated in the administration of CP on the CP Trainer Mannequin. These mannequins registered the force applied by all participants in newtons (N) with the results being blinded to the participant. Participants included student registered nurse anesthetists (SRNAs), Certified Registered Nurse Anesthetists (CRNAs), and anesthesiologists.

Results: Study sample size was 100 participants and included all actively practicing anesthesia personnel. Statistical analysis revealed that upon the first and second administration of CP approximately 71% of participants were well below the recommended parameters of 30 N. It was discovered that level of anesthesia experience had no statistical significance. In addition to this, formal training appeared to have no statistical significance in administration of correct CP. While we found that practitioners regularly applied inappropriate CP, there was significant consistency within provider application. There appeared to be no relationship between the number of times individual providers had applied CP in practice and accuracy during this study.

Conclusions: This study appears to show that the majority of anesthesia providers are not consistent in their performance of CP. These findings suggest that ongoing education is needed in order to increase the level of efficacious use of CP by current anesthesia providers.

CRNAs' Knowledge of Postoperative Nausea and Vomiting Guidelines

Tracy A. Johnson, RN, BSN

Lourdes University Nurse Anesthesia Program

Introduction: In the United States, 80 million surgical procedures are performed each year and the potential risk for postoperative nausea and vomiting (PONV) is at least 30% of this population. Untreated PONV can affect up to 80% of this at-risk group. PONV is one of the most common complications of anesthesia and only second to the complaint of postoperative pain. However, the practice of anesthesia varies as does the availability of the most effective antiemetics due to consistent drug shortages throughout the country.

Methods: After Lourdes University IRB approval, a pilot email survey was sent to approximately 60 CRNAs at an area hospital system. The pilot provided validity and reliability and also provided the initial raw data for this project. The survey was designed to evaluate CRNAs' current knowledge and practice as it relates to the American Society of Anesthesia (ASA) Guidelines for PONV prevention. The 23-question survey tool developed via Survey Monkey consisted of demographics that focused on knowledge of the ASA's PONV guidelines, evaluation of high-risk patients, use of multimodal therapy, and nonpharmacologic therapies to decrease PONV risks prior to exposure of anesthetic.

Results: The email survey was sent to 2,500 random CRNAs from the AANA members list. Of those, 148 responded to the survey. The data indicates that 36.7% of the CRNAs surveyed are not familiar with PONV guidelines. There was no significant correlation between the knowledge deficit and any demographic factor asked in the survey. A percentage of 20.9% of the CRNAs who responded indicated that they never follow PONV guidelines. Seventy percent of the CRNAs surveyed are master's degree prepared CRNAs. A percentage of 29.9% of the CRNAs surveyed have been practicing for 20 years or greater. Twenty percent have been practicing for < 5 years.

Conclusions: A review of the literature indicates PONV can affect up to 80% of the surgical population. Not treating this population leads to poor patient outcomes, prolonged hospital stays, and increased medical costs. PONV is one of the most common complications of anesthesia, second only to the complaint of postoperative pain. The survey results showed a lack of practitioner knowledge for PONV guidelines, indicating that further practitioner education could improve PONV rates. The next step would be to develop an educational tool based on the guidelines and the practitioners' deficits, piloting it to a small group of CRNAs to evaluate the effectiveness of the tool.

Source of Funding: The funding for this project is from the McKesson Research Grant Awards from Lourdes University College of Nursing, which supported the development of the survey tool, as well as the development and printing of the final poster presentation.

DNR in the Perioperative Setting: Realigning Approach With Patient Rights

Sparkle M. Graham, RN, BSN, Maj., USAF, NC; Chris M. Green, RN, BSN, Capt., USAF, NC; Stacey A. VanDyke, CRNA, DNP, MSN, Maj., USAF, NC

Uniformed Services University

Introduction: Do-not-resuscitate (DNR) status creates challenges in the perioperative setting. The Patient Self Determination Act of 1991 mandates that patients have the right to prepare advance directives. However, the inherent nature of surgery and anesthesia implies the provision of resuscitative measures such as intubation, ventilation, and use of vasoactive drugs. Traditionally, DNR status has been suspended during perioperative care. In 1993 the American Society of Anesthesiologists (ASA) developed practice guidelines called '*required reconsideration*' to address this ethical quandary. To ensure patients' right to self-determination the ASA recommends explicitly discussing options and allowing patients to choose interventions. The objectives of this investigation were to assess perioperative team members' understanding of recommendations, align beliefs with ASA position statements, and ensure protection of patient's rights to self-determination.

Methods: A quasi-experimental test-retest design was used for this project. The convenience sample was comprised of perioperative personnel from an academic medical center. A survey was administered to participants to determine attitudes, beliefs, and practices regarding perioperative DNR orders. Thereafter, the researchers presented current findings and position statements from relevant professional organizations. The same survey was then administered post-presentation and the de-identified data evaluated to determine if perceptions regarding DNR status in the perioperative setting had changed.

Results: Thirty three perioperative clinicians (n=33) returned surveys for inclusion in data analysis. Demographic and DNR knowledge assessment data was entered into IBM SPSS® and paired t-tests completed. Three of ten items regarding perioperative DNR perception and management yielded statistical significance after the educational intervention; DNR should be automatically revoked ($p = 0.001$), every anesthetic should allow clinicians to maximize outcome regardless of preoperative DNR status ($p = 0.05$), and age of initiation of a hypothetical advanced directive was five years prior ($p = 0.02$).

Conclusions: Despite the introduction of '*required reconsideration*' by the ASA to disseminate perioperative DNR management guidelines, results indicated that clinicians were unaware of current recommendations. However, a simple educational intervention successfully aligned clinicians' understanding with appropriate management strategies. Quality care infers patient inclusion in the decision making process which clearly extends to DNR preferences and desires. Logically, the educational intervention from this project should extend beyond this sample and into all settings with a perioperative interest.

Does Low-dose Ondansetron Increase the Risk of Perioperative Polymorphic Ventricular Tachycardia or Death?

Sarah C. Voogd, RN, BSN; Heather M. Wagner, RN, BSN; Gregory A. Nuttall, MD; Mary E.S. Marienau, CRNA, PhD; William C. Oliver, MD; Michael J. Ackerman, MD, PhD

Mayo Clinic College of Medicine, School of Health Sciences Master of Nurse Anesthesia

Introduction: Postoperative nausea and vomiting affects as many as one third of surgical patients and is associated with increased length of hospital stay and decreased patient satisfaction. This potential for increased cost and patient dissatisfaction makes its treatment of interest to anesthesia providers.

Ondansetron is one of the drugs used in the perioperative period for prevention and treatment of nausea and vomiting. The US Food and Drug Administration issued a black box warning regarding the use of ondansetron and the potential to develop polymorphic ventricular tachycardia (torsades de pointes).

Methods: The primary objective of this retrospective study was to determine if ondansetron administration (4 mg) was associated with episodes of polymorphic ventricular tachycardia (PVT) during a 2-year period. The authors identified 121,910 doses of ondansetron given to 70,252 patients in our institution during a 2-year time frame. These patients were cross-matched with an electrocardiogram and adverse outcome database; this identified 4,759 patients with documentation of prolonged QTc (> 450 ms), PVT within 48 hours of receiving ondansetron, or death within 7 days of receiving ondansetron.

Results: Twenty-eight patients had documented monomorphic ventricular tachycardia, and 156 patients died within 48 hours of ondansetron administration. No patients developed PVT or died as a direct result of ondansetron administration. Of the 28 patients with documented ventricular tachycardia, 5 were surgical patients and 23 were medical patients. All ventricular tachycardia events were precipitated by existing cardiovascular disease, acute hypoxemia, acute hemorrhage, or sepsis. Of the 156 patients that died, 42 were surgical patients and 114 were medical patients. All deaths were a direct result of underlying disease.

Conclusions: Our evidence suggests that low-dose ondansetron does not increase the incidence of PVT or death when used to treat nausea and vomiting in medical and surgical patients.

Source of Funding: All data collection was performed by 2 of the coauthors. Statistical analysis was performed with funds from the institution's Center for Clinical and Translational Science.

Effective Ventilation Maneuvers for Obese Patients Undergoing Bariatric Surgeries

Xin Yan Hu, MA, BSN

Lourdes University

Introduction: Over 200,000 bariatric surgeries are performed in the United States each year. Morbidly obese patients present mechanical ventilation-related challenges that may lead to perioperative complications. Pneumoperitoneum associated with laparoscopic bariatric surgeries further complicates the ventilation efforts. Multiple clinical trials have been published investigating effective ventilation maneuvers for this patient population.

Methods: A systematic review of the literature was conducted. Databases including Pubmed, CINAHL, Ovid, and Web of Science Core Collection were systematically searched for clinical trials of ventilation maneuvers for obese patients and bariatric surgeries. A predetermined set of selection criteria was utilized. Selected studies were evaluated using CASP tool. A matrix was developed to present the essential components of the trials. Clinical recommendations are to be made based on the gathered and graded evidence.

Results: Alveolar recruitment maneuver (ARM) is an effective ventilation maneuver for patients undergoing bariatric surgeries. Positive end expiratory pressure (PEEP) should be used to maintain the recruited alveoli. PEEP level of 8 to 12 cm H₂O is effective without causing significant hemodynamic instability. Potential hypotension caused by the ARM and PEEP can be prevented with fluid bolus. There is no evidence in favor of either volume control ventilation or pressure control ventilation during bariatric surgeries. Several ARM methods appear to be effective, but continual clinical investigation is needed regarding the optimal ARM delivery method and the best assessment tool of ARM.

Conclusions: Alveolar recruitment maneuver followed by PEEP is an effective ventilation strategy for patients undergoing bariatric surgeries. Additional research is needed to address the optimal ARM delivery method and the best assessment tool.

Effects of L-Theanine on PTSD-induced Changes in Rat Neurobehavior

Jeremiah Wolfe, BSN; CPT Bryan Ferrara, BSN; Susan Baldwin, BSN; Thomas Onstott, BSN; CPT Ken Aytes, BSN; CPT Mark Alleyn, BSN; CPT Chris Fortner, BSN; George A. Ceremuga, BS; Gina Padron, BS; MAJ Michael Bentley, CRNA, PhD, MSN; Tomás Eduardo Ceremuga, CRNA, PhD

US Army Graduate Program in Anesthesia Nursing

Introduction: Posttraumatic stress disorder (PTSD) is a devastating emotional injury associated with war and devastating events. The symptoms of PTSD are complex and often result in memory loss, nervousness and hypervigilance. No one treatment has been found to be entirely effective. Alternatives to traditional treatment are herbal medications, such as L-Theanine, a major compound in green tea. The purpose of this study was to investigate L-Theanine and its effect on PTSD-induced neurobehavior in the rodent model. The aims were to determine the effects of L-Theanine on anxiety, locomotion, memory, and depression.

Methods: A prospective experimental between groups design was used. Eighty rats were equally divided into 2 groups: nonstressed and PTSD-stressed. They were then subdivided into 4 groups: control, L-Theanine, midazolam, or L-Theanine and midazolam. The behavioral component was evaluated using the elevated plus-maze (EPM), Morris water maze (MWM), and forced swim test (FST) in a restraint/shock stress model. Data analysis was performed using 2-tailed multivariate analysis of variance (MANOVA) and least significant difference (LSD) post hoc tests.

Results: There were significant differences in anxiety between the groups. The PTSD-stressed rat groups had significantly reduced time (mean seconds = 10.52) on the open arms of the EPM demonstrating significant increased anxiety compared with the nonstressed groups (mean seconds = 36.04), $p = .004$. Data regarding weight gain between the 40 control (nonstressed) and 40 PTSD (stressed) rats were significantly different ($p < .001$), where the control rats gained an average of 55.4 grams compared with 37.4 grams for the PTSD rats over the 10 poststress days. This research did not show statistical significance in the forced swim test or Morris water maze with single dose administration of L-Theanine or in combination with midazolam.

Conclusions: While a single dose did not significantly decrease anxiety or enhance memory in the PTSD-stressed rats, the PTSD-stressed model was validated. This study establishes a solid framework for future investigation of PTSD treatments. Future studies of L-Theanine and other herbal therapies may use an extended dosing period to obtain steady state for the period of time needed to alter neurobiology. Further investigation is recommended to evaluate multidose or prophylactic regimens.

Source of Funding: This study was funded by TriService Nursing Research Program and was conducted and supported at the US Army Institute of Surgical Research

Evaluation of a Perioperative Intravenous Insulin Infusion Algorithm (With Guidelines for Conversion From Insulin Pump Delivery)

Tamra Dukatz, CRNA, MSN; Emma Hurst, CRNA, MSN; Mary Golinski, CRNA, PhD; James Van Loon, MS

Beaumont Health System

Introduction: Intravenous insulin infusion (IvII) algorithms developed for glycemic control in intensive care units (ICU) are often used throughout facilities, including perioperatively (perioP). PerioP tight blood glucose (BG) control is rarely advocated due to hypoglycemia risk. A trend-based ICU algorithm that targeted BG at 80 to 140 mg/dL was modified to 140 to 179 mg/dL goal for perioP noncardiac surgery use. Guidelines for converting patients from their own insulin pumps to IvII were added. Our purpose was to evaluate this modified algorithm with insulin pump guidelines for efficacy, safety, and compliance.

Methods: IvII were retrospectively identified from pharmacy list. Subjects converted from insulin pumps were separated from general group for side-by-side analyses. Algorithm BG (140-179 mg/dL) and widened perioP BG (100-179 mg/dL) were target ranges. Efficacy endpoints were % target achievement (BG <180 mg/dL), time-to-target (TtT), proportion of subsequent time in target ranges (mPST), and time-weighted average (TWA) BG mean. BG <70 mg/dL (% subjects), adherence to algorithm initiation (init) and maintenance (mnt) tables and % BG testing intervals <90 minutes (i90m) measured safety and compliance.

Results: In general group (n=132, baseline BG \bar{x} =266.5 mg/dL), 4.5% of subjects presented with and 72.7% achieved BG <180 mg/dL. TtT (\bar{x} =2.8 hours), mPST (.64 [algorithm]; .85 [perioP]) and TWA BG (\bar{x} = 200.9 + 42 mg/dl). BG <70 mg/dl was 1.5% (0<50 mg/dL) and i90m was 93%. Algorithm adherence was 53.8% (init) and 55.6% (mnt). Subjects with >67% mnt adherence (n=44) had lower mean TWA BG (190.0 vs 206.4 mg/dL, p=.03) and lower TtT (NS) than rest (n=88). In insulin pump conversion group (n=19, baseline BG \bar{x} =189.8 mg/dL), 57.9% of subjects presented with and 26.3% achieved BG <180 mg/dL. mPST was .43 (algorithm) and .81 (perioP); TWA BG (\bar{x} =168.0+ 41 mg/dL); i90m (92%); and no BG <70 mg/dL experienced. Adherence was 57.9 % (init) and 55.4% (mnt).

Conclusions: Over 80% of subjects achieved BG <180 mg/dL and 80% of subsequent BG remained in 100 to 179 mg/dL range. No severe hypoglycemia occurred. Post hoc, in general group, closer adherence was associated with improved glycemic control. Low adherence and extended BG testing intervals may have underestimated algorithm efficacy, thus limiting conclusions. In insulin pump conversion group, glycemic control was primarily maintained and is attributed to diabetes nurse practitioner collaboration and the guidelines. Glucometrics and compliance seem similar to those reported for paper-based ICU algorithms.

Examination of Anesthesia Equipment for the Presence of Blood

Valerie W. Aquino, RN, BSN; David Holt, RN, BSN; W. Patrick Monaghan, PhD, CLS, SBB; Joy Elliott, CRNA, BSN

University of North Florida

Introduction: The possible avenues for the spread of bacteria and infectious diseases are abundant in healthcare settings. This potential exists in the operating room with the use of anesthesia equipment that comes in direct contact with multiple patients and anesthesia practitioners, putting both populations at risk for acquiring various bacterial or viral infections. Although more commonly reported to occur through injuries, such as inadvertent needlesticks, contamination through contact with inadequately cleaned anesthesia equipment is less researched and documented. This study was conducted to ascertain the prevalence of occult blood on previously decontaminated anesthesia equipment.

Methods: The incidence of occult blood was assessed utilizing both visual inspection and the forensic phenolphthalein (ISCHAPSTM) blood test. Samples were collected at random times throughout the day in both main operating rooms and outpatient surgery suites in a large urban trauma center. The equipment tested includes pressure cuffs, ECG leads, and pulse oximeter cables.

Results: The number of samples totaled 171 (e.g., 57 samples from each of the 3 pieces of equipment), and the collection occurred at random times over a period of 37 days. The results of our study indicated the random incidence of occult blood present on previously decontaminated anesthesia equipment was approximately 3%. Of the 171 samples taken, only 5 were positive for occult blood. It is interesting to note, however, that 4 of the 5 positive results occurred during the first 2 collection times, and the researchers noted that the equipment appeared to be new during subsequent collection times.

Conclusions: Healthcare-associated infections (HAIs) pose an enormous risk to patients with a concomitant burden of the exaggerated expense on the healthcare system. The presence of occult blood is suggestive of contamination and is a risk factor for the spread of disease. The results of this study indicate the incidence of occult blood on decontaminated anesthesia equipment has decreased from a high of 24% (Cross, Pietan, Monaghan, Kalynych, 2008) to a current 3% at the same institution.

Factors Associated with Prolonged Anesthesia Recovery Following Laparoscopic Bariatric Surgery: A Retrospective Analysis

Toby N. Weingarten, MD; Natasha M. Hawkins, RN, BSN; W. Brian Beam, MD; Heather A. Brandt, RN, BSN; Diana J. Koeppe, RN, BSN; Todd A. Kellogg, MD; Juraj Sprung, MD, PhD

Mayo Clinic

Introduction: Identifying and mitigating potential delays in postanesthesia care is important. Factors associated with prolonged PACU stay were examined. For this study it was hypothesized that postoperative respiratory depression in obese patients with obstructive sleep would be a major component of delayed discharge from the recovery room. The study examined if surgical patients with preoperative obstructive sleep apnea (OSA) have higher rates of postoperative respiratory depression and prolonged postanesthesia recovery. Associations with other clinical and anesthetic variables and prolonged recovery were examined.

Methods: This retrospective chart review studied phase I postanesthesia recovery of patients undergoing laparoscopic bariatric surgery at a major academic tertiary center. Data were abstracted from electronic medical records and entered into a web-based Research Electronic Data Capture (REDCap®) system. Perioperative variables were included in multivariable logistic regression analysis to find associations with prolonged recovery. Additional post hoc analyses were performed. Two-sided tests were used. P values ≤ 0.05 denoted statistical significance. Statistical analyses were performed with JMP Pro 9.0.1.

Results: The study enrolled 788 patients. Prolonged recovery was found in 304 patients. History of hypertension and longer surgical time was associated with prolonged recovery. Use of prophylactic triple antiemetics was associated with < 90 minutes recovery. Respiratory event rates didn't vary between CPAP/BiPAP users and non-users ($P=0.301$). Use of PACU antihypertensives was greater among patients with preexisting hypertension ($P < 0.0001$). Median length of hospital stay was longer in prolonged recovery patients ($P=0.0005$), resulting in higher rates of admission to advanced monitoring ($P=0.0584$). No in-hospital deaths were found. Readmission rates were similar in patients who had recovery in <90 minutes and those with prolonged recovery ($P=0.7566$).

Conclusions: Despite study patients' high rate of OSA, phase I postoperative respiratory depression rates were low in appropriately managed patients and were not associated with prolonged recovery. Most common cause of delayed recovery was nausea/vomiting, which suggests more aggressive antiemetic prophylaxis might reduce postanesthesia recovery time. Preoperative hypertension and the use of postoperative antihypertensives increased the likelihood of delayed discharge from the PACU. Institution-specific protocols, which mandate additional monitoring after use of these medications, may not be observed in other practices.

Source of Funding: This project was supported by the Department of Anesthesiology, Mayo Clinic College of Medicine, Rochester, Minnesota, and NIH/NCRR CTSA Grant Numbers UL1 RR024150 and KL2 RR024151.

Gender Differences in PONV and Pediatric Adenotonsillectomy Patients

Karmella M. Franic Everhart, CRNA, MS; Keri H. Ortega, CRNA, DNAP; Mary Canfield, CRNA, DNAP
Wolford College

Introduction: Postoperative nausea and vomiting (PONV) is a common complication and pediatric patients are no exception. Adenotonsillectomy is a common pediatric surgery and with incidence of PONV occurring more than 50% without treatment. The authors evaluated the evidence of treatment responses for male and female pediatric patients.

Methods: After IRB approval, a retrospective chart review from an ongoing study by Sadhasivam et al was conducted. A total of 356 patients with an American Society of Anesthesiologist (ASA) classification of I or II between 6 and 15 years old were evaluated. The groups consisted of 179 male patients and 177 female patients. Each patient received an intraoperative dose of dexamethasone, 0.5 mg/kg, up to a maximum dose of 12 mg and ondansetron, 0.1 mg/kg, up to a maximum dose of 4 mg. The incidence of PONV in the postanesthesia care unit (PACU) was collected.

Results: Average age in this study was 8.8 (7.1, 11.4) in the female group and 8.4 (7.1, 10.6) in the male group ($P=0.11$). The average weight per kilogram was 34.0 (26.0, 48.7) in the female group and 31.9 (25.0, 43.5) in the male group ($P=0.11$). PONV was higher in the female group with 30 patients or 17% and the male group with 28 patients or 16% ($P=0.74$). These patients required a rescue dose of ondansetron and were discharged on average of 90 minutes. Patients with prolonged PONV requiring longer than 90 minutes in the PACU were also higher in the female group. A total of 13 female patients or 7% compared with 11 male patients or 6% ($P=0.65$).

Conclusions: Despite measures to treat and prevent PONV, it remains a leading cause for a prolonged stay in the PACU or admission. Females continue to have a higher incidence of PONV after adenotonsillectomy compared with males.

Handoff Communication: Interprofessional Standardization of Postprocedural Interactions Between Perioperative Providers

Jennifer Evans, RN, BSN; Henry Talley, CRNA, PhD; Patricia Goorin, CRNA, MSN; Lynn Raynor, RN, MSN, CNOR; Ann Southworth, RN, BSN; Genevieve Kidd, RN, BSN; Barbara McQuillan, RN, MSA, BSN
Michigan State University College of Nursing

Introduction: For perioperative providers, handoffs represent a point of vulnerability in patient care. Insufficient or variable handoffs contribute to errors, care omissions, treatment delays, inefficiencies from repeated work, inappropriate treatment, adverse events with minor or major harm, increased length of stay, avoidable readmissions, and increased costs. According to The Joint Commission, the root cause of 60% of sentinel events are due to breakdown in communication. The purpose of this study was to elicit feedback about perceptions of current patient handoffs among perioperative providers.

Methods: A cross-sectional descriptive correlational design was used. Forty-eight perioperative providers completed a 16-item Likert self-report preintervention survey that was developed for this study using the W. Edwards Deming's plan-do-study-act (PDSA) model. Descriptive statistics were used to examine the data. Spearman correlation coefficient (r_s) was used to assess the relationship between variables.

Results: Eighty-one percent reported that information was left off during handoffs that led to near misses or direct harm to patients; 63% reported that their unit views of important information was different from other units; 81% believed that handoffs could be handled more efficiently; 83% are willing to adopt a standardized method. Participants reported inadequate time for handoffs (27%), interruptions (67%), and having no policy or guidelines (58%).

Conclusions: The absence of vital patient information was associated with near-miss events and the belief that transfer could be accomplished more efficiently. Chronbach Alpha for the survey was 0.84. These findings suggest that handoff communication between perioperative providers is inadequate. There is a need for the development of standardized handoff communications between perioperative providers, which is the next step of this study.

Hemolysis of Erythrocytes During Rapid Transfusion

Brandon J. Taylor, RN, BS; Joshua I. Troyer, RN, BS; W. Patrick Monaghan, PhD, CLS, SBB
University of North Florida

Introduction: Frequently, units of blood need to be transfused rapidly due to blood loss, and often the rate of flow is too slow. The common way in which the rate of flow is increased is with a pressure bag inflated around the unit of blood to 300 mm Hg. The purpose of this research was to determine whether using a large syringe to force the blood into the patient, using the dependent variables of intravenous (IV) catheter size and the amount of force applied to the syringe, would result in hemolysis of the blood sample.

Methods: Human blood was attained from the blood bank to conduct in vitro assessments. A 30-mL syringe was filled with packed red blood cells and injected through 18-, 20-, and 22-gauge catheters. The 16-gauge distal port of a 9 French triple lumen catheter (TLC) was also used. Samples were injected at 20, 40, and 60 newtons. The force of injection was measured using a calibrated force meter. Infused samples were evaluated for hemolysis by osmotic fragility and haptoglobin assessments.

Results: All of the samples tested exhibited some amount of hemolysis. There was a positive correlation between increasing force of injection and degree of hemolysis, while showing an inverse relationship between catheter size and degree of hemolysis. It was observed that injected samples with a higher hematocrit exhibited a greater degree of hemolysis. The samples injected through the 22-gauge catheter unexpectedly showed significantly lower rates of hemolysis than the other assessments. The TLC, despite having the greatest diameter port, demonstrated a greater quantity of hemolysis than the IV catheters.

Conclusions: The results of these experiments show that increasing force, decreasing lumen diameter, and increasing lumen length negatively impact erythrocyte integrity. It is currently recommended to dilute the blood before transfusion. It can be theorized that the 22-gauge catheter hemolyzed blood to a lesser degree in part because of Bernoulli's principle, and because the volume to time ratio was reduced when compared with the other catheters. Further studies using hemodiluted boluses and measuring the amount of time required to inject the bolus may prove beneficial. In light of this, bolusing blood via syringe cannot be recommended.

Hydroxocobalamin Compared With 6% Hydroxyethyl Starch in Lactated Electrolyte Solution for Hemorrhagic Shock Resuscitation at Military Health Systems Level I and II Echelons of Care

Normalynn Garrett, CRNA, PhD; Vikhyat Bebarta, MD; Susan Beaudreau, RN; Maria Castaneda, MS
Clinical Research Emergency Medicine and Toxicology Program

Introduction: We developed a Type III hemorrhagic shock model such that animals are hemorrhaged at a rate of 2.15 mL/kg/min over 7 minutes, and then 1.15 mL/kg/min over 13 minutes. This model provides a consistent 30% blood loss and significantly increases serum lactate, an early indicator of shock, from baseline compared with immediately postbleed. The model was developed to examine the efficacy of hydroxocobalamin (HOC) as a resuscitative fluid against standard of care resuscitative fluids. Level I and II echelons are limited in treatment options because of limited resources. A small volume of HOC may restore systolic blood pressure (SBP) and normalize serum lactate levels.

Methods: Eighteen swine (45-55 kg) were anesthetized, intubated, and instrumented with continuous femoral and pulmonary artery pressure monitoring. After 10 minutes of stabilization, with 1.5% isoflurane in air and oxygen (FIO₂, 0.45), animals were hemorrhaged as described. Five minutes after, hemorrhaged animals were randomly assigned to be administered intravenously (IV) 150 mg/kg HOC solubilized in 180 mL of saline or 500 mL of 6% hydroxyethyl starch in lactated electrolyte solution, military standard of care treatment recommended by the Tactical Combat Casualty Care Guidelines. Following treatment, animals were monitored for 60 minutes.

Results: A sample size of 8 animals per group was determined based on 80% power and an alpha of 0.05 to detect an effect of size of at least 0.25 difference (1 sd) in SBP between groups. Data were analyzed using repeated-measures MANOVA. There were no significant differences between the IV HOC and Hextend^(R) groups at baseline or at shock (HR 94 vs 81 bpm; SBP 47 vs 51 mm Hg; MAP 39 vs 43 mm Hg; SVR 790 vs 949 dyne-sec-cm⁵; lactate 1.2 vs 1.4 mmol/L). Postbleed the repeated-measures MANOVA model detected no significant difference by time between groups ($p > 0.05$). At 60 minutes cardiovascular parameters of HOC vs Hextend^(R) were the following: HR 116 vs 90 bpm; SBP 75 vs 85 mm Hg; and MAP 60 vs 64 mm Hg. By 60 minutes, serum lactate levels were falling in both groups from mean peak at 20 minutes postbleed of 1.43 vs 1.81 mmol/L to 1.36 vs 1.45 mmol/L.

Conclusions: A small volume of IV HOC improved blood pressure and reduced serum lactate as well as intravenous 500 mL of 6% hydroxyethyl starch in lactated electrolyte solution. Because the effective dose of hydroxocobalamin is less than half the volume of the standard of care treatment, it may be a valuable, lightweight, small footprint alternative to the current standard of care treatment.

Source of Funding: The US Air Force Office of the Surgeon General.

Identification of Stressors Among Student Nurse Anesthetists During the First 18 Months of Their Program

Tiffany D. Miller, RN, BSN

Lourdes University

Introduction: Performing in the clinical setting for the student registered nurse anesthetist (SRNA) has been known to be an anxiety-provoking setting that requires the student to function with precision, utilizing acquired knowledge and skill to demonstrate competency. A certain amount of stress is necessary to motivate learning; prolonged or excessive stress, however, can have a detrimental effect on progression through clinical practicum or a nurse anesthesia program. Clinical practicums have been identified as stressful and a vulnerable time period for attrition in nurse anesthesia education.

Methods: Stressors identified through a literature inquiry were used to generate an online quantitative design questionnaire, including questions to elicit demographic information and perceived stressors for SRNAs during their first year in the program. The questionnaire was tested for validity through expert review and reliability through a pilot study. Next, the questionnaire will be administered to a random sample of 2,500 students in nurse anesthesia programs (NAP) around the United States via the AANA data bank. The results from junior students will be reviewed for statistical significance.

Results: Of the 2,500 SRNAs invited to participate in the survey, the response rate was 8.5% (n=212). Responses from 13 participants were from senior students and excluded from data analysis. Demographic results showed the majority of the participants have 1 to 5 years nursing experience (60.8%), are married (55.3%), do not have children (68.3%), and are currently in 7 to 12 months of their program (55.3%). Stressors were divided into 3 main categories: personal, related to clinical practicum, and related to NAP in general. The highest rated stressors were loss of income ($\mu=3.48$, $SD=1.22$) in the personal category, fear of making an error ($\mu=3.71$, $SD=1.05$) in the clinical category, and information overload ($\mu=3.98$, $SD=0.89$) in the general NAP category.

Conclusions: Data gathered from the survey showed high reported stress levels in all 3 of the categories (personal, clinical practicum, general NAP). Success in both the academic and clinical sections of the nurse anesthesia program has been shown to be affected by stress. Evaluation of all aspects of a nurse anesthesia program is imperative to produce competent and confident anesthesia providers. Through exploration of primary stressors identified by SRNAs, future implementation of stress reduction strategies may improve successful progression through clinical practicum and reduce NAP attrition rates.

Source of Funding: McKesson Research Grant through Lourdes University.

Improving Patient Satisfaction Scores: Using Transversus Abdominus Plane (TAP) Block After Cesarean Delivery

Rachel D. Cadan, CRNA

Bridgeport Hospital

Introduction: The purpose of this study is to develop an improved postoperative pain management regimen for patients undergoing elective cesarean delivery. Traditional pain protocols are often attended by such side effects as nausea and vomiting, which make it difficult for patients to bond with their baby and have a pleasant recovery experience. The introduction of the transversus abdominus plane (TAP) block may help provide pain relief without nausea, vomiting and itching.

Methods: This research project was of quasi-experimental design. The participants were American Society of Anesthesiology (ASA) patient classification II and III, and of various ethnic backgrounds. Patients ranged in age from 18 to 45 years. Exclusion criteria included allergy to any of the study medications, chronic pain problems, chronic pain medications use (increasing their tolerance to narcotics), non-English speaking patients, a body mass index (BMI) >40, and any patient who required pain medication before the surgical procedure was completed.

Results: A repeated-measures ANOVA was performed to examine the effect of the 3 regimens on postoperative pain visual analog scale (VAS) over 3 time periods: 2 hours, 6 hours and 24 hours postoperatively. No statistically significant differences in VAS were seen over the 3 time periods ($F = 1.345$, $df = 2$, $p = .266$). There were statistically significant between-subject effects ($F = 33.69$, $df = 2$, $p = .043$), specifically for the Duramorph and intravenous patient-controlled analgesia (PCA) groups ($p = .015$). There was a significant interaction effect between the pain control regimen and VAS over time ($F = 4.043$, $df = 4$, $p = .005$) with patients receiving Duramorph showing significantly lower VAS at 2 and 6 hours compared with intravenous PCA. Pain scores for patients receiving TAP blocks were similar to Duramorph only at 2 hours postoperatively.

Conclusions: Pain scores were comparable between the TAP and Duramorph groups. Also of importance is the fact that in some cases the 2-hour survey was completed prior to the completion of the TAP block. Occasionally the surgery took a little longer than expected; however, if the spinal was still in effect the TAP block could be performed. The pain scores, however, may have been a little higher than expected in this patient population because the added analgesic of the TAP block was not yet in effect. If pain scores in the TAP block and Duramorph group remain consistent with each other, the TAP block offers an additional and equally effective alternative regimen to Duramorph.

Source of Funding: AANA Foundation Doctoral Fellowship.

Inculcating Research Into the Nurse Anesthesia Program

W. Patrick Monaghan, PhD, CLS, SBB; John P. McDonough, CRNA, EdD, Dr (habil.) NScA, ARNP
University of North Florida

Introduction: Almost all anesthesia providers agree that having a fundamental knowledge of conducting research is vital for becoming an effective clinician. Six years ago, a relatively new nurse anesthesia program was established, and it was decided to inculcate research throughout the 7-semester curriculum. A concerted effort was made by the faculty starting with the admissions process to advocate and support student research endeavors throughout the training and education program.

Methods: All graduate anesthesia students were expected to successfully complete an approved research project. They were approved to work solo or in a team of no more than 2. Graduate students were expected to complete research projects that resulted in a paper of publishable quality. A complete review of all student research efforts for the previous 5 years was conducted.

Results: In the first 5 years, a total of 118 graduate students were matriculated into the program, and 109 of these successfully completed the graduate Research Methods for Evidence Based Practice course during the third semester. Sixty-six written abstracts were completed and submitted to the AANA Foundation for consideration of either oral or poster presentation at the annual conference. Fifty-four presentations, with a mean of 12, range of 10 to 14 per annum were accepted and provided at 5 consecutive AANA Annual Meetings. Numerous other presentations of these research projects were provided at clinical training hospitals at local, national and international facilities; local and regional nursing meetings; and College of Health symposia. Nine of these projects resulted in formal publication in clinical journals.

Conclusions: The importance of including pertinent clinical research into the graduate nurse anesthesia curriculum provided numerous benefits. Besides the intellectual stimulation, it promoted intense student-faculty and clinical site interaction. Nurse anesthesia students were better prepared to devise and conduct research endeavors. Most importantly they were able to examine and critique published research reports in order to gather the best evidence to assist in their clinical practice.

Intraoperative Dexamethasone

Krystle L. Swatsell, RN, BSN; Carrie L. Cook, RN, BSN; Kyle Krupa, RN, BSN

University of Michigan-Flint/Hurley Medical Center Master of Anesthesia Program

Introduction: Pain is one of the main postoperative adverse outcomes causing much distress to patients, prolonging hospital stay, and increasing the incidence of admissions after surgery. The purpose of this study is to examine whether the addition of dexamethasone intravenously during total knee arthroplasty (TKA) was effective at reducing postoperative pain scores and at reducing the total amount of opioids needed. We hypothesize that patients who received intraoperative dexamethasone will have had decreased pain ratings and will have had required less opioids.

Methods: Following approval from Hurley Medical Center and the University of Michigan-Flint Institutional Review Board, a larger retrospective study will be conducted comparing postoperative pain scores following a TKA at Hurley Medical Center in Flint, Michigan. Patients who had an ASA physical status 1, 2, and 3 who underwent TKA from 2013 to 2014 will be placed into 2 different groups. The treatment group will be patients who had received intraoperative dexamethasone, 8 mg, intravenously and the control group during a TKA.

Results: A total of 102 patients were included in this retrospective study. No significant difference was noted between the groups with regard to age, gender, weight, and height. General and spinal anesthesia were included in this study and immediate postoperative pain scores were compared among each specific anesthetic at that time. Our results showed that patients who received dexamethasone required significantly less opioids (oral morphine equivalence 37.1 mg) compared with the control group (73.1 mg) ($p=0.020$) throughout the hospital stay. However, there was no difference found in the intravenous PCA dose between the 2 groups ($p=0.68$). Postoperative NRS pain scores were compared immediately postoperative in the PACU, 12 hours and 48 hours, with no statistical difference noted. However, at 24 hours the NRS pain scores were less for the dexamethasone group (4.57) than in the control group (6.077) ($p=0.003$.)

Conclusions: In conclusion, literature suggests that the administration of dexamethasone decreases postoperative pain scores, reduces opioid consumption, and minimizes postoperative nausea and vomiting. All of these factors impact patient satisfaction, and most importantly, produce an overall positive postoperative outcome. There are many studies suggesting the efficacy of dexamethasone in orthopedic surgery; however, a single dose of intravenous dexamethasone has not been studied in TKA and further studies need to be done.

Management of Pain and Anxiety in Women Undergoing Needle Guided Breast Biopsy

Stacey A. VanDyke, CRNA, DNP, MSN; Anne W. Alexandrov, RN, PhD, CCRN, FAAN

University of Alabama at Birmingham School of Nursing

Introduction: Anxiety associated with a possible breast cancer diagnosis requires empathetic support for patients awaiting needle localization for surgical breast biopsy. Although anxiety and modalities for treatment are cited in the literature, expectations concerning its treatment in needle localization breast biopsy patients are not evident. The CDC affirms the Health Related Quality of Life (HRQOL) concept is integral in meeting national health goals, avoiding disparities in healthcare, and is a new area of focus for Healthy People 2020. Therefore, using a retrospective chart review, we sought to determine how commonly anxiolytics and sedation were used in managing these patients.

Methods: A retrospective chart review was conducted to determine use or nonuse of local anesthetics in combination with anxiolytics and sedation in patients aged 19 to 80 undergoing needle guided breast biopsy. Data from de-identified records spanning 18 months were collected and descriptive statistics computed. Literature was reviewed/synthesized for recommendations using the following terms in PubMed and CINAHL: anxiety + breast biopsy, anxiolysis + needle localization breast biopsy, anesthesia + needle localization breast biopsy, radiology + breast biopsy + benzodiazepine, HRQOL+ anxiety + pain + breast biopsy. The state of anxiolysis use was compared with current literature recommendations.

Results: A total of 74 cases met inclusion/exclusion criteria and underwent review. Women averaged 62 +/- 13 (median 65) years of age, and were 84% white, 14% African American, 1% Asian, and 1% Hispanic. Local anesthesia was withheld in 26% of women undergoing breast biopsy, and no patients in the study received any anxiolytic medications. Ages were similar among women that received local anesthesia (62.7 +/- 14 years) and women who had local anesthesia withheld (61 +/- 11 years; p=ns). A nonsignificant trend toward nonuse of local anesthesia was noted in white women (chi square, 7.1; p=.069).

Conclusions: Anxiolysis for needle localization prior to breast biopsy is not routinely offered in some settings. This finding is in conflict with evidence-based recommendations for the use of short acting benzodiazepines in the radiology suite. Decreasing anxiety in this population may improve HRQOL.

Maternal Vein and Umbilical Vein Hydromorphone and Bupivacaine Concentrations After Epidural Infusion During Labor

Cynthia French, CRNA; Denis Snegovskikh, MD

Yale New Haven Hospital

Introduction: The standard solution used at our institution for continuous labor epidural infusions is 0.05% bupivacaine with 3 mcg/mL hydromorphone, often maintained for many hours. We examined the potential for drug accumulation in the mother and neonate after these infusions. We hypothesize the umbilical vein (UV) and maternal vein (MV) concentrations of bupivacaine and hydromorphone will be lower than previously studied infusions of 0.125% bupivacaine and 2 mcg/mL fentanyl due to the lower overall concentration of bupivacaine in our infusate, and the greater hydrophilicity of hydromorphone as compared with fentanyl.

Methods: In this prospective observational study, 10 healthy parturients with uncomplicated pregnancies received an initial 100 mcg hydromorphone and 0.25% bupivacaine bolus, followed by continuous infusion of 0.05% bupivacaine and 3 mcg/mL hydromorphone. UV and MV blood samples were obtained within 15 minutes of delivery to determine hydromorphone and bupivacaine concentrations. The UV/MV ratio was calculated for each sample. UV and MV concentrations of hydromorphone and bupivacaine with respect to infusion duration and time after epidural bolus were quantified using Pearson correlation or Spearman rank correlation coefficient, as appropriate.

Results: For bupivacaine, only 2/10 UV samples had detectable levels, while the average MV concentration was $0.23 \pm 0.18 \mu\text{g/mL}$. The only detectable UV samples occurred in patients who required more than 1 additional bolus. The average hydromorphone concentration was $0.23 \pm 0.18 \mu\text{g/mL}$ in the MV samples and $0.26 \pm 0.09 \mu\text{g/mL}$ in the UV samples. The calculated UV/MV ratio was 0.88 ± 0.18 for hydromorphone and approached 0 for bupivacaine. There was no significant relationship between the duration of infusion and the UV and MV concentrations of hydromorphone and bupivacaine. When compared with UV and MV concentrations of 0.125% bupivacaine and 2 mcg/mL fentanyl, hydromorphone UV and MV concentrations were similar to fentanyl despite its 50% higher concentration in our solution, and bupivacaine UV and MV were lower.

Conclusions: Continuous labor epidural infusion of 0.05% bupivacaine with 3 mcg/mL of hydromorphone does not appear to result in significant maternal or neonatal accumulation of drug with respect to infusion duration. Studies have found incidences of neonatal respiratory depression after epidural fentanyl. Given that the potency of hydromorphone is only 1/10 to 1/12 that of fentanyl, the fetus is exposed to a lower equipotent opioid dose. As expected, the MV and UV concentrations of bupivacaine with our solution are significantly lower than with the 0.125% bupivacaine solution. This may be particularly beneficial in limiting neonatal exposure in cases of fetal acidosis.

Source of Funding: Yale New Haven Hospital Anesthesia Department Funding, \$5,000. An additional \$5,000 was awarded on April 11, 2014 to extend the study to include 10 additional participants.

Methodological Approaches to Study Anesthesiologists' Attitudes Toward Expansion of Anesthesia Services by Advanced Practice Nurses in the Canadian Healthcare System

Bethany K. Wooten, RN, BSN, BA, BSEd; Suzanne R. Hawley, PhD, MPH, LP; Martina R. Steed, CRNA, MSN

Webster University

Introduction: The Canadian healthcare system is structurally similar to the United States; however, Canadian advanced practice nurses have limited anesthesia care roles. Canada's newest initiative to address the anesthesia provider shortage includes the first nurse practitioner in anesthesia care (NP-A) program. Licensed graduates do not have the legal authority to provide the full scope of anesthesia care seen in the United States. This project collected expert-informed data on present attitudes about nurse anesthetists, which can guide future research on expanding the nurse anesthetist practice model in Canada.

Methods: A diverse group of healthcare professionals completed one-on-one interviews to assess attitudes about adopting a nurse anesthetist practice model similar to what currently exists in the United States (n=17). A general script with open-ended questions was used to interview anesthesiologists, advanced nurse practitioners, NP-As, nurses, anesthesia assistants, medical students, and other healthcare professionals. Responses were recorded by the interviewer then coded for content analysis. Qualitative data on convergent and divergent themes were analyzed.

Results: The majority of participating Canadian anesthesiologists did not support expanding the role of nurse practitioners to include intraoperative anesthetic management of the patient. Concerns by anesthesiologists about nonphysician anesthesia providers performing specific procedures were revealed. Canadian nurses indicated differing attitudes about the expansion of the nurse practitioner role and how it addresses the anesthesia provider shortage in Canada. Nurse participants also discussed their perceptions of their physician colleagues and barriers in the current political climate regarding the expansion of nurse practitioner anesthesia services. The NP-A participants revealed similar attitudes and perceptions as their nurse counterparts.

Conclusions: Qualitative data will continue to be an important methodology to address the expansion of the NP-A role. The healthcare community may need education in appropriately considering the scope of practice for nurse practitioners. The lack of knowledge about critical stakeholders in the Canadian healthcare system must be addressed. Increasing awareness about strengths and weaknesses of diverse anesthesia service models and better understanding the perspectives of anesthesiologists is critical to future interventions and policy development that address the anesthesia provider shortage in Canada.

Michigan CRNA Views and Management of Postoperative Nausea and Vomiting

Ashley Schatzle, RN, BSN; Ashley Skrocki, RN, MPH, BSN; Yuliya Vrettos, RN, BSN; Henry C. Talley V, CRNA, PhD

Michigan State University College of Nursing

Introduction: Postoperative nausea and vomiting (PONV) is a major determinant of patient satisfaction. However, institutional PONV risk assessment is highly variable, affecting the administration of PONV prophylaxis. In addition, adherence to the Society for Ambulatory Anesthesia PONV guidelines by Certified Registered Nurse Anesthetists (CRNAs) is inconsistent.

Methods: Using convenience sampling, an anonymous electronic 33-item survey was distributed to CRNAs at Michigan State University Nurse Anesthesia Graduate Program Clinical Site Affiliates and the Michigan Association of Nurse Anesthetist membership. A total of 1,861 CRNAs received the survey with a response rate of 12.9%. Descriptive and correlational statistical analysis was done using SPSS Version 22.

Results: Use of PONV guidelines differed between CRNAs with 1 to 4 years and those with ≥ 20 years of experience. Half of CRNAs with 1 to 4 years of experience used PONV guidelines in their everyday practice, yet 84% believed that practice guidelines improve quality of care compared with 65.7 % of CRNAs with more than 20 years of experience.

Conclusions: Inconsistency in using PONV guidelines was one of the major findings of this study. Current guidelines recommend that patients with low PONV risk should not receive PONV prophylaxis. However, only 17.3% of survey respondents adhered to this recommendation. Poor adherence or unfamiliarity with PONV guidelines results in administration of unnecessary and costly pharmacological agent(s) to the patients that might not need it.

Mobile Computing Devices in the Practice of Nurse Anesthesia: An Exploration of Uses and Impact on Care

Anne M. Hranchook, CRNA, DNP; Barbara B. Penprase, RN, PhD; Ronald J. Piscotty, RN, PhD
Oakland University

Introduction: The use of mobile computing devices (MCD), such as smartphones, tablet computers, and laptops among Certified Registered Nurse Anesthetists (CRNAs) in the clinical area may provide benefits as well as pose risks. Limited research is available on the use of MCD in the practice of nurse anesthesia. The purpose of this study was to answer the following questions: (1) What are the clinical and nonclinical uses of mobile computing devices among Michigan CRNAs; and, (2) what are the opinions of Michigan CRNAs regarding the impact of using these devices on patient care?

Methods: A descriptive survey design was used to answer the research questions. Data were collected between January and February of 2014. A link to an anonymous 33-question survey (surveymonkey.com) was sent via email to CRNA members of the Michigan Association of Nurse Anesthetists. Questions asked CRNAs to report on MCD ownership, types of uses, and opinions regarding benefits, risks and safety.

Results: The majority of CRNAs (93%) reported that MCD use during direct patient care was beneficial while 57% reported that it posed significant risks. Eighty-five percent report using an MCD during direct patient care, and 93% report witnessing another CRNA using an MCD during direct patient care. An important finding of this study was the CRNA self-report and/or observations of a colleague having incidences of distraction, declines in performance, or knowledge of a near miss or anesthesia accident as a result of using an MCD during direct patient care. The findings were as follows: distraction (self = 17.8%; other CRNA = 24%), declines in performance (self = 3.2%; other CRNA = 12.8%), and awareness of near misses or anesthesia accidents (6.6%).

Conclusions: The results of the survey suggest that CRNAs believe there are many important benefits as well as significant risks associated with using an MCD while providing direct patient care. Additional findings reveal that some of the participants have either personally experienced or witnessed incidents of distraction, performance declines, or serious anesthesia events as the result of MCD use during patient care. Further studies are needed to investigate the impact of MCD use on CRNA performance. In addition, there is a need for guidelines that promote safe, appropriate, patient-centered use of MCD for the specialty of nurse anesthesia.

Music in the Operating Room: Is it a Safety Hazard?

Lyda Shambo, CRNA, MS

Barry University

Introduction: While technology is innovative, it is also noisy, distracting and pervasive. Consequently, 12.5% of US children show a noise notch in one or both ears suggesting western citizens are at risk for hearing loss from general noise exposure. Since 1960, hospital noise levels have risen around the world. Current operating room (OR) noise levels exceed established safety guidelines. Humans do not evolve at the rate of technology. Noise exposure, sensory overload, and the capacity to adapt to this stimulus are absent from the human condition. Although OR noise is inevitable, music is a choice.

Methods: This literature search occurred via databases on PubMed/Medline, CINAHL, Cochrane, Google Scholar, JAMA, ProQuest, and Infotrac Health Reference Center Academic. The studies were assessed by the American Society of PeriAnesthesia Nurses Evidence Based Practice Model and Stetler. Analytic designs were delineated as experimental or observational using the design tree from the Centre for Evidence-Based Medicine. Each study was assessed via the Methodological Index for Non-Randomized Studies for the indicators: aim, inclusion criteria, data collection, endpoints, and assessment of endpoints.

Results: Noise is pandemic in the OR. Repeated exposure to noise leads to noise-induced hearing loss (NIHL). NIHL may be greater to the anesthetist who is near the patient. Anesthetized patients are at greater risk for NIHL because the stapedius muscle reflex that attenuates loud sounds is paralyzed by the anesthetics. Patients receive greater noise exposure than staff if the drill touches the ossicular chain. A study found OR noise was greater for patients who acquired a surgical site infection after abdominal surgery. Research indicates that competing information and divided attention may decrease the ability of anesthetists to detect subtle changes in the monitor leading to errors as anesthesia accidents are often the result of subtle changes. These events are the result of excess environmental noise.

Conclusions: Patient care in a multidisciplinary setting requires timely and accurate dissemination of information. Baseline OR noise can result in NIHL in a venue where patient care requires vigilance. Nowhere in healthcare is the patient more vulnerable than the OR. Research proves music adds to the stress of the environment, inhibits concentration and communication, and impacts health and safety. The ability to hear monitors, respond to alarms, and perform complex tasks demands consideration of all stakeholders. Therefore, playing music in the OR requires education and the imposition of safety parameters.

Operating Room Noise Levels during Induction and Emergence of Anesthesia: Education's Impact

Liana R. Madsen, BSN; Sarah M. LoBue, BSN; Marlea A. Judd, CRNA, DNP; Mary E. Shirk Marienau, CRNA, PhD

Mayo Clinic College of Medicine, School of Health Sciences Master of Nurse Anesthesia

Introduction: Noise is an occupational hazard in the operating room (OR). It is a barrier to patient safety and can also alter physiological status. The origin of most noise comes from OR behaviors such as dropping instruments and unnecessary personal conversations. The purpose of this prospective study was to determine if staff education can lead to decreased sound levels in the OR during induction (I), maintenance (M), and emergence (E). These crucial phases require anesthesia providers' complete, undivided attention due to the patients' tenuous state.

Methods: A 3M SoundPro continuously recorded time stamped noise decibels (dBs) using its external microphone in a single OR. The sound meter was calibrated daily with a 3M QC10 calibrator and secured atop the anesthesia machine for 4 consecutive weeks. Two weeks later, a 20-minute educational session (ES) guided by PowerPoint was presented to OR staff sharing the negative effects of sound with audience engagement through TurningPoint. Two weeks post-ES, noise was measured again for 4 consecutive weeks. A retrospective chart review was then conducted to obtain demographics and times of I, M, and E.

Results: Data was analyzed for each surgery performed over the pre- and post-ES. The equivalent continuous sound level average and peak were calculated for I, M, and E. Due to skewed distributions of noise measurements, nonparametric methods were used. The signed rank test was used for pairwise comparisons of noise levels between I, M, and E. The rank sum test was used to compare noise levels obtained before and after the ES. For both pre- and post-ES time periods the noise levels during induction and emergence were higher than during maintenance (all $p < 0.01$). Noise levels did not differ significantly between pre- and post-ES.

Conclusions: Research indicates that noise is a problem in the OR. Most noise in the OR comes from staff behaviors and actions. It is unlikely that education alone will reduce noise levels in the OR. A more structured practice intervention is required. Installing a visual noise monitoring device may decrease noise by providing constant feedback. Applying the sterile cockpit rule could limit unnecessary noise and activities. This aviation standard prohibits nonessential activities and conversations from occurring during takeoff and landing. These interventions may provide a safer environment for patients.

Source of Funding: This work was supported by the Department of Anesthesiology with no direct financial support.

Perceptions of Preparedness for Academic Success in Nurse Anesthesia Students

Bridget Beaudoi, RN, BSN; Tammy Weckerly, RN, BSN; Jessica Zolle, RN, BSN

The University of Michigan Flint Hurley Medical Center, Master of Science in Anesthesia Program

Introduction: One of the largest stressors for nurse anesthesia students is the pressure to succeed academically. This research aims to identify if there is a relationship between how prepared students feel for academic success and the time span between their prerequisite sciences and the start of a nurse anesthesia program. The researchers surveyed how nurse anesthesia students feel their prerequisite science courses contributed to their success in a nurse anesthesia program. The goal of this research is to determine how to maximize student success in the academic portion of nurse anesthesia school.

Methods: A cross-sectional survey was administered to current nurse anesthesia students in the state of Michigan. Students rated how prepared they felt to start the academic program, what type of academic preparation was received prior to starting the program, and the importance of each prerequisite to their success in the program. A bivariate analysis was performed to determine the relationship between time frame of prerequisite to program start date and perception of preparedness for academic success. A chi-square test was performed to determine statistical significance of the relationship.

Results: Of the 134 SRNAs surveyed, 79% agreed they felt prepared by their prerequisite coursework to get passing grades in anesthesia school. The majority of students obtained a traditional 4-year bachelor's degree (71%) compared with an RN-to-BSN or accelerated BSN. The majority of students had taken their prerequisite courses within 6 years of starting school. Only 25% of students had retaken classes to qualify for admission to their program. There was no statistically significant difference between the student's level of preparedness and the type of bachelor's degree received, the number of years prior to school that they took their prerequisite coursework, or whether they had retaken courses prior to entering nurse anesthesia school.

Conclusions: The relationship between student perception of preparedness and time elapsed from prerequisite class completion to starting a nurse anesthesia program was not statistically significant. However, valuable information was obtained from this survey regarding topics students would like to review prior to beginning a program to be more successful academically. Greater than 60% of students surveyed would take a review course in physiology, pathophysiology, anatomy, and chemistry, as these were the courses felt to be most important to success in anesthesia school.

Period Prevalence of Ketamine-Propofol Admixture “Ketofol” in the Operating Room Among Anesthesia Providers in an Academic Medical Center

Alliene N. Olson, RN, BSN; Willow R. Rao, RN, BSN; Mary Shirk Marienau, CRNA, PhD; Nathan J. Smischney, MD

Mayo Clinic College of Medicine, School of Health Sciences Master of Nurse Anesthesia

Introduction: Ketamine and propofol admixture (“ketofol”) for sedation and induction has become more prevalent in current research. The primary aim of the present study was to determine the period prevalence of single syringe ketamine and propofol admixture (“ketofol”) used for sedation and induction among anesthesia providers within the last 5 years. Secondary aims were to determine barriers to its use and address the most prevalent concerns through educational sessions. The population consisted of CRNAs, student anesthetists, anesthesia residents, and anesthesiologists at Mayo Clinic, Rochester, Minnesota.

Methods: A survey containing qualitative and quantitative questions was developed with Mayo Clinic Survey Research Center. The survey was mainly closed-ended questions with 1 open ended and 1 Likert question. Functionality and validity was pilot tested prior to distribution via Research Electronic Data Capture (Redcap), which is a web-based data collection system. Identified barriers were addressed by oral or electronic presentations with identical content. Nonparametric descriptive statistics are reported as counts and percentages and were assessed via chi-square or Fisher exact test.

Results: A presurvey was sent to 442 providers, resulting in 253 completed surveys (57%) and 22 partially completed surveys. Period prevalence for sedation was 110 (43%) and induction 64 (25%). Barriers were uncertainty of benefit 62 (23%), mixed controlled substance disposal 48 (18%), regulatory/institutional policies 20 (7%), and compatibility 9 (3%). No concerns were noted in 113 (42%) of the presurvey group. A postsurvey was sent to 503 providers, 233 completed surveys (46%). Period prevalence for sedation was 102 (44%), and induction 63 (27%). No concerns were noted in 72% of the posteducation group versus 42% in the preeducation group ($p<0.01$). No concerns were reported in 51% of the electronic education group versus 64% in the oral education group ($p<0.01$).

Conclusions: The period prevalence of “ketofol” was greater for sedation than induction. A large percentage of participants reported barriers related to the admixture. The period prevalence following education showed a slight increase in both sedation and induction use. There was a significant reduction in barriers following education with oral presentations being more effective than electronic. The reduction in concerns related to the admixture revealed a positive educational impact. Period prevalence is trending up as a result of education; however, allowing more time may show a significant practice change.

Source of Funding: This work was supported by the Department of Anesthesiology with no direct financial support.

Physical Activity in Nurse Anesthesia School

Terra S. Barber, RN, BSN; Heather M. Nusca, RN, BSN; John P. McDonough, CRNA, EdD, Dr (habil.) NScA, ARNP; Jürgen Osterbrink, CRNA, PhD; Ryan Shores, CRNA, MSN; Debran L. Harmon, CRNA, MSN

University of North Florida, Nurse Anesthetist Program

Introduction: Stress management is not currently a part of most curriculums and research shows that physical activity can decrease stress levels. Student nurse anesthetists enter a 28-32 month graduate level program that challenges them mentally and physically. There is no current research on student nurse anesthetist physical activity levels during this program. The purpose of this research is to determine the physical activity level of student nurse anesthetists while looking at barriers to physical activity, stress level, and weight gain or loss during their graduate program.

Methods: Physical activity in nurse anesthesia school was evaluated using a self-evaluation survey. Data was collected at the winter Florida Association of Nurse Anesthetists meeting, held February 19-22, 2014. The survey included two sections and was distributed utilizing Qualtrics software. The first section was the short version of the International Physical Activity Questionnaire (IPAQ), an internationally accepted valid and reliable physical activity survey. The second section included questions on demographic data and current stress status. Ninety-three surveys were collected at the meeting.

Results: Results from the ninety-three participants included the majority of students reporting weight gain (51%), no stress management program available in their curriculum (80%), and a stress level of seven or greater on a 0 to 10 scale (64%). Demographic data showed an almost even male to female ratio (47%/53%) and majority age range of 30 to 39 (49%). The IPAQ results revealed a majority of moderate physical activity level (49.4%) and an average of 7.47 hours sitting a day. The IPAQ defines moderate activity as a minimum of 600 MET (metabolic equivalent of task) minutes/week.

Conclusions: A majority of nurse anesthetist students reported high levels of stress and weight gain in anesthesia school with no available university stress management resources. Exercise and increased activity may be instrumental in decreasing these adverse effects experienced by students. Future research should focus on incorporating a wellness program in anesthesia school to prevent detrimental physical and emotional effects during this intense graduate level program.

Postoperative Pain Management for Total Knee Arthroplasty in a Community Hospital

Rudolph L. Pavlesich III, RN, BSN, CCRN; Dwayne J. Thibeault, RN, BSN, EMT-P, CCRN; John P. McDonough, CRNA, EdD, Dr (habil.) NScA, ARNP; Philipp Lirk, MS; Nathan Rachman, MD; Danielle Holloway, MD; William L. Self, CRNA, MSN

University of North Florida

Introduction: The practice of regional anesthesia for patients undergoing total knee arthroplasty is an evolving process, with the common nerve blocks used for this surgical procedure being sciatic and femoral blocks. There has been a shift toward blocking specific nerves believing that the motor function of the surgical leg will be preserved, leading to quicker ambulation times and shorter hospital stays, while still providing adequate pain relief after surgery. The aim of this study was to gather statistical data on whether or not the adductor canal and tibial blocks are providing adequate pain relief after total knee arthroplasty without the addition of intra-articular deposition of local anesthetic.

Methods: A retrospective chart review was performed with participants being identified by the inclusion and exclusion criteria who underwent surgery between December 1, 2013 and March 31, 2014. Three groups were identified for the study: (1) femoral and tibial nerve blocks (control), (2) adductor canal and tibial nerve blocks with intraoperative intra-articular deposition of local anesthetic, and (3) adductor canal and tibial nerve blocks without intra-articular deposition. The pain score was recorded after arrival to the postanesthesia care unit, and the nerve blocks were rated as a success or failure based on the participants visual analog scale (VAS) pain score and need for a rescue treatment.

Results: Utilizing one-way analysis of the VAS score (1-10), group 1 had a mean of 1.67 (\square 2.39), group 2 had a mean of 5.19 (\square 3.72), and group 3 had a mean of 5.80 (\square 3.75). Nonparametric comparison of pairs using the Wilcoxon method produced statistically significant differences in VAS scores between groups 1 and 2 ($P=0.0008$), and between groups 1 and 3 ($P=0.0008$). Statistical significance was produced between groups 2 and 3 ($P=0.695$). The success rate for group 1 was 25/28 (89%), the success of group 2 was 9/21 (43%), and the success rate for group 3 was 4/15 (27%).

Conclusions: There are statistically significant differences in VAS pain scores between groups 1 and 2 ($P \leq 0.0005$) and groups 1 and 3 ($P \leq 0.001$). There is no statistically significant difference in VAS pain scores between groups 2 and 3 ($P \leq 0.8407$). The results of this study do not support reports in the current literature that identify the adductor canal and tibial nerve blocks as equal to, or better than, femoral and tibial nerve blocks for postoperative pain management. The results indicate that femoral and tibial nerve blocks provide superior postoperative pain relief after total knee arthroplasty.

Pulmonary Hypertension and Noncardiac Surgical Outcomes

Jennifer E. Dickman, BA, BSN; Matthew D. Earl, BSN; Mary Shirk Marienau, CRNA, PhD; Michael D. McGoon, MD; Leal G. Segura, MD; Juraj Sprung, MD, PhD; Toby N. Weingarten, MD; Maria D. Fritock, MD

Mayo Clinic College of Medicine, School of Health Sciences Master of Nurse Anesthesia

Introduction: Pulmonary hypertension (PH) is a rare, chronic condition that ultimately leads to right heart failure and decreased survival. The perioperative management of these patients is challenging, as the hemodynamic changes induced by general and neuraxial anesthetics can be detrimental to multiple organ systems. Few studies have investigated the multiple pulmonary hypertension forms and classes in relation to perioperative morbidity and mortality. Overall, there is a paucity of data looking at perioperative pulmonary hypertension.

Methods: A retrospective cohort study of surgical patients was performed at Mayo Clinic College of Medicine Hospitals in Rochester, Minnesota, from the years 2009 to 2012. The study included patients greater than 18 years of age with previously diagnosed pulmonary hypertension via echocardiogram or cardiac catheterization undergoing noncardiac surgery. Only those receiving either general anesthetic or a primary neuraxial anesthetic were evaluated. When multiple surgical encounters occurred, only the first chronological anesthetic was used for analysis to reduce bias.

Results: Inclusion criteria were met by 119 patients. Ten underwent primary neuraxial anesthesia. Preoperative comorbidities included hypertension (70%), diabetes (32%), obstructive sleep apnea (45%), chronic kidney disease (29%), connective tissue disease (26%), pulmonary arterial hypertension (37%), and PH resulting from lung or left heart disease in 50% of patients. Of the 119 patients (first anesthetic), 6 (5%) expired within 30 days of surgery and general anesthesia. The expired population consisted of 4 patients with moderate PH and 2 with severe PH; half were morbidly obese (BMI, 38.8-52.2) and 1/6 was New York Heart Association class 4. Preoperative RV function in deceased group ranged from normal (2/6) to moderate dysfunction (4/6). Postoperative morbidity included shock (9%), acute renal failure (7%), and respiratory failure (6%).

Conclusions: Consistent with previous studies, this retrospective study supports the conclusion that patients with pulmonary hypertension undergoing noncardiac surgery are at increased risk of perioperative morbidity and mortality. Whether factors such as anesthetic techniques, comorbid conditions, PH type/severity, and certain echocardiographic parameters are associated with increased risk is not clear. Further data collection and analysis is planned to identify perioperative risk markers in this population.

Source of Funding: This work was supported by the Department of Anesthesiology at the Mayo Clinic College of Medicine in Rochester, Minnesota.

Reducing Subglottic Aspiration During Extubation With Positive Pressure: A Pilot Study

Cristal R. Turner, RN, BSN, CCRN; Christina M. Maloney, RN, BSN, CCRN; Gerard Hogan, CRNA, DNSc, ARNP; Ryan Shores, CRNA, MSN

University of North Florida, Nurse Anesthesia Program

Introduction: Aspiration of accumulated subglottic secretions is a concern of extubation that may result in laryngospasm. The application of positive pressure on extubation may be used to prevent aspiration of subglottic secretions. However, this maneuver is not consistently practiced in the clinical setting. The purpose of this study is to determine the effectiveness of various extubation techniques at clearing subglottic secretions. We hypothesize that the use of positive pressure at extubation will significantly reduce the amount of subglottic secretions, thereby attenuating the risk of laryngospasm.

Methods: Pig larynxes were attached to collection circuits and intubated with 7.0 mm endotracheal tubes (ETT). Two milliliters of a saliva-equivalent solution was instilled above the ETT cuff and each extubation technique was performed. Techniques included: (A) APL valve set to 20 cm H₂O, (B) APL valve set to 40 cm H₂O, (C) ventilator set to PSVPro mode with 20 cm H₂O of PEEP, (D) positive pressure breath delivered with the APL valve set to 40 cm H₂O, and (E) a control utilizing no positive pressure. After each extubation, secretions were collected and weighed to determine the volume aspirated.

Results: Each positive pressure extubation technique cleared significantly more subglottic secretions than the control (1.9 mL aspirated, $p < 0.0001$). The data support the use of positive pressure extubation with statistically indiscernible differences among the various examined techniques. The application of 40 cm H₂O decreased subglottic secretion aspiration the most (0.14 mL). Additional delivery of a positive pressure breath via the reservoir bag prior to extubating with the APL valve set to 40 cm H₂O resulted in comparable aspiration reduction (0.18 mL). Extubating with 20 cm H₂O via APL valve closure and PSVPro mode also demonstrated greater effectiveness at reducing subglottic secretions than the control method (0.34 mL/0.34 mL/1.9 mL).

Conclusions: The results of this study indicate that utilizing positive pressure on extubation is protective against subglottic secretion aspiration. In this anatomically-appropriate model, techniques incorporating the delivery of positive pressure just prior to cuff deflation and extubation were determined to be superior at reducing subglottic secretion aspiration. Extubation without the application of positive pressure was the least effective technique.

Right Internal Jugular Vein Cross-Sectional Area: Is There an Optimal Level for Cannulation?

Edward A. Maratea, MD; Oscar Aljure, MD; Catalina M. Castillo-Pedraza, MD; R. Lebron Cooper, MD; Greta Mitzova-Vladinov, CRNA, DNP

University of Miami

Introduction: Perioperatively, the preferred site for central venous access is the right internal jugular vein (RIJV). Maneuvers such as Trendelenburg position and positive end-expiratory pressure (PEEP) are commonly performed to increase the size of the RIJV, therefore increase the success rate of cannulation. This study evaluates the size of the RIJV at various anatomic levels in the neck in relation to the cricoid cartilage to assess the most advantageous level for cannulation.

Methods: In supine position, the cross-sectional area (CSA) of the RIJV was measured in 18 healthy subjects, using vascular ultrasound, at the level of the cricoid cartilage (0 cm), cephalad to the cricoid cartilage at +1 cm and +2 cm and caudad to the cricoid cartilage at -1 cm and -2 cm. Factors that may influence the RIJV size, including age, gender, and body surface area (BSA), were included in the data analysis.

Results: The average CSA of the RIJV at the 5 levels measured (from +2 cm to -2 cm) were 0.91, .97, 10.6, 1.10, and 1.14 cm² respectively. The CSA of the RIJV was significantly larger at every 1 cm interval from the most caudad level at -2 cm to the +2 cm most cephalad level, except for the 0 to the -1 interval. No differences were found based on age, gender or BSA.

Conclusions: As with other maneuvers that may increase the size of the RIJV, the anatomic level of the neck in relation to the cricoid cartilage, at which jugular puncture is performed, should be considered. Success of RIJV cannulation may be increased by accessing the vein at a point with the largest CSA, 1 to 2 cm caudad of the cricoid cartilage, especially in cases when Trendelenburg position is not tolerated by the patient or ultrasound guidance is not available.

Safety and Success With the Laryngeal Mask Airway in the Prone Position

David Y. Chung, RN, BA, BSN, CCRN

Columbia University

Introduction: The use of the laryngeal mask airway (LMA) for the anesthetized patient in the prone position (PP) is a controversial technique. Endotracheal tube (ETT) insertion has traditionally been regarded as the definitive airway in the PP providing better protection from complications. Opponents to the use of the LMA in PP commonly argue that insertion is difficult, failure rates are high, dislodgement can easily occur, and there is increased risk of pulmonary aspiration. The purpose of this inquiry is to review the safety and success of starting anesthesia in the prone position with an LMA.

Methods: Ovid MEDLINE and PubMed online databases were searched using the keywords laryngeal mask and prone position. Duplicates were eliminated yielding a total of 46 articles. Clinical trials, publications dates between 2004 and 2014, induction of anesthesia in PP were included. Case reports, animal studies, pediatric populations under 18 years of age, and emergency rescue insertion in prone were excluded. A total of 735 patients participated in the studies. Five articles with level of evidence II-III met these criteria and were included in this review.

Results: LMA insertion was achieved in all patients (100%) with a high success rate on the first attempt. No patient had to be turned to the supine position for an airway problem. All patients were anesthetized in the prone flat or knee-chest position for various procedures. Complications in all studies were minor with blood-staining on removal and sore throat being the most frequent. There were no recorded incidences of aspiration, sustained hypoxia or dislodgement in any patient. Of note, 1 study comparing ETT and LMA demonstrated that starting anesthesia in prone with an LMA shortened induction-incision time reduced the manpower involved in turning the anesthetized patient, and showed more favorable hemodynamic parameters.

Conclusions: Current evidence suggests that LMAs may safely and successfully be used in the PP. Starting anesthesia in the self-positioned PP may reduce OR time, better utilize personnel and optimize patient comfort. There is insufficient data at this time to determine with confidence if such a role for LMAs should be implemented into regular practice. Further research is needed to account for larger sample sizes, procedure variables, and patient characteristics. Future implementation may need to overcome the prevailing belief that LMAs are unsafe and unsuccessful to drive change in practice.

Simulation and Text-Based Instruction and Evaluation of the Effect on Knowledge Retention: A Pilot Study

Joshua S. Newby, RN, BSN; Jacob R. Atkins, RN, BSN; Gerard T. Hogan, Jr, CRNA, DNSc

University of North Florida

Introduction: The primary objective of this pilot study was to develop a simulation scenario to be utilized with and without a reading selection. This would be used to determine whether differences in the retention of knowledge for infrequently encountered events exists between simulation-based instruction, text-based instruction, and a combination of these. A secondary objective was to explore the feasibility of the methodology on a larger scale to produce generalizable results.

Methods: Preliminary research of malignant hyperthermia (MH) was conducted to develop a simulated scenario script, identify a suitable reading selection, and outline learner objectives. Knowledge assessment questions were developed and IRB approval was attained. Three randomized groups of SRNAs received instruction on MH management: a control group by reading a selection of text, the second group via simulation, and the third by both text and simulation. Participants completed a pretest, an interventional session, and posttests 30 minutes and 2 weeks postintervention.

Results: The control group (n=4) had mean pretest, first posttest, and second posttest scores of 62.29, 85.63, and 85.83, respectively. The mean pretest, first posttest, and second posttest scores of the simulation group (n=5) were 71.2, 89.87, and 91.33, respectively. The combination group (n=5) had respective mean pretest, first posttest, and second posttest scores of 65.07, 91.87, and 95.00. The groups participating in simulation interventions noted a lack of familiarity with lab equipment and controls, as well as citing a need for more explanation of expected simulation performance. One question from the posttests was missed by a disproportionate number of participants.

Conclusions: This pilot study supports the feasibility of the described methodology for continued investigation of simulation and text-based learning, with minimal adjustments needed for larger scale research. The results of the assessments, while not statistically significant in this pilot study, suggest that further research encompassing a suitably large sample with students from multiple programs may produce statistically significant findings. A study of the implementation and outcomes of such a course into an established nurse anesthesia program could then be undertaken.

Standardized Communication Tool Improves Patient Hand-Off During Surgery

Kaitlin D. Hurley, CRNA, DNAP; Laura L. Ardizzone, CRNA, DNP

Memorial Sloan Kettering Cancer Center

Introduction: During a single anesthetic, a patient may have different anesthesia providers involved in their care for reasons that are multifactorial. There is an exchange of essential information at that time, and any omission of critical information related to the patient or the procedure can pose a threat to patient safety. In 2006 and 2014, The Joint Commission designated the standardization of staff communication as a national patient safety goal. To align with this goal, we developed a specific anesthesia hand-off tool to be utilized during the transfer of patient care.

Methods: The hand-off tool was developed to contain specific anesthesia cues along with blank spaces to be filled in with pertinent patient and surgical case information. After development, the tool was presented to the patient safety officer for recommendations and approval. It was then pilot tested by 15% of the CRNA staff (n=10). Following this, the anesthesia staff was educated about the importance of the hand-off tool, its availability, and how it was to be used. After 3 months of utilizing the tool, an online survey was conducted to assess its significance and impact on patient care.

Results: The online survey response rate was 75% (n=45 out of 60 CRNAs). Of the respondents, 53% (n=24) felt their patients' transfer of care was more thorough while using the hand-off tool. However, only 11% (n=5) stated they use the tool daily, while 44% (n=20) reported they never use the tool at all. Further investigation on the reasons for nonuse found that 44% (n=20) stated that the tool was unavailable to them. We discovered that during the rollout, there had been a lack of education to our anesthesia technicians who were supposed to stock the hand-off tools in the operating rooms so they would be available for use. Thus, the anesthesia technicians and staff were reeducated to both stock and use the tool to increase patient safety.

Conclusions: Over 50% (n=24) of the CRNAs who responded to the survey are very satisfied with the provided checklist, and they find it makes the transfer of their patients' care more systematic and thorough. One important lesson learned was that when rolling out a change in practice, it is important to map out all aspects of a new process and remember that all members of the team are stakeholders in the project from the outset. We will assess the impact of this tool on patient safety through future surveys within the department with our next evaluation occurring in 6 months.

Substance Misuse Among Student Registered Nurse Anesthetists in Michigan

Sara E. Hogan, RN, BSN; Lisa Ruwart, RN, BSN

University of Michigan-Flint/Hurley Medical Center Anesthesia Program

Introduction: Substance misuse, including drugs and alcohol, is a problem in the anesthesia community. Bell et al (1999) defines controlled drug misuse as “the improper use, unlawful misapplication, or incorrect use of one or more controlled drugs that were illegally diverted from patient use for the purpose of self-administration.” In a 1999 survey administered to 1,709 actively practicing Certified Registered Nurse Anesthetists (CRNAs), results revealed a drug misuse prevalence of almost 1 in 10 people (9.8%). Student registered nurse anesthetists (SRNAs) have not been studied on this topic, and therefore this investigation was intended to shed light on SRNA substance misuse and contributing factors.

Methods: Quantitative, primary data collection via an online confidential survey was given to junior and senior SRNAs in the 5 CRNA schools in Michigan. In a descriptive cross-sectional study design, data analysis examined the prevalence of substance misuse among SRNAs. IRB exemption was obtained from University of Michigan-Flint. A pilot study administered to CRNAs reduced threats to internal validity. This nonrandomized survey sample was administered through Qualtrics to protect subject confidentiality. Data was compiled November 2013 to January 2014 and analyzed from February to April 2014.

Results: Data was analyzed using IBM SPSS. Statistical significance was tested with chi-square analysis, and $p \leq 0.05$ showed statistical significance. Bivariate analysis was done comparing year in anesthesia school, stress perception, and personal and family substance misuse to assess relationships between them. Eight students (11.4%) admitted to misusing alcohol, tobacco, or marijuana prior to anesthesia school. There were 4 of 70 people who admitted to misusing prescription medications to manage stress and all 4 misused ADHD medications. Statistical significance was not reached ($p = 0.471$), but the correlation between the stress of anesthesia school and the new onset of misusing ADHD medications seems apparent with a 5.7% prevalence rate.

Conclusions: There were 70 of 176 SRNAs that completed the survey. Results did not show statistical significance when comparing many variables. Although there was no statistical significance, stress from school contributed to 44.4% of the students' misuse. This may point to a relationship between stress and substance misuse if assessed in a larger sample population. Limitations of the study were the sensitive nature of the survey, fear of repercussion, and that program directors distributed the survey, possibly accounting for the decreased or nontruthful responses. A larger study is needed in the future.

The Effect of Intravenous Dexamethasone on Postoperative Sore Throat

Sarah Ladrack RN, BSN; Thea Epple RN, BSN; Zachary Caldwell BSN, RN; Elizabeth Jane McCarthy CRNA, PhD, FAAN

University of Maryland, Baltimore

Introduction: In the surgical patient requiring general anesthesia with an endotracheal tube does IV Dexamethasone intra-operatively compared to no Dexamethasone decrease sore throat pain postoperatively?

Methods: Five randomized controlled studies and 1 meta-analysis were pooled related to our topic. The information was placed into a chart to compare them both to our topic.

Results: All the studies showed a statistical significance for intravenous dexamethasone to reduce the probability for acquiring a sore throat after general anesthesia with an endotracheal tube compared with the control groups. Also, it seems that the larger the dose of intravenous dexamethasone, the lower the risk of sore throat postoperatively (however, this will increase the risk, and possibly the magnitude, of the side effect related to the drug).

Conclusions: Utilizing intravenous dexamethasone for the patient under general anesthesia with endotracheal tube statistically significantly reduces the incidence of postoperative sore throat. This is an all too common side effect from the placement of an endotracheal tube, and reducing this possibility will lead to better patient satisfaction concerning both the surgery and the anesthetic.

The Effect of Ultrasound Use on the Placement of Epidurals and Combined Spinal Epidurals

Jessica M. Premis, BSN; Sarah K. Eller, BSN; Michael J. Burns, CRNA; Christopher M. Black, CRNA; Jason A. Corey, CRNA; John T. Fitzgerald, CRNA

Webster University

Introduction: Ultrasound has proven to enhance regional anesthesia placement. Neuraxial blockade is the gold standard in the obstetric patient. Its use has extended to the general operating room for orthopedic patients as well as pain relief in abdominal surgery. These patients can present having a higher body mass index and spinal abnormalities. The use of ultrasound may aid anesthesia providers in a higher success rate for the placement in these patient populations. The independent variable is the placement of epidurals. The dependent variables include time and number of attempts for successful placement.

Methods: Phelps County Regional Medical Center patients will be evaluated for inclusion criteria of 18 years of age or older, ASA physical status 1 to 3, and weight from 50 kg to 150 kg. Exclusion criteria include absolute contraindication to neuraxial anesthesia, allergies to medications utilized, and renal or liver dysfunction. Subjects will be randomized for palpation or ultrasound. Data collection includes patient demographics, student or licensed provider, time in the room, time mapping or palpating, procedural time, number of attempts, number of puncture sites, calculated depth, and actual depth.

Results: The mean palpation time was 30.41 seconds with standard deviation of 3.794 seconds. The mean ultrasound mapping time was 192.1 seconds with standard deviation of 22.28 seconds. A 1-tailed t-test showed a significant difference between palpation time and ultrasound mapping time ($p < 0.0001$). The mean procedure time with the palpation group was 7.152 minutes with standard deviation of 0.5645 minutes. The mean procedure time with the ultrasound group was 7.724 minutes with standard deviation of 0.8057 minutes. A 1-tailed t-test showed no significant difference in procedure time between groups ($p = 0.2762$). A Mann Whitney test was performed for ventral attempts that showed no significance between groups ($p = 0.3815$).

Conclusions: Results evaluated 27 palpation and 21 ultrasound epidurals. No significant difference existed for ventral attempts and procedure time between groups. A significant increase in time was needed for ultrasound mapping versus palpation. The ultrasound group had a larger BMI overall. The results showed the use of ultrasound for placement of neuraxial blockade yielded equal results to the palpation technique. These results differed from a similar study that showed a decrease in number of attempts in which ultrasound was performed by a single experienced provider.

The Effectiveness of an Anesthesia Hand-Off Tool: An Electronic Health Record Application to Enhance Patient Safety

Karen E. Gillikin, CRNA, DNP; Nathaniel Apatov, CRNA, PhD, MSN, MHS

Old Dominion University

Introduction: Ideally, 1 anesthesia provider would be responsible for the entire perioperative phase for a surgical patient; however, discontinuity of care is inevitable. It is paramount that hand-off process be accurate, thorough, and concise in order to reduce errors, promote patient safety, and support a busy surgical schedule. The emphasis of this study was to compare the incidence of patient information inaccuracies and omissions during patient care transfer before and after implementation of an electronic patient care transfer tool.

Methods: This study was conducted using a preintervention postintervention observational design. A power analysis was performed for 2-tailed analysis with alpha set at $p < 0.5$, estimating an effect size at 0.7. The researcher observed and collected data on the information provided by the CRNA as they transferred patient care to the relieving CRNA. Eighty-two observations were conducted before and 75 after the electronic anesthesia hand-off tool was introduced and comparisons were made. Descriptive statistics, 2-tailed t-test, and Spearman correlations were conducted. Alpha level was set at $p < 0.05$.

Results: There were significantly fewer errors made in all categories of patient information following the introduction of the electronic anesthesia hand-off tool ($p < .05$). There were only 5 inaccuracies noted during the observations; all 5 inaccuracies were observed in the preintervention group. Perioperative hand-offs were appreciably improved when the transfer tool was utilized appropriately. Though there were trends toward more omissions occurring after 3:00 pm, the difference in most patient information categories was not statistically significant. There were no differences in omissions related to the severity of patient comorbidities based on the patients' ASA status.

Conclusions: This study confirms previous findings that communication breakdown and loss of information occurs during anesthesia hand-offs threatening patient safety. Utilizing an anesthesia hand-off tool within electronic health record provides much needed communication structure. Additional research regarding the tool's effect on patient morbidity and mortality is required to further the CRNA impact on patient safety. Few professionals receive hand-off education. Additional research surrounding teamwork training on the effectiveness of patient care transfer would expand the scholarship of this sizable problem.

The Effects of 2,6-Diisopropylphenol on Adenosine Triphosphate Release from Human Erythrocytes

Amanda C. Smith, RN, BSN; Joseph Chamberlain, RN, BSN

Webster University

Introduction: Adenosine triphosphate (ATP) has long been known to participate in countless intracellular processes. One of these processes is ATP's ability to function as a powerful vasodilator. It has been well established that isolated human erythrocytes (RBCs) release ATP when exposed to a hypoxic/hypercarbic environment. Propofol is known to cause a dose-dependent decrease in blood pressure, but differing hypotheses exist as to the exact mechanism. These hypotheses include direct vasodilation, myocardial depression, and blunting of the baroreceptor reflex. This research investigates the potential release of ATP from RBCs upon exposure to propofol's active ingredient 2,6-diisopropylphenol.

Methods: Erythrocytes (RBCs) were obtained from a donor and then washed and resuspended. RBC counts were performed on each test and control group prior to testing. Test-group RBCs were exposed to calculated doses of 2,6-diisopropylphenol representative of differing propofol plasma concentrations. Control and test groups were assayed using the ATP Bioluminescent Assay Kit to determine if test group RBCs released a greater amount of ATP than control RBCs. When ATP is the limiting reagent, the light emitted during the firefly luciferase reaction is proportional to the amount of ATP present. The light reading was extrapolated to indicate the amount of ATP released from the RBCs.

Results: Posttesting erythrocyte counts were performed to verify that cell lysis had not occurred. The erythrocyte test group exposed to 50 mcg/mL of 2,6-diisopropylphenol showed a significant increase in extracellular ATP ($p < 0.05$) when compared with control groups. All other test group results were insignificant ($p > 0.05$). Pretesting and posttesting erythrocyte counts showed no significant difference ($p > 0.05$) in number of cells. The quantity of ATP released per erythrocyte exposed to 50 mcg/mL of 2,6-diisopropylphenol was found to be in the same order of magnitude as would be predicted to be released from erythrocytes perfusing a microvessel within a hypoxic tissue region in vivo. This concentration of ATP has previously been found to produce maximum conducted vasodilation.

Conclusions: The results of this research imply that an unexplored mechanism for the dose-dependent hypotension produced by the anesthetic agent propofol may exist. It was found that 2,6-diisopropylphenol, the active ingredient in propofol, significantly increases the release of ATP from human erythrocytes in vitro. It is possible that this increased release of ATP may result in the vasodilation and hypotension seen when propofol is used in bolus dose concentrations, such as during anesthetic induction. Additional research including in vivo testing would be necessary to confirm this hypothesis.

Source of Funding: Webster University, Saint Louis, Missouri.

The Effects Vasopressin and Epinephrine on Cardiac Arrest Following Desipramine Overdose in a Porcine Model

Jennifer Brady, BSN; Allan Bolido, BSN; Kenneth Gore, MSN; Tammy King, BSN; Heather Leal, BSN; Brian Gallahan, BSN; Brian Lowery, BSN; Kyle Stevens, BSN; Joseph O'Sullivan, CRNA, PhD; Don Johnson, PhD

US Army Graduate Program in Anesthesia Nursing

Introduction: Suicide rates in the military have recently increased; rates outnumber combat deaths. Because of an increase in traumatic brain injuries (TBIs) and posttraumatic stress disorder (PTSD), medications for depression such as desipramine, a tricyclic antidepressant, have also increased escalating the possibility of overdose. This was the first study to investigate the effects of vasopressin vs epinephrine in the treatment of cardiac arrest following an overdose of desipramine. The purpose of this study was to determine the most effective treatment of an overdose of desipramine.

Methods: This was a prospective, experimental study based on ACLS guidelines. Pigs were assigned to 1 of 3 groups: CPR only (n = 7), epinephrine + CPR (n = 7), or vasopressin + CPR (n = 7). Pigs were anesthetized and given an overdose of desipramine until there was a nonperfusing rhythm. A compression device was used to deliver 30 compressions to 2 respirations (100 compressions per minute). If the pigs were found to have either ventricular fibrillation (VF) or ventricular tachycardia (VT), they were defibrillated beginning with 200 J and then were increased to 360 J every 2 minutes.

Results: All of the swine (100%) in the vasopressin + CPR group survived, and 1 in the epinephrine + CPR survived (14.2%). All of the subjects (100%) in the CPR only and 6 (85.7%) in the epinephrine + CPR groups died. We used a Fisher exact test for significant differences between group and found there was no significant difference between the CPR only and the epinephrine + CPR groups ($p = 1.0$); a significant difference between epinephrine + CPR and the vasopressin + CPR groups ($p = .005$); and a significant difference between CPR only and vasopressin + CPR groups (.001).

Conclusions: Results indicate that with desipramine overdose, vasopressin + CPR is more effective for treatment of cardiac arrest than epinephrine + CPR or CPR alone. ACLS guidelines recommend epinephrine, 1 mg, in an arrest. Alternatively, vasopressin, 40 units, may be used instead of the first or second dose of epinephrine. An odds-ratio indicated that the vasopressin + CPR had a 225 times greater odds of survival compared with CPR only group and 65 times greater odds of survival compared with the epinephrine + CRR group. The odds of survival for the epinephrine + CPR group were 3.64 times greater than CPR only.

Source of Funding: TriService Nursing Research Program.

The Safety and Efficacy of Hydromorphone Patient Controlled Analgesia and Patient Controlled Analgesia by Proxy for Pediatric Postoperative Pain Control

Judith M. Lewis, CRNA, DNP, APRN; Ibrahim S. Farid, MD; Wm. Terry Ray, CRNA, PhD; Aris Eliades, RN, PhD, CNS; Miraides F. Brown, MS

Akron Children's Hospital

Introduction: Morphine has been considered the gold standard in pediatric pain management and is the most frequently prescribed drug today, yet it may not be the most suitable for pediatric pain control. Hydromorphone has several reported advantages over morphine but lacks quality studies that focus on or support its use in postoperative pediatric pain management. The purpose of this study was to evaluate the safety and efficacy of hydromorphone patient controlled analgesia (PCA) and patient controlled analgesia by proxy (PCA-P) by examining known side effects and pain scores in a postoperative pediatric population.

Methods: After IRB approval, records of pediatric subjects who received hydromorphone PCA or PCA-P for postoperative pain were reviewed. Data included age, ASA classification, and whether PCA or PCA-P. Safety was evaluated by examining known side effects: respiratory depression, urinary retention, nausea/vomiting, and pruritus. Efficacy was evaluated by analyzing postoperative pain scores. Subjects were divided into 3 age groups by physiological maturation; ≤ 1 year, 13 months to 8 years, and 9 to 20 years. Each child was assigned to 1 of 12 groups by age, ASA (I/II or III/IV), and PCA or PCA-P.

Results: This study included 564 children. There was no respiratory depression in $> 89\%$ of all the subjects and no cases of severe respiratory depression (requiring naloxone). Group 12 (9-20 years, ASA III/IV, PCA-P) showed the greatest amount of mild respiratory depression (requiring O₂) at 32.26% ($p < 0.05$). Urinary retention was 1.95% with no difference between the 12 groups ($p > 0.05$).

Nausea/vomiting, the most frequently reported side effect in 57.27% of the sample, showed a statistical difference between the 12 groups ($p < 0.05$). Pruritus occurred in 42.38% of the sample with no difference between the 12 groups ($p > 0.05$). Pain scores showed a mean of 2.25 ± 2.81 over the first 4 postoperative days, and 49.27% of those scores were 0 on a 10-point scale.

Conclusions: In this study, some children did experience opioid-induced pruritus as well as possible opioid-induced nausea/vomiting, but overall safety was supported with over 89% experiencing no respiratory sequelae and no patients requiring naloxone. Pain was well controlled with the average pain score in the mild to moderate range (1-6 on a 10-point scale) and almost half of all pain scores were "0" or "no pain." This study supports that hydromorphone is safe and effective for use in postoperative pediatrics and can provide an alternative method of postoperative pain management for children.

The Use of a Preoperative Educational Video in Managing Preoperative Anxiety in the Ambulatory Surgical Patient

Carlos F. de Jesus, CRNA, MSN; Keri Ortega, CRNA, DNAP; Tito D. Tubog, CRNA, DNAP

Wolford College

Introduction: As ambulatory surgery becomes more prominent, it is imperative that ambulatory surgical patients be educated about their surgical process. Evidence suggests that preoperative education decreases fear and anxiety toward the surgical experience. However, not enough has been done to improve and carry out preoperative education programs. In the current clinical setting, the use of a preoperative educational video decreases the patient's level of anxiety the morning of surgery.

Methods: Twenty ASA I and II adult patients for ambulatory surgery were selected for the study. The patients completed a visual analogue scale to identify areas that elicited high levels of anxiety. A self-developed short educational film was shown, followed by a discussion session. The morning of surgery, the participants answered the State-Trait Anxiety Inventory (STAI) for adults to measure their anxiety level.

Results: Out of 20 patients, only 1 score was above 44, which correlates to high anxiety in accordance to the STAI scores classification. The average STAI score for the other patients was 38.31. Visual analogue scale scores showed awareness during anesthesia, not knowing what is happening, and waiting for the operation were causes of anxiety.

Conclusions: Patient anxiety is highly prevalent preoperatively and is associated with many postoperative complications. Findings of this study suggest that media-based interventions play a crucial role in reducing preoperative anxiety.

Too Anxious to Learn? Should the Ongoing Debriefing Technique Be Among the Best Practices in Simulation?

Marc Code, CRNA, MSN; Megha Bhatnagar, MBBS; Joseph Burkard, CRNA, DNSC

Samuel Merritt University

Introduction: It has been established that moderate levels of stress are necessary for effective learning. In contrast, excessive stress and anxiety cannot only impair but hinder psychomotor performance. There is scientific evidence that a relationship exists between high levels of stress in simulation and poor performance. However, the degree of stress and effects on learning and performance produced by simulation in Certified Registered Nurse Anesthetist (CRNA) training programs are unknown. The aim of this paper is to demonstrate benefit of the Ongoing Simulation Debriefing Technique on lowering anxiety levels among those participating in simulation activities.

Methods: After IRB approval, the presimulation/postsimulation anxiety levels were evaluated in first-year nurse anesthesia students (n=26) in 3 different scenarios using State Trait Anxiety Inventory (STAI). Students were divided into 2 groups: control group (End Debriefing) and experimental group (Ongoing Simulation Debriefing Technique). Both groups were exposed to identical simulations of increasing scenario complexity with the last scenario being the most difficult and complex (pediatric induction). Students were asked to complete a questionnaire both pre/postsimulation. The data were collected from 2012 to 2013.

Results: A quasi-experimental design was used to collect research data and analyzed for validity and significance utilizing SPSS and t-test analysis. The anxiety levels were reduced in both control and experimental groups postsimulation as compared with their presimulation values as evident by STAI scores. The overall mean STAI scores were reduced by 15.21 and 21.81 percentage points, respectively, in control and experimental groups. The difference between means was statistically significant ($P < 0.001$).

Conclusions: Ongoing Simulation Debriefing Technique reduces stress and anxiety levels generated by simulation more than when using the End Debriefing Technique. The Ongoing Simulation Debriefing Technique creates a safer learning environment in which students can maximize their learning potential. This technique should be considered as a best practice for simulation-based learning with adults. This method has shown to exhibit more confidence in students, but more research is needed to determine its implications on performance in the clinical setting.

Tracheal Cuff Pressures in the Operating Room

Susan M. Gajdos, RN; Ineka K. Irish, RN; Stacy M. Luttrell, RN

University of Michigan - Flint

Introduction: Many people undergo general anesthesia every day where a cuffed endotracheal tube can be placed in their airway. Once the tube has been placed, the cuff on the end of it becomes inflated with air to secure the tube in place. Inaccurately inflated cuffs have been found to cause damage and harm to the patient if not properly performed. Currently, some hospitals in the United States have policies in place to check cuff pressures after the tube has been placed while others do not. The purpose of this study was to assess whether hospital-administered policies directed at measuring cuff pressures after intubation are helping decrease these adverse events.

Methods: A cross-sectional, primary research study was performed to collect quantitative data using a mailing survey list that was sent to 1,000 Certified Registered Nurse Anesthetists nationwide who are currently members of the American Association of Nurse Anesthetists. The respondents identified whether their institution had a policy in place for measuring inflated endotracheal cuff pressures, what methods are used, and how often. If no policy was in place, it was assessed how the anesthetist then ensured proper inflation of the endotracheal tube cuff. The survey assessed if negative adverse events from overinflated or underinflated endotracheal cuffs have been witnessed, and, if so, what were they.

Results: Out of the 1,000 surveys sent, 453 were returned. The results were entered into a SPSS statistical software program and evaluated. When asked who inflated the endotracheal cuff most of the time, respondents reported 47% of Certified Registered Nurse Anesthetists, 17% of anesthesiologists, 7.2% of student registered nurse anesthetists, 1.6% of registered nurse circulators, 1.3% of anesthesia technicians, and 0.7% of other personnel, such as residents, inflated the cuff. Overall, 96.5% of the respondents said that their institution did not have a policy in place to measure endotracheal cuff pressures and 3.5% did have a policy in place. Out of those who do not have a policy, only 7.1% have seen adverse events take place from overinflated or underinflated cuffs, whereas 50% of those who have a policy have seen adverse events occur.

Conclusions: Literature shows that adverse events take place after 15 minutes of the endotracheal tube cuff being overinflated or underinflated. Only 8.6% of respondents in this survey have seen adverse events actually take place in the operating room. It was thought that those who had a policy in place at their institution would see fewer adverse events occur, but this was not the case. Whether this is because the policy in place makes CRNAs more aware that adverse events occur or a policy was initiated due to the high incidence of adverse events, this information is not known. This was one of the first studies performed evaluating endotracheal cuff pressures in the operating room.

Type and Screen for Total Knee Replacement: Is the Benefit Worth the Cost?

Catherine M. Simms, RN, BSN; Melissa A. Weekley, RN, BSN; Patrick W. Monaghan, PhD, CLS, SBB; Patrick Ziemann-Gimmel, MD; Allison Goldfarb, CRNA

University of North Florida

Introduction: The purpose of this study was to determine how many patients undergoing total knee arthroplasty (TKA) receive blood transfusions and if risk factors can be identified to guide selective type and screening in order to reduce unnecessary cost. Approximately 600,000 TKAs are performed annually in the United States. Previous studies have shown that over 98% of TKA patients are type and screened preoperatively regardless of preexisting health status. The cost of a type and screen test is \$75 to \$100. Cross-matching packed red blood cells (PRBC) adds further costs in the perioperative period.

Methods: The data were collected as part of a retrospective chart review single-center study to assess the frequency of type and screens, as well as PRBC transfusions for patients undergoing TKA. Following Institutional Review Board approval, all patients at 1 community hospital who underwent a TKA during a 6-month period were reviewed. Preoperative type and screening, cross-matching, various laboratory results, medical history, home medications, surgical blood loss, surgical times, and the perioperative use of tranexamic acid, tourniquets, or volume expanders were reviewed along with transfusion records.

Results: During the 6-month period, 189 patient records were reviewed. Of these 189 patients, 96.8% of the patients were either type and screened or cross-matched. Six patients (3.2%) were not type and screened. Sixty-eight patients (36.0%) were type and screened and 115 patients (60.8%) were type and crossed for 2 units of packed red blood cells (PRBCs). No patient required a blood transfusion in the perioperative period. Only 2 patient records indicate that a volume expander was administered.

Conclusions: In a 6-month period, no patient scheduled for TKA required a blood transfusion. The estimated cost is \$75 per type and screen plus an additional \$70 for each unit of PRBC cross-matched. This amounts to approximately \$29,825 spent at this community hospital for this 6-month period. The rare incidence of blood transfusion in this patient population requires a significantly larger sample size to determine patient specific risk factors. The results indicate that generalized type and screening or cross-matching in patients undergoing TKA may be unnecessary.

Unanticipated Expenses of Nurse Anesthesia Programs

Lynn M. Siljander, RN, BA; Christine M. Kelley, RN, MS, BSN; Elizabeth L. Joseph, RN, BSN
University of Michigan-Flint

Introduction: CRNAs “provide high-quality, cost-effective care in a variety of healthcare settings.” Only 1.1% of RNs in the United States are CRNAs. The majority of nurse anesthesia educational programs (NAEPs) impose financial challenges beyond the published cost of attendance. There are often costs not covered by limited federal funding. The limited availability of financial resources imposes a barrier to nurse anesthesia education. Discovery of unanticipated expenses and available financial resources are critical steps toward promoting the growth of the future nurse anesthesia profession. Secondly, this may decrease stress related to unforeseen expenses that overall promotes the health of the nurse anesthesia student.

Methods: A cross-sectional, primary research study was used to collect quantitative data using a survey. It was administered to senior nurse anesthesia students attending 1 of the 113 NAEPs in the United States. The survey addressed student expenses related to their graduate program and sources of income. The main focus was on identifying unanticipated expenses during enrollment and how the student covered such expenses. The data was analyzed with descriptive statistics. Frequencies, means, and standard deviations were determined for what were identified as unanticipated expenses, beyond the cost of tuition.

Results: This study determined that expenses often exceed the published cost of attendance. The majority of tuition cost was between \$30,000 and \$80,000. Although just 14% of tuition costs were greater than \$100,000, 38% had expected debt of \$100,000 or more upon graduation. Unanticipated costs included ability to not work, conferences, travel, gas, review courses, health insurance, and life expenses including medical bills, vehicle maintenance, child care, and family emergencies. Financial resources included graduate loans, savings, credit cards, spousal income, grants/scholarships, and private loans. The most frequently reported advice for future students was to save to build a financial cushion for 2 years and decrease debt before entering an NAEP.

Conclusions: The data from this survey demonstrate the financial burden of NAEPs. The survey results are a valuable resource to inform prospective nurse anesthesia students of the specific costs they may encounter. Total education costs often exceed the amount of loans available. Advocacy for financial resources (i.e., grants, loans, federal funding) to parallel the increasing cost of NAEPs may alleviate the financial burden. Development of a comprehensive budget worksheet may be helpful for students in preparation for nurse anesthesia education.

Source of Funding: An Annual Fund Grant was received on March 13, 2014 from the University of Michigan-Flint Office of Development and Alumni Relations in the amount of \$500.

Up In Flames: A Flammability Assessment of Alcohol-Based Hand Sanitizers on Common Perioperative Materials

Samuel A. Almengor, RN, BSN

University of North Florida

Introduction: The objective of this study was to perform a flammability assessment of alcohol-based hand sanitizers on common perioperative materials. There is an estimated 550 to 650 surgical fires that occur nationally each year, an instance comparable to that of wrong-site surgery, yet only about 100 operating room (OR) fires are reported each year. The median cost of an OR fire settlement claim is \$120,166. Generation of fire requires the presence of 3 components, known as the “fire triad”: (1) an oxidizer, (2) an ignition source, and (3) fuel.

Methods: The flammability of 5 common perioperative materials was assessed (conform stretch gauze, surgical drape, foam headrest, OR towels, and lap sponges). The flammability of these materials was assessed alone and with 6 test liquids (Purell Advanced, Germ-X, generic hand sanitizer, spray hand sanitizer, Chloro-prep, and sterile water). The assessments with the test liquids were conducted immediately after application and after 5 minutes. The ignition sources used were a lighter and 2 spark generators (piezoelectric and battery-powered spark generator).

Results: Two of the 5 perioperative materials were easily ignitable (OR towels and lap sponges), while the others exhibited flame retardant properties, which manifested itself as “melting” when an ignition source was applied (conform stretch gauze, surgical drape, and foam headrest). Chloro-prep served as the positive control and sterile water served as the negative control. When hand sanitizers and Chloro-prep were added to these materials, the flammability increased. The addition of sterile water to the perioperative materials rendered the material nonflammable. The piezoelectric spark generator did not elicit any combustion of perioperative materials with or without test liquids, but the battery-powered spark generator did.

Conclusions: Commonly used hand sanitizers are flammable. When hand sanitizers are applied to perioperative materials, their flammability increases, even materials that were previously nonflammable. Electrostatic discharge did illicit combustion of hand sanitizer on any perioperative materials tested and should be recognized as a genuine safety hazard. Although these personal hand sanitizer products are commonly used for their antiseptic properties, one should exercise prudence with their use to avoid causing harm to the patient.

Use of 0.12% Chlorhexidine Gluconate in the Preoperative Area by Anesthesia Personnel

Alisha M. Gilson, RN, BSN

Lourdes University

Introduction: Ventilator-associated pneumonia is the second most frequent nosocomial infection. The oral cavity is a breeding ground for pathogens, and there is a direct correlation between oral health and pulmonary infections. There is an abundance of literature pertaining to oral care for mechanically ventilated patients in the intensive care centers with the aim of preventing and decreasing rates of ventilator-associated pneumonia. However, there does not appear to be any recommendations for oral care before surgery for patients that require a general anesthetic and possibly mechanical ventilation after surgery.

Methods: A survey will be hand delivered to anesthesia providers who serve as clinical coordinators for a Midwestern university's nurse anesthesia program with the aim of identifying behaviors and beliefs regarding oral care. They will have the opportunity to voluntarily complete the survey at their leisure within a 2-week time frame. The survey will include a postage paid and addressed envelope to increase participation. The completed surveys will be mailed to the primary investigators of this study, and no identifying information will be on the envelopes or surveys. The data will be entered into an Excel spreadsheet and analyzed with a qualified statistician.

Results: Eleven people out of 20 surveyed responded. All 11 indicated that they thought oral care was not the anesthesia provider's responsibility and it should be the role of the preoperative nurse. Two coordinators indicated that the facility they work at has an oral care policy and one of those identified that chlorhexidine was used in the oral care protocol. Preadmission colonization of the oral cavity was believed by the respondents to be the most likely cause of ventilator associated pneumonia, but only 5 people agreed that patients should have oral care prior to a general anesthetic. Sixty-three percent of respondents believe that they need more information on research-proven oral care strategies, but 54% of respondents did not want to learn more about the best way to provide oral care, and only 18% agreed that oral care is a priority.

Conclusions: The evidence shows that chlorhexidine use in the intensive care unit has decreased the incidence of VAP. However, the participants in this study do not rank oral care as a priority in patients undergoing a general anesthetic even though they identified preadmission colonization of the oral cavity with bacteria as the most likely cause of VAP. The majority of patients will have the endotracheal tube removed at the end of surgery, but there is an inherent risk with all general anesthetics that the patient may have to stay intubated postoperatively. Further research needs to be done in order to determine if implementing a standard oral care practice for preoperative patients would be beneficial.

Utilization of Objective Structured Clinical Examination (OSCE) as an Educational Initiative for a Summative Simulation Competency Evaluation of First-Year Nurse Anesthetist Students' Clinical Skills

Linda Wunder, CRNA, PhD; Derrick Glymph, CRNA, DNAP; Johanna Newman, CRNA, DNAP; Vincente Gonzalez, CRNA, DNP; Juan Gonzalez, CRNA, PhD; Jeffery Groom, CRNA, PhD

Florida International University Department of Nurse Anesthetist Practice

Introduction: Simulation technology is used to assess clinical competency before caring for live patients. The most current use of testing clinical competence is the use of Objective Structured Clinical Examination (OSCE) by physician training programs. The OSCE as a testing tool has a great potential to assess clinical competence of students before they enter the clinical setting. The development of the OSCEs' instructional design was guided by Miller's Pyramid utilizing the stages: knows, knows how, and show's how. A descriptive research design for the development of a formal simulation assessment of first year nurse anesthesia students utilizing OSCE is outlined in this inquiry for educators to initiate an OSCE assessment.

Methods: The OSCE stations were developed by experienced nurse anesthesia faculty and anesthesia preceptors associated with the nurse anesthesia program. Delphi methodology utilizing current evidence-based practices were reviewed by the expert educators and five rubrics were developed when consensus was reached. The rubrics for five OSCE stations were: anesthesia delivery, pre-anesthetic evaluation, masking and airway adjuncts, patient transfer and positioning, and general anesthesia induction. Each student's performance was scored on the rubrics and needed to be mastered before progressing to the next clinical semester. Reliability and validity of the OSCE rubrics were not investigated with the initiation of this testing.

Results: The faculty experiences with this premier testing can be utilized as a blueprint for future implementation and development of OSCE stations. A key component in planning is time management that includes extra time for unforeseen (technical) events, adhering to a strict time limit for each station, and faculty scheduling for rating the students' performance. Each OSCE station was manned by one faculty member per station to ensure consistency of the performance rating. Prior planning with the simulation center director and staff was essential in making the whole logistical experience cohesive and effortless. Therefore, diligent preparation, planning, and communication among all stakeholders provide the foundation for a successful OSCE simulation.

Conclusions: This introduction of a summative OSCE assessment can serve as an outline for educators to implement OSCE assessments in their educational curriculum. Future investigation of the best methods for summative and formative student evaluation is imperative. Patient safety and quality outcomes provide the foundation for best practice standards that necessitates the development of reliable student assessments. The utilization of OSCEs as a summative evaluation tool at the conclusion of a semester can provide an assessment of the acquisition of skills of the nurse anesthesia student. The benefits of the OSCE for the faculty, students, clinical sites, and patients are insurmountable.

Vasopressor Use as a Surrogate for Postintubation Hemodynamic Instability is Associated With In-Hospital and 90-Day Mortality

Christina C. Hoelt, RN, BSN; Bryce D. Richter, RN, BSN; Shejan Ansar, RN, BSN; Lisa M. Johnson, RN, BSN; Mary Shirk Marienau, CRNA, PhD; Nathan J. Smischney, MD; Rahul Kashyap, MBBS; Onur Demirci, MD

Mayo Clinic College of Medicine, School of Health Sciences Master of Nurse Anesthesia

Introduction: Current literature inadequately describes the best surrogate of hemodynamic instability following intubation. This deficiency led us to research indicators of hemodynamic instability for their relationship to mortality. The primary aim of the study was to arrive at the best significant factor that indicated hemodynamic instability with a secondary aim of reporting in-hospital and 90-day mortality rates between hemodynamically unstable and stable cohorts. Our population included a mix of medical and surgical adult ICU patients emergently intubated at Mayo Clinic Rochester, Minnesota.

Methods: The 2 groups were assessed for possible surrogates for postintubation hemodynamic instability that would predict in-hospital and 90-day mortality. Patients were included if they were not hemodynamically unstable 60 minutes preintubation. Six surrogates for hemodynamic instability 1 hour postintubation were tested including: SBP \leq 90 mm Hg, MAP \leq 65 mm Hg, fall in median SBP \geq 20% (1 hour preintubation and postintubation), vasopressor use, any nonsinus rhythm, and fluid administration of \geq 30 cc/kg. Univariate analysis and multivariate logistic regression models were used for significant surrogates.

Results: A total of 147 emergent ICU intubations met inclusion criteria. Surrogates that remained significant after multivariate analysis were used to compare in-hospital and 90-day mortality rates in the hemodynamically stable versus unstable patients. Of the 6 surrogates evaluated, only the requirement of any vasopressor 60 minutes postintubation remained significant for both in-hospital and 90-day mortality. Twenty-nine patients were then labeled as unstable and compared with the 118 patients labeled as stable 60 minutes postintubation. After adjusting for cofounders, the hemodynamically unstable group had a significantly higher in-hospital and 90-day mortality [OR (95% CI); 3.84 (1.31-11.57) ($p = 0.01$) and 2.37 (1.18-4.61) ($p = 0.02$)].

Conclusions: Patients exposed to hemodynamic instability, as measured by vasoactive administration 60 minutes postintubation, have a higher association with in-hospital and 90-day mortality. This effect remains after adjustment for potential cofounders of age, APACHE III score, and sepsis diagnosis. Further research is warranted to explore possible risk factors that may explain this association.

Source of Funding: This work was supported by the Department of Anesthesiology and the Division of Critical Care Medicine at the Mayo Clinic College of Medicine in Rochester, Minnesota, with no direct financial support.

Video Laryngoscopy: A Survey of the Current Clinical Practices' of Certified Registered Nurse Anesthetists

James Holliday, RN, BSN; Cheryl Ray, RN, BSN; Danielle Vandervelden, RN, BSN; Kelley LaBonty, CRNA, PhDc; Jane Motz, CRNA, DrAP

University of Michigan-Flint/Hurley Medical Center

Introduction: The literature supports multiple indications of use for video laryngoscopy (VL). With only recently recommended standards within a select arena (the difficult airway), there remains variability in institutional and individual anesthesia provider use of VL. The purpose of this study was to survey the current use of VL among Certified Registered Nurse Anesthetists (CRNA) in the United States.

Methods: Study design included primary, cross-sectional research with all relevant independent variables measured in a single 19-question survey. Surveys were sent via postal mail to a randomly selected sample of 1,000 active CRNAs registered with the AANA. Surveys were sent on March 1, 2014 and accepted through April 10, 2014. Data were coded for entry and analyzed using Statistical Product and Service Solutions. Univariate frequency analysis was utilized for analysis of questions pertaining to provider and facility characteristics. Bivariate analysis was utilized to seek correlations between the multiple independent variables themselves and their relationship to overall VL use.

Results: Four hundred surveys were returned. The majority of the CRNAs had over 20 years of experience. Ninety-nine percent of facilities viewed VL as a strength, and 23.3% of CRNAs were able to correctly identify the addition of VL to the difficult airway algorithm. The frequency of VL use increased with a second attempt at intubation. VL use was always performed with intubation involving possible cervical instability among >50% of CRNAs. Use declined significantly when asked about nasotracheal intubation, increased with increased Mallampati score and BMI. Correlations made were: age was inversely related to the use of VL, years practicing as a CRNA were inversely proportional to the frequency of use, direct relationship between a positive view of VL at a facility and frequency of CRNA use of VL, and no correlation with video game use and frequency of use of VL.

Conclusions: Survey results showed 93.5% of CRNAs had at least 1 VL available at their primary place of employment. There remains a gap between what literature recommends and the current practice. VL use decreased with increasing age. Only 9% of CRNAs stated they always use VL in emergency airways. A concerning result was only half of the CRNAs use VL with a known or possible cervical spine injury, while VL use is associated with a decrease in cervical spine movement. Also, CRNAs don't see VL's role in routine nasal intubations. The survey revealed 86.6% reported they always or sometimes use VL in an anticipated difficult airway. The majority of CRNAs would consider using VL based on a patient's BMI and Mallampati score.

Evidence-Based General Poster Abstracts

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A Case Report: Anesthesia Management of a Patient with Parry-Romberg Syndrome

Wm. Terry Ray, CRNA, PhD; Michael Blust, MD; Deepak Krishnan, DDS; Gary Wilcox, Jr, DMD

University of Cincinnati College of Nursing Nurse Anesthesia Major

Introduction: Parry-Romberg Syndrome (PRS) is a rare disorder characterized by progressive hemifacial atrophy of skin, soft tissue, muscle, cartilage, and bone with unknown etiology. PRS usually begins in the first decade of life and stabilizes in the second. It is more common in females with multisystem complications, including airway, connective tissue, neurologic, ophthalmologic, and maxillofacial. The distribution of atrophic changes follows the innervations of trigeminal nerve, and clinical manifestations vary depending on the age at time of onset, duration, and system involvement. The objective of this case report was to identify anesthesia considerations for a patient with PRS.

Literature Review: A 24-year-old white female presented for extraction of impacted third molars. Medical history included diagnosis of PRS, mild cognitive dysfunction, and seizures. Physical exam revealed BMI, 18.9; BP, 102/57 mm Hg; pulse, 73; left hemifacial atrophy with mandibular and maxillary deviation with occlusal cant; Mallampati classification III; left enophthalmos; full bony impacted teeth #1, 16, 17; and partial bony impacted #32. Radiographic exam revealed #17 spanned the height of the left mandible. Anesthesia management included standard ASA monitors, right nasal intubation, a total intravenous anesthetic supplemented with nitrous oxide. Perioperative course was uneventful and patient was discharged home.

Results: Systemic manifestations linked to PRS include neurologic, ophthalmologic, cardiac, rheumatologic, infectious, endocrine, maxillofacial, orthodontic, and autoimmune. Neurological manifestations affect approximately 15% of the PRS population with seizures being the most common. Enophthalmos due to fat loss around the orbit is a frequent ophthalmologic manifestation. Maxillofacial distortion results in facial and palatal midline shifts distorting airway anatomy. Bone atrophy can lead to thinning and shortening of the body of the mandible. Other clinical manifestations of concern include hypothyroidism/hyperthyroidism, hypertrophic cardiomyopathy, acute rhabdomyolysis, and hyperkalemic cardiac arrest after succinylcholine. Dermatologic changes include alopecia, vitiligo, hyperpigmentation, and linear scleroderma en coup de sabre.

Conclusions: The hemifacial atrophy in PRS can result in severe functional, psychological, neurological, and aesthetic problems requiring a multidisciplinary approach. Anesthesia providers should be aware of the clinical manifestations related to PRS while planning anesthesia care, including potential airway difficulties due to anatomical abnormalities. Other anesthetic concerns relate to neurologic, endocrine, and autoimmune manifestations. If muscle relaxation is required, succinylcholine may not be the first choice given the case report of hyperkalemic cardiac arrest. We demonstrated a successful anesthetic utilizing a total intravenous technique supplemented by nitrous oxide.

A Case Study: Uterine Inversion in a Patient with von Willebrand Disease Treated with Intravenous Nitroglycerine

Joshua C. Barker, RN; Margaret E. Finnigan, RN; Mary B. Ford, CRNA, PhD

Virginia Commonwealth University

Introduction: Uterine inversion is an obstetric emergency that requires immediate recognition and correction in order to prevent profound hemorrhage and hemodynamic instability. This is a case study of a patient presenting for anticipated vaginal delivery and developed an inverted uterus that initially was unrecognized. This case was complicated by a history of von Willebrand disease (VWD) and the progression to a state of disseminated intravascular coagulation (DIC). We describe the pathophysiology of uterine inversion, VWD, and DIC, as well as the treatment options.

Literature Review: MedLine, Pubmed, and Cochrane Library were searched for retrospective studies, scholarly articles, and case studies using the search terms “uterine inversion,” “anesthetic management,” “nitroglycerine,” “VWD,” and “DIC.” A thorough review of academic textbooks was also completed. Information about the patient’s disease processes, comorbidities, and treatment of uterine inversion was reviewed.

Results: A 27-year-old female presented gravida 4, para 2 at 38 weeks for vaginal delivery with a history of VWD and previous placental abruption. VWD is a heritable defect in von Willebrand factor, which normally acts as a bridging molecule between platelets and the endothelial vessel wall. Following uneventful delivery, hemorrhage ensued. Initial treatment included blood transfusion, albumin, and factor VIII based on hemodynamics and labs, including a thromboelastogram (TEG). Continued bleeding necessitated surgical intervention that revealed uterine inversion. We achieved successful uterine relaxation with intravenous (IV) nitroglycerine, and manual reversion of the uterus was completed by the obstetrician.

Conclusions: Uterine inversion is a rare but serious complication of labor. There are no recommendations for best practice in the treatment of an inversion. Intravenous nitroglycerine induces uterine relaxation and may be used as a treatment for uterine inversion. We achieved successful outcome using a combination of intravenous nitroglycerine and manual reversion.

A Literature Review of Pain Management in Opioid Dependent Pregnant Women

Michelle K. Day, RN, MS; Kristen L. Weckenbrock, RN, BSN

University of Cincinnati College of Nursing

Introduction: The prevalence of substance abuse in young adults, particularly females, has steadily increased over the past several decades, with nearly 90% of women abusing drugs being of childbearing age. As a result of the increase, incidence of opioid addiction among women in this age, pain management during labor, delivery, and postpartum has become a complicated issue for anesthesia providers due to the increase in pain sensitivity experienced by these patients leading to possible undertreatment of pain. The purpose of this literature review was to determine current recommendations and practice standards for pain management in the opioid dependent pregnant patient.

Literature Review: A literature search was conducted using the CINAHL, PubMed, EBSCOHOST, and MEDLINE databases. The keywords searched were: opioid abuse, pregnancy, obstetrics, methadone, buprenorphine, pain management, and labor and delivery. The search was limited to research and evidence-based publications from peer-reviewed journals and textbooks with the search limited to the past 10 years and then expanded to 15 years due to a limited amount of data. Results were then grouped into 3 subcategories based on specialty field: obstetrics, drug Abuse and anesthesia.

Results: A majority of the available research focuses on the maternal and fetal outcomes during opioid agonist therapy (OAT). Less research was found regarding the pain management of opioid dependent pregnant patients during labor, delivery and the postpartum time period. Obstetrical journal articles focused on inducing, bridging and individualizing patients on OAT and the impact on fetal safety. In the drug abuse journal articles, efficacy and safety of methadone and buprenorphine use for OAT during pregnancy was discussed at length with additional research involving NSAIDs and short-acting opioids as adjunct pain management options. In the field of anesthesia, the effects of hyperalgesia were discussed with recommendations for effective pain management approaches involving a multimodal approach.

Conclusions: Based on the literature reviewed, the recommendation for pain management and care of opioid dependent pregnant patients during and after labor should include an individualized, multimodal approach. Ideally, prior to labor and delivery, OAT should be initiated and a pain management plan should be established between the anesthesia provider and the patient. A multimodal pain management approach should include the use of scheduled doses of maintenance opioids as well as NSAIDs, acetaminophen, oral and/or intravenous opioids when indicated, and the use of regional anesthetics. Further research and practice recommendations need to be investigated to better manage this patient population.

Acute Hypotensive Transfusion Reaction Related to ACE Inhibitor Use: A Case Report

Sheryl L. Forster, BSN; Wendy L. Griscom, BSN; W. Patrick Monaghan, PhD, CLS, SBB

University of North Florida

Introduction: Acute hypotensive transfusion reaction (AHTR) is a phenomenon that can occur with the administration of blood products and the concomitant use of angiotensin converting enzyme (ACE) inhibitors. Two changes in healthcare practices in the late 1980s and early 1990s resulted in an increased reporting of AHTR. These changes included the increased prescribing of ACE inhibitors and the increased use of leukocyte-reducing blood filters with depth filtration technology. A case report of a probable intraoperative AHTR is presented, along with a related literature review.

Literature Review: Hypotension is the sole manifestation of AHTR, differentiating it from other types of transfusion reactions. Diagnosis is based on clinical presentation and a history of ACE inhibitor use. The hypotension that ensues in AHTR is a result of the generation of bradykinin produced through factor XII activation by contact with negatively charged surfaces such as blood filters. Bradykinin, a vasoactive peptide, can cause vasodilation and hypotension. ACE is 75% responsible for the degradation of bradykinin, so patients on ACE inhibitors are susceptible to the hypotensive effects of bradykinin.

Results: In this case report, a 76-year-old patient, who was being treated with an ACE inhibitor for hypertension, presented for major vascular surgery. During the surgery, significant blood loss occurred, and a transfusion of packed red blood cells (PRBC) was ordered. Within minutes of initiating the transfusion, the patient became acutely hypotensive. The transfusion was discontinued and the hypotension quickly resolved. A second transfusion was attempted with the same results. The surgery concluded and the patient was transferred to the recovery room and then to the intensive care unit. Two further transfusion attempts were aborted, again due to the sole manifestation of acute hypotension. A transfusion reaction workup by the blood bank was negative.

Conclusions: Although AHTR in the intraoperative setting can have detrimental and potentially life-threatening consequences, its occurrence is not well documented. With the increasing use of ACE inhibitors, the prevalence of AHTR is likely to increase. Recommendations and guidelines are needed for the perioperative management of patients on ACE inhibitors at risk for experiencing intraoperative AHTR. It is the authors' belief that the documentation of cases such as this will improve awareness among anesthesia providers and ultimately bring about the guidelines necessary to improve patient safety.

Adult Emergence Delirium: A Literature Review

Maj Darrell Saylor, RN, BSN, USAF, NC; Capt Lyn Cabigas, RN, BSN, USAF, NC; CAPT John Maye, CRNA, PhD, NC, USN; Lt Col Shawna Greiner, CRNA, USAF, NC; Maj Katherine Alguire, CRNA, DNAP, USAF, NC

Uniformed Services University of the Health Sciences

Introduction: Emergence delirium (ED) in the adult population is a well-known and documented occurrence in the postoperative environment dating back several centuries. The etiology, risk factors, and treatment strategies concerning this phenomenon, however, lack clear consensus and understanding. The purpose of this literature review was to explore the population characteristics and risk factors for the development of ED in adults, define gaps in the current literature, and discuss implications for future studies in the adult population.

Literature Review: An inquiry of evidence-based (EB) research consisted of online literature searches using PubMed, Cumulative Index of Nursing and Allied Health Literature, and Google Scholar to locate the highest level evidence available. Included were articles published in English language peer reviewed journals from 1960 to present (with emphasis on articles from 2004 to 2014). Search terms used alone or in combination included emergence delirium, adult, anesthesia, anxiety, fear, agitation, military anesthesia and posttraumatic stress disorder (PTSD).

Results: Seven evidence sources meeting inclusion criteria were identified. The evidence reviewed revealed a variety of population characteristics (age and gender) and risk factors (pain, PTSD, depression, anxiety, pharmacologic agents, duration of fluid fasting, and types of surgeries) that may have an association with the occurrence of ED in the adult population. Possible clinically relevant commonalities among the evidence reviewed were pain, type of surgery, use of benzodiazepines, and age. Current research involving military wounded warriors revealed a relationship between anxiety and PTSD with ED. Limitations included use of multiple definitions of ED and lack of reliable measurement tools.

Conclusions: Further studies are needed to enhance interventional strategies in the prevention and treatment of ED in the adult population. Possible areas of focus might include development of a clear and concise universal definition, use of valid and reliable evaluation instruments, and continued investigation of common risk factors. Clear EB criteria would enable anesthesia providers to accurately identify and provide optimal care for adult patients at risk for the development of ED.

Adverse Events Associated with Perioperative Beta-Blocker Use in Noncardiac Surgery

Richard A. Ligon, RN, BSN, BS, CCRN; Ann B. Miller, CRNA, DNP, ARNP

Florida Gulf Coast University

Introduction: A literature review was conducted for a quality improvement project to support adverse events associated with perioperative beta-blocker administration as recommended by American College of Cardiology Foundation and American Heart Association and Centers for Medicare and Medicaid Services mandate. Patients undergoing noncardiac surgery administered a beta-blocker perioperatively are at a significantly increased risk for bradycardia, hypotension, stroke, and mortality.

Literature Review: The literature review was conducted utilizing the following databases: PubMed, Cumulative Index to Nursing and Allied Health Literature, the Cochrane Library, and Science Direct. Keywords included beta-blocker, beta-adrenergic antagonist, perioperative, noncardiac surgery, cardiac death, and increased cardiac mortality. Ten articles were selected for inclusion in the literature review: 3 meta-analyses, 1 RCT, 1 systematic review, 2 observational studies, and 3 expert opinions.

Results: The research shows the use of perioperative beta-blockers increases mortality, stroke, bradycardia, and hypotension requiring treatment when compared with patients not receiving beta-blockade. Three meta-analyses concluded the current guidelines presented by the American College of Cardiology Foundation and American Heart Association have been founded on weak data, expert opinion, and potentially invalid data. Review of meta-analyses states beta-blocker use in the perioperative area is not beneficial and recommends guidelines set forth by the American College of Cardiology Foundation and American Heart Association be withdrawn.

Conclusions: The results of this quality improvement project are to provide evidence for the revision of beta-blockade protocols by Centers for Medicare and Medicaid Services, American College of Cardiology Foundation, and American Heart Association. Populations that should receive a perioperative beta-blocker include patients on long-term beta-blocker therapy, patients at a high risk for adverse events, and hemodynamically unstable patients. The literature is supporting practice change in beta-blocker administration perioperatively, currently mandated by Centers for Medicare and Medicaid Services.

Alveolar Recruitment Maneuvers: Are Your Patients Missing Out?

Benjamin L. Hartland, RN, BSN; Timothy J. Newell, RN, BSN; Nicole Damico, CRNA, MSNA
Virginia Commonwealth University

Introduction: The sigh is a normal homeostatic reflex that maintains lung compliance and decreases atelectasis. General anesthesia abolishes sighs causing atelectasis in up to 100% of patients. Studies show a strong correlation between atelectasis and postoperative pulmonary complications, which raise healthcare costs. Alveolar recruitment maneuvers (ARMs) or sigh breaths recruit collapsed alveoli, increase gas exchange, and improve arterial oxygenation. There is no consensus in the literature about the benefits of ARMs. A systematic review is necessary to delineate their usefulness and improve practice.

Literature Review: We searched Pubmed, CINAHL, the Cochrane Library, the National Guideline Clearinghouse, and all subsequent research reference lists up to January 1, 2014. All studies were randomized controlled trials comparing the use of an ARM with a control group lacking an ARM in adults not suffering from ARDS, as well as not undergoing cardiac or lung surgeries, in the intraoperative period. We did not limit studies by publication status, date of publication, or language. ARMs included either a stepwise increase in PEEP, tidal volume, or inflation of the patient's lungs to a set PIP.

Results: This systematic review included 6 randomized controlled trials that achieved a ≥ 3 on the Jadad scale. All studies involved abdominal surgery. Most patients had a BMI >25 and were over the age of 40. ARMs consisted of either a stepwise increase in tidal volume to a plateau pressure of 30 cm H₂O, a stepwise increase in PEEP to 20 cm H₂O, or sustained manual inflations of the anesthesia reservoir bag to a PIP of 40 cm H₂O. Overall, participants in the ARM groups experienced a higher intraoperative PaO₂ along with improved lung compliance. There was no significant difference between postoperative PaO₂ among groups. There was no difference in outcomes among different ARMs, but there was a significant advantage to following ARMs with PEEP.

Conclusions: ARMs followed by PEEP should be instituted after induction of general anesthesia, routinely during maintenance, and in the presence of a falling SpO₂ whenever feasible. ARMs allow the anesthesia provider to reduce the FiO₂ while maintaining a higher SpO₂, which limits the masking of shunts. The lack of postoperative benefits of ARMs may be due to the absence of postoperative lung protective protocols in all studies. In order to continue the benefits of ARMs into the postoperative period, a study incorporating ARMs during emergence followed by CPAP in the PACU should be researched.

An Evaluation of the Impact of a Perioperative Warming Protocol on Time to Extubation

Capt Jeremy M. Holzberger, RN, BSN, USAF, NC; Capt Sean M. Amport, RN, BSN, USAF, NC; Maj Nicole R. Salas, CRNA, DNP, MSN, USAF, NC

Uniformed Services University

Introduction: The physiologic response to stress and surgery has been well documented. One perioperative factor that has a profound influence on recovery and postoperative complications is inadvertent perioperative hypothermia (IPH). In addition to the adverse complications linked to IPH, such as impaired coagulation, myocardial ischemia, and increased incidence of infections, other factors such as delayed drug metabolism and prolonged recovery times may decrease perioperative efficiency. The primary aim of this project was to determine whether the implementation of a perioperative warming protocol would reduce the time-to-extubation in orthopedic patients undergoing general anesthesia.

Literature Review: After appraising the literature, an IPH protocol was developed and implemented at an academic medical center. Retrospective deidentified data was obtained from anesthesia records prior to the implementation of the protocol that was initiated on September 1, 2013. Data was then collected over a 2-month time period. Data points extracted from both time periods consisted of ASA classification, surgical procedure, anesthetic method, serial intraoperative patient temperatures, and time from the end of procedure to extubation.

Results: Preimplementation (n = 104) and postimplementation (n = 73) data were entered into IBM SPSS® and compared using chi-square, Mann-Whitney U, and t-test. Groups were similar with respect to age, gender, and surgery length, but were significantly different with respect to the inclusion of regional anesthesia (p = .01) and temperature immediately before extubation (p = .01). However, time to extubation was not different between these subjects. Therefore, the between-group differences in operative characteristics did not appear to confound comparisons of time to extubation by group. Median time to extubation was 4 and 5 minutes in preimplementation and postimplementation groups, respectively. The difference was not statistically significant (p = .15).

Conclusions: The rising cost of healthcare has garnered national attention. Small practice changes that increase perioperative efficiency may reduce operating costs. Although no statistical significance was found in extubation times, there was a statistically significant increase in patient temperature immediately before extubation (p = .01), and an improvement in the organization's temperature compliance metric (increased from 89% to 94.9%). This rise in perioperative thermoregulation may reduce complications associated with IPH, improve recovery time, and increase patient satisfaction.

An Evidence-Based Review of Regional Anesthesia Techniques to Reduce Intraneural Injections and Neurovascular Compromise in Upper Extremity Peripheral Nerve Blocks

Brooks B. Goettle, CRNA, MHS; Kathrine Prater, PhD; Paul N. Austin, CRNA, PhD

Texas Wesleyan University

Introduction: Peripheral nerve blocks (PNBs) are commonly performed to produce anesthesia for surgery of the arm and hand. While rare, nerves can be injured due to intraneural injection of local anesthetic solutions. Most injuries are transient and present as paresthesias or mild mononeuropathies. The paresthesias may persist for many days following the PNB. The question guiding this evidence-based review was: For adult patients undergoing regional anesthesia for upper extremity procedures, what methods can be used to decrease the likelihood of intraneural injection with the associated complications?

Literature Review: A keyword search was done of online databases including PubMed, CINAHL, and the Cochrane Library (2002 to 2014). Websites of governmental and professional organizations were also examined. Evidence was included from systematic reviews (SRs) with or without meta-analysis, human clinical trials, and evidence-based clinical practice guidelines. The authors of the SRs adequately described their search and appraisal methods. The evidence was appraised and leveled using the method proposed by Melynck and Fineout-Overholt.

Results: The search yielded 6 evidence sources: 3 SRs, 1 randomized controlled trial (RCT), 1 observational study (OS), and an evidence-based clinical practice advisory. The authors of the SRs adequately described their search and appraisal methods. Though there was a significant amount of heterogeneity between studies in the Cochrane Review, the included RCTs employed moderate to high quality methodologies. The other 2 SRs utilized 3 different scoring systems to rate the RCTs methodologies but used a rigorous method. The RCT used the CONSORT methodology. The OS and clinical practice advisory used moderately rigorous methods.

Conclusions: Results of the Cochrane Review suggested the incidence of some postoperative neurological symptoms may be reduced using ultrasound guidance. One SR and the RCT found reduced needle passes using ultrasound. Another SR proposed that ultrasound guidance may reduce the frequency of vascular punctures. Interestingly, video analysis by blinded investigators in the OS observed direct intraneural injections, yet no postoperative neurovascular compromise was observed. Overall the evidence suggested there is a benefit of using ultrasound guidance to prevent this complication.

Anesthesia Methods for Esophagogastroduodenoscopy

Jason W. Caldwell, CRNA, MSN; Dion A. Gabaldon, CRNA, DHA; Paul N. Austin, CRNA, PhD
Texas Wesleyan University

Introduction: Various techniques are employed during esophagogastroduodenoscopy (EGD) to limit patient anxiety and pain. Anesthesia providers use topical anesthetics, opioids, benzodiazepines, propofol, or combination of agents. Topical anesthesia with sedation has been speculated to result in better patient outcome and endoscopist satisfaction. The search strategy focused on locating evidence from higher level of evidence sources addressing the question: For patients who are undergoing EGD, what anesthetic/sedation regimen provides optimal patient outcomes and procedure conditions?

Literature Review: A search was done of multiple online databases including PubMed and the Cochrane Library to locate higher level evidence sources examining various methods of managing patients undergoing EGD. Terms used alone or in combination included “esophagogastroduodenoscopy,” “upper endoscopy,” “gastroscopy,” “sedation,” “anesthesia,” “propofol,” “midazolam,” “fentanyl,” “lidocaine,” or “benzocaine.” Studies included in systematic reviews were not separately appraised. The evidence was appraised and leveled using the method proposed by Melynck and Fineout-Overholt.

Results: The initial search revealed 185 possible sources based on the search terms. Five evidence sources ultimately met the inclusion criteria: a systematic review with meta-analysis (SR) and 4 randomized controlled trials (RCTs) that were not included in the SR. The SR included 21 EGD studies with 2,237 subjects. There was marked variability among studies in the drug doses, schedules, and combinations that were compared. The RCTs examining the use of topical agents including lidocaine jelly suffered from possible bias because the operator was not blinded to the use of the lidocaine jelly.

Conclusions: The evidence reviewed suggested there is not an anesthetic/sedation regimen that provides optimal patient outcomes and procedure conditions. Studies were limited when comparing topical anesthesia with sedation to sedation alone. Investigators did not agree if use of topical anesthesia benefits patients who are also sedated. There were a number of methodological problems with the evidence sources that should be addressed in future investigations.

Barriers to the Utilization of Human Patient Simulation in Nurse Anesthesia Programs

Laurie M. Gabel, RN, BSN

Lourdes University

Introduction: Simulation is utilized in 96% of nurse anesthesia programs, and only 50% of programs utilize high fidelity patient simulators (HFPS). There is a lack of information regarding the barriers to HFPS in the education of student registered nurse anesthetist (SRNAs) specifically. As testing evolves and simulation is utilized, they must be analyzed with respect to the reliability and validity of the interpretations made based on the scores (Boulet, 2008). Barriers to reliability and validity take a high-stake role in the future of students. By exploring and then addressing the barriers or ethical dilemmas to utilizing HFPS in the education and evaluation of SRNAs, one can improve the educational process, clinical abilities, and test scores.

Literature Review: This review of the literature involves information related to general medical or nursing education because there is limited research specifically related to nurse anesthesia education. Simulation is gaining widespread acceptance in medical education because of improved patient safety, reproducibility of the content, and the ability to represent multiple patient problems and critical events (Okuda et al, 2009). The barriers to the use of simulation in postgraduate and continuing education for anesthesiologists have not been well studied (Savoldelli et al, 2005). “The use of HFPS as an interview tool in graduate nurse anesthesia programs has not been studied” (Penprase et al, 2012).

Results: One hundred percent of educators surveyed utilize simulation in the program in which they teach; low-fidelity (76%), medium (70%), and high (91%). Programs use simulation in skills training (100%), scenarios (93%), testing/evaluation (52%), clinical time (11%), and program admission evaluation (2%). Sixty-six percent of those surveyed strongly agree/agree that there are barriers to simulation. Barriers to low-fidelity simulation were identified (greatest to least) as cost, time, lack of reality, equipment, educator/faculty, access, and scenario related. Barriers to medium fidelity are time, cost, educator/faculty, equipment, reality, and access. Barriers to high fidelity are educator/faculty, cost, equipment, time, resources/tools, lack of reality, and access.

Conclusions: Simulation is being utilized to determine acceptance into programs, grades, and clinical readiness; barriers take a high-stake role in one’s progression. Ninety-six percent of those surveyed strongly agree/agree that simulation is an effective tool in the education of SRNAs, 2% were neutral, and 2% disagree/strongly disagree. Identifying and addressing the barriers to simulation in the education of SRNAs can improve the effectiveness and reliability. Tackling barriers related to cost, time, reality, and faculty education will ultimately improve educational process, clinical abilities, and test scores.

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Brachial Plexus Injury Following Oncologic Tumor Ablation: A Literature Review

Eleanor W. Rawson, CRNA, MS

Barry University

Introduction: Surgical procedures are trending toward more minimally invasive techniques, and this is especially true in the treatment of cancer. Tumors of the liver and lungs that previously required open surgical procedures are now being treated in interventional radiology (IR) with the ablation of the tumors, in areas located remotely from the main operating room creating new and unique challenges for the anesthesia team. Under general anesthesia, patients are positioned with their arms abducted greater than 90 degrees in order to gain maximal surgical exposure, while still allowing for full motion through the CT scanner.

Literature Review: The purpose of this literature review is to build a foundation on positioning in remote anesthesia locations during tumor ablations, and to determine if there is a current issue with nerve injuries in this area. The literature will be assessed for a better practice or if there is a greater need for knowledge with positioning of these patients. This will include a historical perspective of patient positioning during general anesthesia, as well as a focus on procedures that require general anesthesia in IR. The use of the CT machine makes these cases unique and will be reflected in the following literature review.

Results: Literature from the year 2000 and more recent literature was searched and grouped into 4 categories: anesthesia in remote locations, practice standards and risks of patient positioning, positioning in IR, and prevention of nerve injury. Much of the literature found is geared toward general positioning techniques. A retrospective study from 2003 reports the incidence of nerve injury reported to the AANA Foundation Closed Malpractice Claims Database. An article by the Association for Radiologic & Imaging Nursing provides basic guidelines for positioning in IR. Two case reports were found of patients undergoing tumor ablations that resulted in brachial plexus injury, leading to the adjustment of patient positioning.

Conclusions: Further research is necessary to determine if there is a greater incidence of brachial plexus injury during the treatment of cancer patients undergoing tumor ablations, but the current literature suggests that since there have previously been brachial plexus injuries, this may be an emerging complication and risk to this procedure.

Breast Cancer and Paravertebral Block

Lorraine J. Anthony, RN, BSN; Tushana C. Fowlin, RN, BSN; Verna L. Wilson, RN, BSN; Veronica Y. Amos, CRNA, PhD

University of Maryland

Introduction: Regional Anesthesia is a technique of rendering a portion of a patient's body insensate to surgical stimuli. It provides anesthesia to allow a surgical operation or provide postoperative pain relief. Various types of regional anesthesia exist for a multitude of procedures. Paravertebral block for breast surgery has seen an increase in popularity over the last decade. Several studies and reviews have provided additional support to the reported benefits of this procedure. The purpose of this paper is to describe the evidence on the relationship between regional anesthesia via paravertebral block for breast surgery and recurrence of breast cancer.

Literature Review: The PICO question used to search the literature databases CINAHL, PubMed, and ProQuest was: In patients' undergoing primary breast cancer surgery (P), does the use of general anesthesia combined with regional anesthesia (I) reduce the recurrence of breast cancer (O) compared with general anesthesia alone (C)?

Results: Three retrospective cohort studies and 3 randomized controlled trials were critically reviewed. Using the US Preventative Services Task Force (USPSTF) system, the studies were stratified and ranked according to quality of evidence. The evidence from the selected studies were not sufficient enough to conclude a definitive link between regional anesthesia in conjunction with general anesthesia and the subsequent reduction in the rate of recurrence of breast cancer in patients undergoing primary breast cancer surgery.

Conclusions: Further research on this subject is warranted.

Comparison of Cognitive Outcomes Following Lower Extremity Surgery on Elderly Patients: General Versus Regional Anesthesia

Ben E. Snyders, RN, BSN, CCRN

Goldfarb School of Nursing at Barnes-Jewish College

Introduction: Postoperative delirium (PD) and postoperative cognitive dysfunction (POCD) are common negative outcomes following surgical procedures in the elderly population that can increase morbidity, mortality, length of stay, and quality of life. Regional anesthesia (RA) may decrease the rates of PD and POCD compared with general anesthesia (GA). A literature search was performed using PubMed, from which 10 primary articles examining RA compared with GA and cognitive dysfunction in elderly patients were selected and reviewed.

Literature Review: Five researchers found no correlation to type of anesthesia and PD or POCD. Three articles found a significant decrease in PD and POCD. The first found a decrease in POCD when using RA compared with GA at 1 week, the second at 1 and 3 days when compared with RA, and the third found a significant difference at 1 week in test results following RA versus GA. One study found that deep versus light sedation can significantly change the incidence of cognitive impairment, and another found that fast track spinal anesthesia may also decrease the incidence.

Results: Results were inconclusive regarding RA versus GA in relation to the prevalence of postoperative cognitive outcomes. Five of the articles found no correlation to type of anesthesia and PD or POCD in the first week preoperatively, as well as at longer periods of time. Three of the articles found a significant difference between GA and RA. One article found a significant difference in rates of PD in patients receiving RA with light versus deep propofol sedation, and the final article found fast-track spinal anesthesia patients to have very little cognitive impairment postoperatively.

Conclusions: The results were not sufficient to make a recommendation in the use of RA in elderly patients undergoing lower extremity surgery. Limitations included different testing protocols, different methods of administering RA, different drugs used during GA, differing levels of sedation during GA, and lack of long-term studies. The studies do question the effects of GA on PD and POCD and suggest that in the absence of contraindication to RA or a reason to perform GA, then RA may be the superior choice to prevent postoperative cognitive dysfunction in elderly patients undergoing lower extremity surgery.

Continuous, Noninvasive Versus Invasive Arterial Blood Pressure Monitoring: Do They Even Compare?

Johanna I. Aronson, RN, BSN; Holly A. Cole, RN, BSN; Angela C. Prows, RN, BSN

Texas Christian University School of Nurse Anesthesia

Introduction: In high-risk adult surgical patients that require hemodynamic monitoring, it is common practice to use invasive arterial blood pressure monitoring to get the most accurate beat-to-beat variations in blood pressure. However, because of many risks and high costs associated with invasive arterial monitoring, the use of continuous noninvasive arterial pressure (CNAP) has been considered as an alternative to invasive arterial pressure monitoring. We investigated whether CNAP is comparable to and even interchangeable with invasive arterial pressure monitoring in high-risk adult surgical patients undergoing general anesthesia.

Literature Review: A review of the empirical evidence yielded 5 prospective studies that were published between 2010 and 2013. Findings from each of these studies conclude that the noninvasive arterial pressure monitoring devices provide results comparable to the invasive arterial pressure monitoring devices during normotensive periods. However, during times of low blood pressure or induction of anesthesia, invasive arterial pressure monitoring provided more accurate results than that of the continuous noninvasive arterial pressure monitoring.

Results: When the patient is normotensive, CNAP is an effective alternative to invasive arterial pressure monitoring and can be used as a valuable monitor. However, in times of induction, hypotension, or hemodynamic instability, the CNAP is not as quick or precise as the invasive arterial pressure method and cannot be used interchangeably in patients who absolutely require the beat-to-beat arterial pressure monitoring.

Conclusions: CNAP can be a valuable tool and monitoring guide in patients that do not necessarily require invasive beat-to-beat monitoring of arterial pressure. However, more studies must be conducted in patients with common conditions such as severe atherosclerosis, aortic stenosis and heart failure where vascular changes could alter the results of CNAP. Lastly, future improvements of the CNAP technology are required to virtually compare with the precision and accuracy of invasive monitoring.

Corneal Abrasion: How Do YOU Protect Your Patients' Eyes?

Ian B. Mores, RN; Leah R. Runaldue, RN; Melissa Hindle, RN, BSN; Elizabeth Jane McCarthy, CRNA, PhD, FAAN

University of Maryland Nurse Anesthesia Program

Introduction: Corneal abrasion is second to optic nerve injury as the most common visual pathway injury in the perioperative period. Such abrasions can be caused by a variety of mechanisms and are not usually apparent until the patient is in the recovery period. Although it is not debilitating, it can be very irritating and can make the patients' postoperative period uncomfortable. There is no standard mode of protecting the eyes during general anesthesia; it varies by anesthesia provider. Methods currently used include tape and bio-occlusive dressings. The purpose of this poster is to present the effectiveness of these 2 methods on preventing corneal abrasion perioperatively.

Literature Review: A search of the literature databases PubMed, CINAHL, Medline, and EBSCO was performed using the PICOT question: In adults undergoing elective, nonophthalmic surgery under general anesthesia, does a bio-occlusive dressing compared with lid taping, offer better eye protection as measured by incidence of corneal abrasion perioperatively? One systematic review, 3 retrospective studies, and 3 review articles were relevant to the topic and chosen for critical appraisal. Of these, it was determined that 3 articles met all criteria for our purpose.

Results: The results of these studies found that the incidence of corneal abrasion was statistically significantly less with the bio-occlusive dressing compared with taping the eyelids.

Conclusions: From this evidence it is recommended that bio-occlusive dressing be used to protect the eyes intraoperatively instead of eyelid taping. The use of bio-occlusive dressing appears to be beneficial to all patients, especially those patients at risk of corneal pathology, during head and neck surgery, prolonged procedures, and operations in the prone or lateral position.

Determining the Glycemic Control of Surgical Patients with Diabetes

L. Alan Todd, CRNA, MSN; Robert A Vigersky, MD; Christopher C. Davis; Roy A. Sherrod, PhD, CNE, CNL

The University of Alabama - Capstone College of Nursing

Introduction: Diabetes is a common comorbidity found in surgical patients. Anesthesia providers need to be familiar with strategies to improve the delivery of care to this vulnerable population. A consensus among national medical organizations recommends serum glucose levels be maintained between 140 and 180 mg/dL throughout the perioperative period. The purpose of this project was to evaluate if current practice standards are able to achieve the recommended glucose target of 140 to 180 mg/dL during the preoperative and postoperative periods at a large military medical center.

Literature Review: Surgical patients with diabetes are prone to poor glycemic control and hyperglycemia during the perioperative period. Retrospective cohort studies have found elevated blood glucose levels in surgical patients are associated with increased rates of surgical infections, longer hospital stays, and increased mortality. A review of electronic medical records was conducted to identify surgical patients with diabetes undergoing noncardiac surgery. Preoperative and postoperative blood glucose values were obtained to determine the frequency of blood glucose values maintained in the recommended range of 140 to 180 mg/dL.

Results: Adult noncardiac surgical patients with diabetes accounted for 5.9% (560 of 9,449) of all patients admitted for surgery from January 1, 2013 to December 31, 2013. Preoperative and postoperative blood glucose values were available in 56% (312 of 560) of the records. The target blood glucose range of 140 to 180 mg/dL was achieved in 30.2% patients before surgery and in 31.1% after surgery. Seventy-three percent of patients were identified with type II diabetes, 21.5% with either type I diabetes or using prandial insulin, and 5.5% with prediabetes or no diabetes diagnosis.

Conclusions: The data collected in this project indicate the need to improve documentation of perioperative blood glucose values for patients with diabetes. While the blood glucose target of 140 to 180 mg/dL was not consistently achieved, most values were reasonably maintained in the range of 80 to 180 mg/dL. Practice standards and guidelines should be developed to improve the management of diabetes patients undergoing noncardiac surgery.

Dexamethasone Dosing for PONV Prophylaxis

Daniel A. Dovalina, RN; Judah Labovitz, RN; Emmanuel Ibhaze, RN

University of Maryland, Baltimore

Introduction: Postoperative nausea and vomiting (PONV) is one of the most commonly encountered complications of anesthesia. It can delay discharge from postanesthesia care units, can cause unanticipated hospital admissions after outpatient procedures, and decreases patient satisfaction with anesthesia care. Dexamethasone is a corticosteroid that is routinely used by anesthesia providers to prevent PONV. While its efficacy as an antiemetic has been well established, dosing parameters vary between anesthesia providers. The purpose of this poster is to describe the evidence on the effectiveness of 4 mg compared with 8 mg of dexamethasone on PONV.

Literature Review: The literature databases Medline, Cochrane Library, CINAHL, Google Scholar, and PubMed were searched using the following PICOT question: Do adult surgical patients during general anesthesia (P) given 8 mg of intravenous dexamethasone (I) compared with patients who are given 4 mg of intravenous dexamethasone (C) have a lower incidence of nausea and vomiting (O) postoperatively (T)? Two meta-analyses and 3 RCTs were critically appraised.

Results: The results of 1 meta-analysis and 2 RCTs found that 8 mg was more effective than 4 mg of dexamethasone at reducing PONV. One meta-analysis and 1 RCT found no statistical difference.

Conclusions: The differences in these results could be attributed to differences in methodology between the studies. From this conflicting evidence, however, it is unclear if 8 mg of dexamethasone is more beneficial than 4 mg.

Does the Administration of Intravenous Acetaminophen Decrease the Postoperative Opioid Requirement for Elective Cesarean Delivery Patients Using Neuraxial Anesthesia as Primary Pain Control?

Hazel Pickering, RN, BSN; Johnny Gayden, RN, BSN

University of Maryland School of Nursing

Introduction: Many anesthetists are administering intravenous (IV) acetaminophen alone or in conjunction with an NSAID, for postcesarean delivery pain management despite the lack of available research to support its use in this population. Examination of what the current literature states, risk benefit ratios and cost effectiveness evaluations may lead to an alternative to presently used methodologies for adjunct pain control. The purpose of this evidenced-based literature review is to examine the evidence available about IV acetaminophen, if it reduces postoperative opioid requirements, and if those findings will translate to other patients who have elective cesarean deliveries with neuraxial anesthesia.

Literature Review: Google Scholar, CINAHL, PubMed, Cochrane, and Medline were searched using keywords from the PICOT question. Inclusionary criteria only included IV acetaminophen, paracetamol and cesarean section with spinal anesthesia, epidural anesthesia or neuraxial anesthesia. The outcome measurements were specific for decreases in overall postoperative opioid requirements, patient pain control satisfaction, and visual analog scores. After an extensive search, 3 articles were evaluated and deemed pertinent to PICOT.

Results: Analysis of the evidence identified that IV acetaminophen is effective in reducing postcesarean opioid use. Three RCTs included a total of 303 patients who received IV acetaminophen. Two groups used fentanyl in the spinal anesthetic; 1 used morphine. One article suggested that IV acetaminophen in combination with an NSAID was superior to IV acetaminophen alone. Reduction in the side effect profile was directly proportionate to decreased overall opioid requirements.

Conclusions: Based on the current body of evidence, we can reasonably recommend that 1 g IV acetaminophen is useful as an adjunct in reducing postoperative opioid requirements for elective cesarean delivery patients using neuraxial anesthesia.

Effect of the 5-HT₃ Receptor Antagonist Ondansetron in Reduction of Spinal-Induced Hypotension During Cesarean Delivery

Rajae S. Black, RN, MS

Drexel University

Introduction: The purpose of this inquiry is to examine the effect antagonizing the Bezold-Jarisch Reflex (BJR) prior to the administration of a subarachnoid block (SAB). Hypotension is a predicted side effect of an SAB, which can lead to deleterious effects. The (BJR) exacerbates spinal-induced hypotension by inhibiting sympathetic efferent signals to vasomotor centers. The BJR utilizes the neurotransmitter serotonin via 5-HT₃ receptors in the central nervous system (CNS). Ondansetron is effective in attenuating the BJR. It is theorized that attenuating BJR will reduce the hemodynamic changes caused by the SAB.

Literature Review: An electronic keyword search for the terms: spinal anesthesia, hypotension, cesarean section, serotonin, and ondansetron were performed using CINAHL, PubMed, and OvidSP. The search yielded several studies that expounded on the physiology of the BJR and the efficacy of ondansetron to attenuate it; 3 random controlled trials (RCTs) were included. Two RCTs studied the effect of ondansetron on parturients undergoing cesarean delivery, and the third on general surgical patients. Two additional articles were included for physiological relevance to the subject matter.

Results: Five minutes prior to SAB, the cesarean delivery and general surgery patients were premedicated with ondansetron, 4 mg and 8 mg respectively. Mean arterial pressure (MAP) and systolic blood pressure (SBP) were consistently higher in the groups premedicated with ondansetron in each trial. The trial using the 8 mg dose of ondansetron showed no significant differences in diastolic blood pressure (DBP) between the 2 groups. These studies revealed secondary benefits of ondansetron administration, including reduced incidence of nausea and/or vomiting. Although bradycardia requiring atropine associated with the BJR was rare, it was only seen in the control groups. The study groups also required reduced usage of vasopressors.

Conclusions: The strongest research suggests ondansetron given 5 minutes prior to an SAB causes a significant reduction in the incidence of hypotension in the parturient undergoing cesarean delivery. It is unclear if ondansetron administered in varying doses will alter DBP or heart rate. Further comparison of ondansetron to vasopressors should be done, considering the high cost of serotonin antagonist drugs and the potential deleterious effect of vasopressors on placental perfusion. More research must be done to devise clear guidelines and practice recommendations.

Effectiveness of Dexmedetomidine in the Treatment of Pediatric Emergence Delirium: An Evidence-Based Literature Review

LT John Hamrick, BSN, NC; LT Kimberly Gerber, RN, BSN, NC, USN; CDR John P. Maye, CRNA, PhD, NC, USN; CDR Christopher R. Crerar, CRNA, DNP, NC, USN; LT Riley Williams, CRNA, DNP, NC, USN
Uniformed Services University

Introduction: Emergence delirium (ED) is a common occurrence observed in pediatric patients after general anesthesia. Manifested by crying, confusion, moaning, restlessness, and thrashing, this phenomenon can lead to increased recovery times, inadvertent injury, and anxiety. Multiple modalities, including clonidine, opioids, ketorolac, midazolam, and dexmedetomidine have been used in an attempt to decrease ED. The purpose of this evidence-based review is to determine if dexmedetomidine reduces the incidence of ED in phase I recovery when compared with a placebo following sevoflurane anesthesia in children.

Literature Review: A literature search using PubMed was conducted using the terms emergence delirium, emergence agitation, children, infants, neonates, sevoflurane, dexmedetomidine, and Precedex. Review of the initial search result of 449 articles yielded 30 articles for evaluation. Articles consisting only of background information on ED, utilizing animal study models, or were not available in English were excluded from evaluation. Following a cross-comparison analysis, 17 articles were included for final evaluation: 1 meta-analysis and 16 randomized controlled trials.

Results: The population studied in the literature included American Society of Anesthesiologists class I, II and III pediatric patients ranging in age from 1 to 18 years old receiving sevoflurane anesthesia for ambulatory surgical procedures. Dosing of dexmedetomidine ranged from 0.15 to 4 µg/kg with variable routes of administration, including oral, intravenous bolus, intravenous infusion, and intranasal. All studies comparing dexmedetomidine with a placebo produced a substantial decrease in the incidence of ED. Studies comparing dexmedetomidine with commonly used agents (midazolam or opioids) suggested dexmedetomidine is just as effective in reducing ED. Doses of dexmedetomidine greater than 1 µg/kg were associated with longer recovery times.

Conclusions: The body of evidence indicates dexmedetomidine is an effective agent in reducing ED compared with placebo in pediatric patients receiving sevoflurane anesthesia. Optimal doses and routes of administration require further research; however, administration of 1 µg/kg or less of dexmedetomidine does not prolong recovery time. Compared with commonly used adjuncts such as midazolam or opioids, dexmedetomidine is equally effective but may be cost-prohibitive for routine use.

Effectiveness of Intravenous Tranexamic Acid (TXA) Administration in Managing Perioperative Blood Loss in Patients Undergoing Spine Surgery: A Systematic Review

Jennifer Badeaux, CRNA, DNP; Diane Hawley, RN, PhD, ACNS-BC, CCNS

Texas Christian University

Introduction: Perioperative blood loss during and after spine surgery is a common problem that is encountered and can result in devastating patient outcomes if not controlled. Large-vein bleeding is the major source of blood loss and its persistence can lead to enhanced fibrinolysis, which is a potential contributing factor to blood loss during spinal surgery. The drug tranexamic acid is often used to minimize blood loss. The purpose of this systematic review was to determine if the intravenous administration of tranexamic acid was effective in managing perioperative blood loss in patients of any age undergoing spine surgery.

Literature Review: A 3-step search strategy was used to find both published and unpublished studies in 12 different databases. The studies used in this review all measured the same outcome, blood loss, in milliliters. Once the included studies were retrieved and appraised, the decision to extract data for intraoperative, postoperative, and perioperative blood loss was confirmed and completed. All 12 studies produced data for intraoperative blood loss. Postoperative blood loss was extracted from 2 of the 12 studies appraised and perioperative included 4 studies.

Results: This review included 12 studies with a total of 934 participants. Studies measured patient blood loss for both the control and treatment groups. Intraoperative, postoperative, and perioperative blood loss were outcome measures that underwent meta-analysis. The meta-analysis showed a statistically significant amount of blood loss both intraoperatively and postoperatively in the control group when compared with the treatment group that received tranexamic acid.

Conclusions: Patients with comorbidities except those presenting with preoperative coagulopathies undergoing spine surgery would benefit from intravenous TXA to manage and reduce blood loss in intraoperative and postoperative blood loss for patients undergoing spine surgery. TXA should be considered by both the surgeon and the anesthesia provider when using a pharmacologic intervention for the management of blood loss.

Evaluation of the Risks and Benefits of Routine Gastric Tube Placement in Healthy Surgical Patients Undergoing Laparoscopic Procedures

Raya Rauffi, CRNA, MSN; Ricardo E. Rodriguez, PhD; Paul N. Austin, CRNA, PhD

Texas Wesleyan University

Introduction: Laparoscopic procedures are widely performed. Accidental placement of trocars into the stomach and bowel can occur resulting in serious injury. Some advocate the routine placement of a gastric tube to help prevent these complications. The question guiding the search for evidence was: For healthy, nonobese adults presenting for laparoscopic procedures who have been fasting for at least 8 hours and have no risk factors for gastric or bowel distention and impaired gastric emptying, is the risk/benefit profile more attractive if a gastric tube is placed selectively or routinely?

Literature Review: A keyword search was performed of the PubMed, Cochrane Library, and the SumSearch databases (1990-2014). Websites of professional and governmental websites were also examined. Inclusion criteria were human clinical observational and interventional clinical studies, systematic reviews and evidence-based clinical practice guidelines published in full text English language peer reviewed journals or on professional organization or governmental websites that directly or indirectly helped to answer the clinical question. The evidence was appraised and leveled using the method proposed by Melnyk and Fineout-Overholt.

Results: No evidence was located that directly evaluated the need for prophylactic gastric tube placement prior to the start of laparoscopic surgery in this group of patients. Knowledge transfer facilitated using evidence to help address the clinical question. A total of 36 potential sources were located with 5 evidence sources meeting the inclusion criteria. Four were observational studies and 1 was a systematic review. The systemic review with meta-analysis included 28 randomized controlled trials (4,860 subjects) and was the highest level of the evidence.

Conclusions: The evidence suggested complications of blind orogastric tube (OGT) or nasogastric tube (NGT) placement is associated with morbidity and even mortality. Also, the presence of endotracheal tube and tracheostomy are shown to be major risk factors for complications when blind placement of OGT or NGT is attempted. The evidence suggested the risk of trocar-related injuries is extremely low. The anesthesia provider collaborating with the surgeon may carefully consider not routinely placing gastric tubes for these cases; however, more definitive investigations should be conducted.

Healthcare Utilizing Deliberate Discussion Linking Events (HUDDLE)©: Systematic Review

Derrick C. Glymph, CRNA, DNAP; Maria Oleneck, RN, PhD

Florida International University

Introduction: The football huddle was invented by Paul D. Hubbard, a quarterback at Gallaudet University, in 1892. Gallaudet University is an institution of higher education in Washington, DC for the deaf and hard of hearing. Hubbard utilized the huddle as a means to prevent other schools for the deaf from seeing his team's sign language signals. The huddle is described as a circular formation in which the players face each other to communicate strategies and plans. The huddle form of communication is used throughout sports, and the huddle can be translated for use in healthcare.

Literature Review: The literature suggests that anesthesia crisis management training and teaching improves anesthesia providers' ability to handle critical incidents. However, interprofessional collaboration, training, and teaching continue to be an area in healthcare that can be improved. Interprofessional training can give anesthesia providers the tools to efficiently and effectively communicate with other health professionals.

Results: The first systematic search yielded 3,843 articles. When further broken down, the literature search using CINAHL database generated 1,283 articles, and the literature search conducted in ProQuest Medline yielded 2,560 articles. Of the total articles, 951 reviewed for inclusion, only 2 articles met the criteria for inclusion and were included in the literature review. The second search was conducted in both CINAHL and ProQuest Medline; this systematic search yielded 3,335 articles. CINAHL database generated 93 articles and the literature search conducted in ProQuest Medline yielded 3,242 articles. Of the total articles, 1,183 reviewed for inclusion, only 10 articles met the criteria for inclusion and were included in the literature review. A total of 3,325 articles were excluded.

Conclusions: The phenomena "huddle moments" should be taught and implemented into anesthesia. Leadership plays a vital role in changing the culture for new initiatives such as huddle moments in healthcare. The literature shows interprofessional education can provide anesthesia providers with the tools to improve communication with other healthcare providers. The huddle creates a shared mental model among team members by bringing them together before a case to discuss its critical aspects. Teamwork and interprofessional communication may be increased by a proposed educational intervention of a huddle moment.

High-Sensitivity Cardiac Troponin T Monitoring to Improve Preoperative Cardiac Risk Stratification in Noncardiac Surgery

Casey A. Panepinto, RN, BSN; Ann B. Miller, CRNA, DNP, ARNP

Florida Gulf Coast University

Introduction: Perioperative myocardial infarctions are frequently unrecognized, undiagnosed, and untreated. Heterogeneity among perioperative cardiac risk stratification is an imperative issue in the quality of anesthesia care. The aim of this evidence-based quality improvement project is to identify the empirical evidence regarding the use of high-sensitivity cardiac troponin T (hs-cTnT) assay levels in establishing objective, cardiac risk stratification. Specifically, in determining the efficacy of preoperative hs-cTnT levels in intermediate to high-risk patients undergoing major noncardiac surgery.

Literature Review: An extensive literature review was conducted by searching CINAHL, ScienceDirect, DynaMed, PubMed, and Cochrane Database. The following keywords were utilized: “high-sensitivity troponin, acute myocardial infarction, noncardiac surgery, operative, and prognostic.” Final search constraints yielded 9 primary source cohort studies and 1 systematic review, all of which were conducted with human subjects and published in English between 2005 and 2014.

Results: The empirical evidence supports perioperative hs-cTnT surveillance as an independent predictor of major perioperative adverse cardiac events. Research demonstrates increased preoperative hs-cTnT levels, in addition to postoperative increases from baseline levels as prognostic identifiers useful in cardiac risk stratification in the perioperative setting. Further evidence is needed to identify specific clinical thresholds and the relationship to specific patient outcomes: perioperative myocardial infarction, morbidity, and mortality.

Conclusions: The results of the research indicate a need to establish hs-cTnT threshold guidelines for varied patient populations. Variability among the literature, even when comparing similar samples, indicates the need for additional research. Further investigation is suggested for high quality diagnostic cohort studies and diagnostic randomized controlled trials to clinically evaluate hs-cTnT in preoperative cardiac risk stratification.

How Useful is Video Scribing in Learning Mathematical Concepts in Anesthesia?

Christol D. Williams, CRNA, DNAP

Midwestern University Nurse Anesthesia Program

Introduction: Video scribing is an information delivery method well suited for teaching foundational concepts in anesthesia, but its instructional worth has not been explored in the literature. Integrating video scribes into the educational process has the potential to improve learning experience and attitudes toward the experience. Students commonly search for online videos, especially YouTube©, to supplement learning with relevant content. The accuracy, reliability, and quality of the content covering anesthesia topics in online videos are rarely authenticated. This pilot study investigated the use of video scribe technology and its value as a supplementary learning tool.

Literature Review: Forty first-year student registered nurse anesthetists (SRNAs) completed a 10-item pretest on mathematical concepts in fluid and blood component therapy. Next, SRNAs viewed a 20-minute video depicting step-wise calculations for fluid deficit, replacement, blood loss and replacement, and relevant subtopics. Next, they completed a 10-item posttest. Finally, SRNAs were randomly assigned to receive 1 of 3 supplemental learning formats to reinforce the in-class lesson: video scribe on DVD; transcript in a pdf file; or an audio lesson on a CD. SRNAs completed a retention test and an evaluation tool 48 hours later.

Results: All scores were analyzed. A paired sample 2-tailed t-test compared pretest scores to both posttests and retention scores. An analysis of the variance (ANOVA) for the between groups and within groups was completed. A paired student t-tests for comparisons of scores among groups was also done. Alpha level .05 was selected. A data analysis was conducted on each instructional evaluation tool item. The results indicate students' perceptions of learning new material using video scribe for supplemental instruction of 1 core math topic is positive. In part 1, posttest scores were significantly higher than pretest scores. In part 2, retention scores from video scribe DVD recipients were higher than retention scores from audio CD recipients. There was no difference between the DVD group and written groups.

Conclusions: The depth of academic value of video scribing is yet to be discovered. Further research investigation into the effectiveness of video scribing as supplemental instruction is currently in progress with the generous support of AANA Doctoral Fellowship.

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Implementation of an Evidence-Based Practice Change Project Intended to Decrease the Occurrence of Peripheral Nerve Injury in the Operating Room

Marian G. Feil, CRNA, DNP

Thomas Jefferson University School of Nursing School of Nurse Anesthesia

Introduction: The use of anesthesia can lead to perioperative peripheral nerve injury without proper positioning. Knowledge deficits among clinicians increase the risk of improper positioning and nerve injury. Evidence for educational interventions to prevent peripheral nerve injury is lacking; however, educational interventions can affect patient outcomes (Warren et al, 2004). The project's purpose was to provide an educational program to increase CRNAs, SRNAs, OR RNs, and anesthesia residents' knowledge of peripheral nerve injury and proper positioning.

Literature Review: The intervention consisted of a 68-slide educational program. Participants were recruited via email sent to all surgical team members in a large urban medical center. A 20-item test to measure participants' knowledge of peripheral nerve injury and positioning was verified by anesthesiologists and CRNAs and administered before and after the educational intervention. Data were examined with descriptive statistics and the effect of the educational program was tested by a paired t-test.

Results: Following the educational intervention, mean scores significantly increased from time 1 (M=51.6; SD= 10.1) to time 2 (M=74.4; SD=11.4; $p<.0001$). The percentage changes from pretest to posttest were: 14.6% for third-year SRNAs, 22.2% for second-year SRNAs, and 28.2% for first-year SRNAs, 21.4% for CRNAs, 23.9% for OR RNs, and 24.2% for anesthesia residents. Only the anesthesia residents met the institutional benchmark of 80% correct, although the number was small (n=3).

Conclusions: The educational intervention was successful in increasing provider knowledge. Limitations were: using an untested measurement tool and a one-time educational presentation; and the small number of participants in each subgroup limited the ability for comparisons. Future projects could extend the educational program to clinical staff in other relevant postsurgical settings. Future research implications include testing different methods of content delivery. Practice implications include integrating educational programs into mandatory staff development.

Improving Quality of Care Through Evidence-Based Intrathecal Opioid Dosing During Cesarean Section

Nicole A. Gonzaga, CRNA, MS; Nicole Warren, PhD, MPH, CNM; David Sinclair, MD

Johns Hopkins University School of Nursing

Introduction: Approximately one third of women in the United States deliver via cesarean section (CS) making it the most common surgical procedure in the United States. Certified Registered Nurse Anesthetists (CRNAs) provide about 32 million anesthetics a year in the United States and are commonly the providers in CS deliveries. Intrathecal (spinal) opioid use is effective for pain relief with CS; yet, no protocol exists for standardized doses that minimize side effects of nausea, vomiting, and itching. Variable dosing among anesthesia providers leads to high rates of side effects, and patient satisfaction is impacted.

Literature Review: An integrated review of literature using PubMed, EMBASE, and CINAHL was conducted to evaluate evidence on optimal intrathecal opioid dosing for CS. Search terms included obstetric patient, parturient, spinal anesthesia, intrathecal opioid, nausea, vomiting, and itching. Literature from 1979 to 2013 was included.

Results: Thirty-two studies met the review's inclusion criteria and were evaluated using the Johns Hopkins Nursing Research Evidence Appraisal Tool. Most studies were randomized controlled trials and quasi-experimental studies. A smaller number of systematic reviews with meta-analyses and practice guidelines were also included. Overall, recommendations from high quality evidence point to lower doses of intrathecal opioids to achieve optimal pain management with minimal nausea, vomiting, and pruritis.

Conclusions: Although current recommended practice of intrathecal opioid dosing remains effective, standardized protocols to minimize side effects due to variable dosing practices among anesthesia providers may improve patients' delivery experience. Patients may achieve greater benefit from smaller, standardized, intrathecal opioid doses that achieve adequate pain relief, minimize side effects, and ultimately improve their overall satisfaction.

Improving Situational Awareness in Anesthesia Through the Use of Simulation

Kelly Zipko, RN, BSN, BA, CNRN; Ann B. Miller, CRNA, DNP, ARNP

Florida Gulf Coast University

Introduction: The purpose of this evidence-based quality improvement project is to determine if the utilization of simulation, coupled with instruction in situational awareness and Crew Resource Management techniques, is an effective means of increasing patient safety in the operating room. During the perioperative period, focus must be maintained on every aspect of patient care. Distracting and dynamic stimuli proliferate in the operating room environment. Initially, anesthesia providers do not have the ability to maintain the broad focus to provide safe patient care.

Literature Review: A comprehensive literature search was completed utilizing Science Direct, CINAHL, OVID, MEDLINE, and PubMed databases. Keywords utilized for this evidence-based practice project included anesthesia, situation awareness, and simulation. Articles written in English, with full text, and peer reviewed were incorporated if written after the year 2000. Several background articles were also integrated to establish the pervasiveness of deficient situational awareness and provide a thorough historical perspective on the topics.

Results: The empirical evidence included in this literature review supports the assertion that simulation provides an effective modality for anesthesia instruction. The addition of Anesthesia Crew Resource Management training also shows potential to improve communication and situational awareness for anesthesia providers. Anesthetists who have been exposed to Crew Resource Management express the combination of educational formats have positively affected anesthetic practice by improving situational awareness and increasing the margin of patient safety.

Conclusions: A high degree of situational awareness develops over the lifetime of the nurse anesthetist. The research demonstrates tunnel vision becomes dangerous when important information is overlooked by an anesthesia provider that is strictly task oriented. The practice of training through simulation on the principles of Anesthesia Crew Resource Management foreshortens the process of trial and error and has an immediate effect on increasing patient safety. Controlled research studies are necessary to further assess situational awareness phenomena.

Innovative Educational Approach for an International Nurse Anesthesia Education Program

Kathleen A. Durkan, CRNA, MSN; Lisa M. Bernardo, RN, PhD, MPH; Suzanne T. Brown, CRNA, BSN; Laura Palmer, CRNA, DNP; Richard Henker, CRNA, PhD, FAAN

University of Pittsburgh, School of Nursing

Introduction: The country of Belize has 15 nurse anesthetists providing care for the majority of surgical cases and on-call anesthesia coverage in the country's 4 hospitals. This critical shortage of anesthesia providers prompted the Belize Ministry of Health, University of Belize, and Health Volunteers Overseas to create a nurse anesthesia education program. Collaboration of international experts for didactic and clinical education requires constant communication. To coordinate, faculty selected Typhon, an electronic tracking system. Typhon provides access to student progress throughout the program.

Literature Review: Health Volunteer Overseas (HVO) faculty travel to Belize for 2 to 4 week intervals to teach didactic concepts and/or clinical skills. Didactic content was front-loaded for 2 terms, followed by clinical rotations and additional didactic topics. Typhon is used to track student clinical progress by following case numbers and allowing HVO faculty and Belizean anesthesia faculty to electronically submit clinical evaluations. In order to best meet student clinical needs, Typhon is utilized to coordinate clinical rotations to allow students to meet minimum case requirements from 3 hospitals.

Results: International nurse anesthesia educators have log-in access to Typhon from anywhere around the world. Planning and implementation of curriculum design, lecture format, and telecommunication for Internet-based lectures has occurred for the benefit of the Belizean nurse anesthesia students. The utilization of Typhon for logging of student clinical cases has facilitated record keeping and allowed for prompt student accessing of clinical preceptor evaluations. Students can view their clinical evaluations via Typhon, while HVO faculty and the University of Belize coordinator view and manage student progress. As the students progress, evaluations have been edited to allow for more applicable questions to monitor clinical development.

Conclusions: With the ability to create and design individualized evaluation tools, Typhon allows for flexibility in the international communication aspects of this nurse anesthesia educational program. Faculty can monitor student case numbers and clinical evaluation feedback from preceptors who are in Belize, while being located anywhere there is Internet access. With 16 initial students, Typhon efficiently organizes data. This innovative approach to clinical case tracking, as well as evaluation creation and management, has had a positive impact on this overseas nurse anesthesia education program in Belize.

Source of Funding: This project is being funded by the AANA Foundation Doctoral Fellowship awarded to Kathleen Durkan, CRNA, MSN, for her doctoral capstone project.

Is Pediatric Emergence Delirium Attenuated More by Sevoflurane or Desflurane?

Melissa A. Gilkison, RN, BSN; Lorna E. Longwell, RN, BSN; William T. Stewart, RN, BSN

Texas Christian University School of Nurse Anesthesia

Introduction: Emergence agitation and delirium in the pediatric population has been documented with the use of desflurane and sevoflurane. The degree to which each of these agents causes emergence delirium is not well understood by practitioners. The goal of this research is to establish an understanding of potential benefits in using one agent over another in minimizing these effects. Upon gathering evidence from the literature, it is the aim of this review to establish a maintenance anesthetic agent that might minimize emergence delirium in the pediatric population. The proposed solution will be to implement into practice the use of the agent that minimizes the occurrence of emergence delirium.

Literature Review: The IOWA Model for Evidence-Based Practice was used as a guide for the literature search. Databases searched included Embase, Ebsco, and Cochrane Database of Systematic Review. The following search terms were used: “sevoflurane, desflurane, emergence delirium or emergence agitation, and pediatric patients.” Only full text articles in English were considered, and there were no limits placed on the date of publication, which ranged from 1996 to 2013. Inclusion criteria were limited to a population of pediatric patients. Lastly, the Oxford Levels of Evidence table was used to critique, rate, and organize each article.

Results: The existing literature on the subject was lacking in results that were congruent with other research. In fact, some of the findings were inconsistent or even contradictory. Five articles showed no significant difference in the incidence of emergence delirium with either sevoflurane or desflurane. One study showed emergence delirium is more common when desflurane is used. Adjunct drugs such as fentanyl, propofol, and ketamine attenuated or prevented emergence agitation in both painful and painless procedures. Other studies illustrated the actual duration of emergence delirium was shorter with desflurane.

Conclusions: Desflurane and sevoflurane maintenance anesthesia were found to have similar rates of emergence delirium in pediatric patients. No clear evidence supports that utilization of one agent over another will reduce the incidence of emergence delirium. Anesthesia providers should utilize the anesthetic agent they are more experienced with. Also, the use of pharmacologic adjuncts should be considered, when warranted, to reduce the incidence of emergence delirium. The pediatric anesthesia emergence delirium (PAED) scale has been considered the gold standard of evaluation tools, but several articles showed a disparity in its use. Further research is needed to standardize use of the PAED scale.

Source of Funding: Texas Christian University School of Nurse Anesthesia.

Keeping a Watchful Eye: Limiting Surgical Time and Blood Loss to Decrease Ischemic Optic Neuropathy in the Prone Position: An Evidence-Based Review

Becky M. Arand, RN, BSN; Marsha L. Sierra, RN, BSN

University of Maryland, School of Nursing

Introduction: Reported incidence of visual disturbances following spinal surgery ranges from 0.028 to 0.2%. Posterior ischemic optic neuropathy (ION) is the etiology most prevalent in such cases. Its risk factors include prone positioning, long operative time, massive hemorrhage, and anemia. The purpose of this paper is to describe the evidence in which the development of ION occurred in the setting of extensive blood loss and/or extended surgical duration for patients positioned prone.

Literature Review: The PICO question used to search the literature databases CINAHL, EMBASE, Cochrane Library, and Google Scholar was: In (P): patient's undergoing a procedure utilizing prone positioning, (I): does limiting surgical time to < 5 hours and/or blood loss to < 1 liter (C): compared to surgical duration > 5 hours and/or blood loss > 1 liter (O): decrease the incidence of ION? An extensive review of the literature was conducted and 2 retrospective studies, 1 multicenter case control study, and 1 systematic literature review was critically appraised using the MeInyk critical appraisal tool.

Results: Evidence from these sources showed that the duration of surgery (> 5 hours) in the prone position and/or blood loss greater than 1 liter in the prone position were significant risk factors for the development of ION. However, several other risk factors with ION were also identified.

Conclusions: As a result, definitive causality of ION remains unclear. It is recommended that further investigation is needed on the subject to directly link ION with surgical duration and extensive blood loss.

Klippel-Feil Syndrome: A Case Study

Ruth Hammerschmidt, ADN, BSN, CCRN

Yale New Haven Hospital, School of Nurse Anesthesia

Introduction: Klippel-Feil Syndrome (KFS) is a rare congenital deformity due to failure of segmentation of the cervical somites at 3 to 8 weeks of gestation. This results in multiple fused cervical vertebrae. The range of deformity extends from fusion of the 2 vertebrae to the entire cervical spine. KFS can pose multiple challenges to the anesthesia provider, with the presence of a difficult airway representing the major anesthetic concern. There are multiple plans regarding the safest course of action in anesthetizing a patient with KFS. The best anesthetic plan is one tailored to the individual patient.

Literature Review: The range of deformity extends from fusion of the 2 vertebrae to the entire cervical spine. Multiple cervical vertebrae fuse in utero, most commonly C2 and C3. KFS includes 3 types: Type I is a massive fusion of several cervical and upper thoracic vertebrae into bony blocks. Type II is fusion at 1 or 2 interspaces, although occipito-atlantal fusion occurs in conjunction with other anomalies. Type III is cervical fusion and lower thoracic or lumbar fusion. Cervical spondylosis, disc herniation, and secondary degenerative changes can be possible at levels of the fused vertebrae.

Results: Affected patients can also have multiple co-anomalies. Cervical fusion can result in a shortened neck that appears web-like. Cervical ribs can cause nerve compression resulting in pain and numbness in the upper extremities, a condition known as thoracic outlet syndrome. Upper limb defects or deficiencies, radial anomalies, lumbar fusion, and patellar hypoplasia have all been recognized. Neurological impairments occur in 50% of patients and range from quadriplegia, paraplegia, hemiplegia, and spasticity to facial nerve palsy. Unilateral renal agenesis is the most common renal abnormality.

Conclusions: These patients can have an unstable cervical spine and atlanto-occipital junction, thus at increased risk of neurological damage during laryngoscopy, intubation, and throughout the perioperative period. Laryngeal cartilages can malform, producing aphonia or other voice impairment. The safest course of action varies. Several sources cite awake fiberoptic intubation as the best plan, while others state the best anesthetic plan is one tailored to the individual patient. Glidescopes, regional anesthesia techniques, and direct laryngoscopy have all been successfully used.

Measuring Competency in Ultrasound Guided Regional Anesthesia

LCDR Peter W. Schenke, RN, BSN, NC, USN; LT Thomas R. Dixon, RN, BSN, NC, USN; Capt Adina L. Westmark, RN, BSN, USAF, NC; CDR Jason M. McGuire, CRNA, PhD, NC, USN; MAJ John T. Wilson, CRNA, PhD, ANC, USA

Uniformed Services University of the Health Sciences

Introduction: Ultrasound guided regional anesthesia (UGRA) is commonplace in many institutions today. Its safety and effectiveness has been demonstrated in the literature. The American Society of Regional Anesthesia (ASRA) and the American Association of Nurse Anesthetists (AANA) recommend formal training in UGRA, and many newly graduated practitioners have ultrasonography integrated into their curriculum. Many types of training programs have been developed to educate experienced anesthesia providers without previous ultrasonography training. An assessment tool to measure competency in UGRA is necessary. The checklist and GRS adapted from Cheung et al may be the most appropriate tool and can easily be integrated into UGRA training programs.

Literature Review: Systematic review of literature (EMBASE, PubMed/Medline, CINAHL, and Cochrane) from 2003 to 2013. MESH terms: ultrasound, competence, competency, regional AND anesthesia. Article exclusion criteria: non-English and not involving human subjects. A total of 103 articles resulted and further explored for regional anesthesia skill assessment tools. Ultrasound history, safety, training requirements, and conceptual models for competency also searched for. Forty-one articles resulted. Thirteen had specific methods that evaluate competency in regional anesthesia. The evidence was divided into 3 groups: CUSUM (8), the Imperial College Surgical Assessment Device (ICSAD) (1), and checklists and global rating scales (GRS) (4).

Results: CUSUM – subjectivity; requires increased number of procedures to reach statistical competence; assesses outcome and not technique quality. ICSAD – by itself, assesses motor skill performance and not outcome; reflects improvement in manual dexterity and speed; differentiates between novice and expert level; combined with checklist and GRS provides thorough assessment of competency and expertise. Checklist and GRS – reliable, valid, and objective instruments for measuring competence; superior assessment tool when both used in combination; checklists are very specific, describe the steps of the procedure; GRS adds nontechnical elements such as patient interaction and overall performance. The checklist and GRS developed by Cheung et al can be utilized for assessment of competency in different types of UGRA in an objective manner.

Conclusions: With the expanding use of ultrasound in regional anesthesia delivery, an instrument for assessment of competence with UGRA is necessary. Cheung's Delphi consensus-backed checklist was conceived by experts in UGRA and is very specific. Nontechnical elements not included in the checklist are covered by the GRS. The combination of GRS and a checklist will provide the most comprehensive tool for assessment of UGRA competence. Future studies should refine Cheung's checklist and GRS and evaluate their validity and reliability as competence assessment methods for different types of UGRA procedures.

Nonpharmacologic Neuraxial Interventions as Prophylaxis for Postdural Puncture Headache Following Accidental Dural Puncture During Epidural Placement in Obstetrics

Heather W. Suescun, CRNA, MSN; Dion A. Gabaldon, CRNA, DHA; Paul N. Austin, CRNA, PhD
Texas Wesleyan University

Introduction: Postdural puncture headache (PDPH) due to accidental dural puncture (ADP) during epidural catheter placement is a source of morbidity for new mothers. It can interfere with maternal-newborn bonding and result in increased length of hospitalization. Only 14% of anesthesia providers responding to a recent survey reported that they have a protocol addressing ADP. This evidence-based review examined the following question: For obstetrical patients with ADP during epidural placement, what nonpharmacologic prophylactic neuraxial interventions decrease the incidence of PDPH?

Literature Review: A keyword-based search strategy of PubMed, the Cochrane Library, and professional and governmental websites was executed. The following keywords were searched alone or in combination: epidural, postdural puncture headache, accidental dural puncture, prophyla, parturient, pregnant and obstetric. Evidence was limited to systematic reviews (SRs) with or without meta-analysis and randomized controlled trials (RCTs) not included in SRs. The evidence was appraised and leveled using the method described by Melynck and Fineout-Overholt.

Results: Four SRs with meta-analysis and 1 RCT met the inclusion criteria. The SRs included RCTs or studies with a control group. Three of the 4 SRs used rigorous appraisal methods. Two SRs included nonobstetric populations and 3 SRs included additional interventions. Subgroup analyses allowed for exclusion of the results of additional interventions. Nonpharmacologic prophylactic neuraxial interventions studied were prophylactic epidural blood patch (PEBP), epidural saline administration, intrathecal catheter (ITC) placement for continuous spinal analgesia after ADP, and ITC maintenance for less than or greater than 24 hours. The absence of intervention standardization was a possible source of bias across the evidence.

Conclusions: PEBP is somewhat effective in preventing PDPH. However, the evidence did not suggest epidural saline administration or ITC are effective in preventing PDPH. Overall the studies lacked homogeneity and many times were underpowered, lacked control, randomization, and blinding. The treatment method selection was both provider- and patient-dependent. The risks and benefits must be individually scrutinized. Further investigations into prevention of PDPH is warranted. Future work should include large multicenter RCTs with improved methodology.

Occupational Exposure to Nitrous Oxide: Adverse Effects on Healthcare Providers

Kristen Frye, RN, BSN; Ginette Peterson, RN, BSN, CCRN; Ann B. Miller, CRNA, DNP, ARNP
Florida Gulf Coast University

Introduction: Anesthesia providers and operating room personnel are exposed to anesthetic waste in operating rooms, trauma centers, ambulatory surgical centers, eye institutes, and dental offices. An evidence-based quality improvement project was conducted to educate and evaluate the harmful effects of nitrous oxide on healthcare providers.

Literature Review: A literature review was performed utilizing the following electronic databases: Cumulative Index to Nursing and Allied Health Literature, Cochrane Library, ProQuest, Science Direct, American Association of Nurse Anesthetists, Centers for Disease Control and Prevention, National Institute of Occupational Safety and Health, US Occupational Safety and Health Administration, and Environmental Protection Agency. The keywords comprised of nitrous oxide, harmful effects, healthcare providers, and nitrous oxide exposure.

Results: One hundred articles were reviewed; 26 articles within the last 20 years met inclusion criteria of peer reviewed, full text, English language, and the effects of nitrous oxide exposure on healthcare workers. Exclusion criteria omitted articles examining the effects of nitrous oxide exposure on patients, non-peer reviewed, and without an English translation. Nitrous oxide exposure positively correlated with DNA damage and B12 deficiency to healthcare providers, $p < 0.001$. Medical personnel with a B12 deficiency and exposure to nitrous oxide were subject to megaloblastic anemia and myelopathy. Women exposed to unscavenged nitrous oxide for a period of 5 or more hours had decreased ability to procreate, $p < 0.01$. Nitrous oxide levels greater than 50 parts per million impaired neurobehavioral performance and decreased vigilance on the healthcare worker.

Conclusions: The results of the literature review revealed scholarly evidence supporting the prevalence of health issues on healthcare providers exposed to nitrous oxide. Despite the use of scavenging systems, leakage of anesthetic gases is inevitable. The research supports further investigation to maintain a safe workplace for healthcare providers in all operating room settings.

Ofirmev Use in Orthopedic Surgery During the Perioperative Period

Jenna E. Cox, RN, BSN, CCRN

Texas Christian University

Introduction: Intravenous (IV) acetaminophen is a synthetic, nonopiate, centrally acting drug. Mechanism of action is still not completely known. Primarily acts through centrally acting cyclooxygenase inhibition. Clinical analgesia within 5 minutes of administration. After 15 minutes, mean plasma concentration is about 70% higher than equivalent oral dose. Reduced initial hepatic exposure. Improved safety profile. Opioids first-line choice for postoperative pain control, adverse effects dose-dependent. Adding nonopioid analgesics would reduce adverse effects associated with opioids by decreasing amount of opioids used. Few contraindications.

Literature Review: CINAHL complete, Academic Search complete, EMBASE with articles limited to those published from 2005 to present and full text availability. The search words used were: “acetaminophen” AND “pain management” AND “surgical”, “acetaminophen” AND “pain” AND “orthopedic”, “iv acetaminophen” AND “orthopedic surgery”, “iv acetaminophen” AND “postoperative pain”, “paracetamol” AND “orthop*”. All retrieved articles were cross referenced to obtain any potentially missed relevant works.

Results: Helps reduce postoperative pain associated with orthopedic surgeries. Decreases surgical pain with or without the use of regional anesthesia. Preemptive administration results in decreased postoperative pain intensity, longer times to first rescue medications, and decreased total rescue medication consumption. Decreased pain scores reported despite administration time. As effective as NSAIDs with less contraindications or adverse side effects. Studies still need to be done to determine if opioid-related adverse effects are reduced. Majority of studies done in Europe, which utilized intravenous paracetamol or intravenous propacetamol.

Conclusions: Ofirmev® should be infused over 15 minutes during the perioperative period for a patient undergoing an orthopedic surgery. If appropriate, repeated infusions should be considered every 4 to 6 hours with a maximum of 4 grams of acetaminophen per day. Ofirmev® infusion should begin approximately 15 minutes before surgical incision for preemptive pain management or before surgical closure for preventative pain management.

One-Lung Ventilation Through a Tracheostomy

Tiffany Landry, RN, BSN

Texas Christian University

Introduction: There is often a time in the operating room when lung isolation needs to occur to facilitate surgical visualization. To effectively get to the specific area of the lung being operated, the lung needs to not be inflated or ventilated. There are many ways to obtain one-lung ventilation, including bronchial blockers, double lumen endotracheal tubes, or inserting a single lumen tube down the mainstem of a lung. A double lumen tube is usually the first choice in a normal patient; however, a patient with a difficult airway can prove to be challenging. When attempting to isolate a lung on a patient with a tracheostomy, modifications may have to be made.

Literature Review: Out of 17 cases reviewed, 7 used a bronchial blocker. Two were placed orally and 5 were placed through the stoma. One case had to remove bronchial blocker and return to two-lung ventilation because of decreased oxygen saturations. Ten cases used a double lumen tracheostomy tube. Fiberoptic bronchoscope plays major role in placement of chosen tube and confirmation. Size of stoma may determine what kind of endotracheal tube can fit through the stoma, or if oral intubation should take place. Age of the tracheostomy may also be a determining factor of ventilation. Overall, more repositioning was reported with bronchial blockers and were more time consuming.

Results: Bronchial blockers were difficult to place, time consuming, and failed to completely isolate one lung. Ideally, a double lumen tube would be used, if stoma size can support the size of a double lumen tube. Mainstem intubation is not a first choice but, in our cases due to secretions, it was the quickest way to obtain one-lung ventilation. The decision on which airway device to use when the patient has a tracheostomy is determined by the patient situation, type of surgery, and anesthesia provider's preference. Problems that arise with ventilation should be communicated with the surgeon. It can then be decided whether or not one-lung ventilation is absolutely necessary for the surgery or if returning to two-lung ventilation is the best option for the patient.

Conclusions: In summary, the decision on which airway device to use when the patient has a tracheostomy is determined by the patient situation, type of surgery, and anesthesiologist's preference. Ideally, a double lumen tracheostomy tube would be used, but most facilities do not have access to them. Problems that arise with ventilation should be communicated with the surgeon promptly, so a decision can be made regarding modification. It can then be decided whether or not one-lung ventilation is absolutely necessary for the surgery or if returning to two-lung ventilation is the best option for the patient.

Perioperative Ketamine Utilization in Patients With Chronic Pain

Monica L. Raney, RN, BSN; Anne B. Miller, CRNA, DNP, ARNP

Florida Gulf Coast University

Introduction: Moderate to severe pain has been historically treated with opioids that can lead to opiate tolerance and hyperalgesia. Ketamine has been advocated as an adjunct to analgesia to decrease postoperative pain, analgesic requirements, and nausea and vomiting. Research studies have been done on ketamine and its impact on postoperative pain. Clinical benefits with use in the chronic pain patient remain unclear as most studies contain large amounts of opioid naive patients. Little is known about the usefulness of preventative NMDA receptor antagonism in patients with chronic pain.

Literature Review: A literature review was conducted by searching the following databases: CINAHL, Cochrane, MEDLINE, PubMed, and ScienceDirect. Keywords utilized included ketamine, chronic pain, hyperalgesia, NMDA and N-methyl-D-aspartate. Inclusion criteria included English and publications between 2009 and 2014. Articles were reviewed for objectives, methodology, results, strengths, and weaknesses. The search resulted in 3 Cochrane reviews, 7 randomized controlled trials, and several case studies. The literature chosen was based on ketamine and its relevance to chronic pain.

Results: Ketamine decreases postoperative pain and opioid consumption in chronic pain patients undergoing general surgery. Use of ketamine modulates the μ -opioid receptor enhancing the effects of opiates when used concomitantly. Ketamine was also found to reverse induced hyperalgesia initiated by decreased and delayed GABA release and maintained by increased glutamate release. Ketamine was shown to relieve symptoms of chronic depression, and by crossing the blood brain barrier, acts centrally to relieve symptoms significantly faster than traditional treatments. Ketamine decreases inflammation by limiting pro-inflammatory markers IL-6 and C reactive protein but preserving anti-inflammatory marker IL-10.

Conclusions: Ketamine has multiple sites of action and has been shown to reduce acute postoperative pain and opioid consumption in both opioid naive and chronic pain patients. Mechanisms of action include modulation of opioid receptors, attenuation of pro-inflammatory markers, prevention of central sensitization, and antidepressant activity. Future research studies will enable anesthesia providers to make informed decisions related to the benefits of ketamine utilization that include decreased opiate consumption, shortened hospital stays, decreased levels of pain, and decreased inflammation.

Pharmacogenetics of Anesthetics: An Integrative Review

Edwin N. Aroke, CRNA, MSN

University of Massachusetts, Worcester, Graduate School of Nursing

Introduction: Narrow therapeutic indices make the potential for severe adverse drug reactions (SADR) high in anesthesia practice. While several factors contribute to individuals' response to drugs, genetic predisposition accounts for about 50% of SADR. Historically, prolonged apnea from succinylcholine and malignant hyperthermia were the first studied pharmacogenetic disorders. From 1990 to 2007, medication problems accounted for 8% of anesthesia closed claims. The purpose of this review is to explore the impact of genetic differences on patients' response to volatile and intravenous general anesthetics.

Literature Review: Whittemore and Knafl's (2005) methodology guided the integrative review, while the matrix method guided the data extraction, reduction, and synthesis. Following consultation with a librarian, a search for pharmacogenetics of volatile and intravenous anesthetics was performed. The titles, abstracts, and/or summaries of all the articles were reviewed for relevance. Papers deemed relevant were skimmed for general scope, quality, and type of article. Studies on malignant hyperthermia were excluded because it has been covered thoroughly in excellent review articles.

Results: Of the 239 articles retrieved, 72 included the pharmacogenetics of anesthetics, and 13 were in vivo, primary source articles. Only 5 anesthetics have reported genetic associations: CYP2B6 and UGT1A9 metabolize propofol; CYP2B6, CYP2C9 and CYP 3A4 metabolize ketamine; CYP2E1 defluorinate isoflurane and sevoflurane; and a melanocortin 1 receptor gene allele (common in red haired females), increases desflurane requirement. The CYP2B6 G516T variant, UGT1A9 1366C>T variant, and age >65 decreases propofol metabolism, and may increase risk of adverse reaction. CYP2B6 expression is higher in females and they require higher doses and recover faster from propofol. There is no direct relationship between CYP 2B6 polymorphism and propofol or ketamine response.

Conclusions: Although these studies lay the foundation for individualized anesthesia care, this integrative review highlights the underinvestigation of the pharmacogenetics of anesthetics. Until more convincing evidence is established, anesthesia providers should continue to practice according to current standards, observe adverse effects, and be aware of possible genetic basis of interindividual variability in response to anesthetics. Future research should focus on investigating the pharmacogenetics of other anesthetics and replications of current studies.

Pharmacological and Nonpharmacological Interventions for Pediatric Emergence Delirium

Larry Heredia, CRNA, MSN, MJ; Loraine S. Silvestro, PhD; Paul N. Austin, CRNA, PhD

Texas Wesleyan University

Introduction: The incidence of pediatric emergence delirium (PED) ranges from 10% to 50%, but some reports are as high as 80%. It is usually self-limiting and lasts between 5 and 15 minutes. PED can be disruptive and children can injure themselves and others while emerging from anesthesia. It can be frightening for the child, caregivers and family and requires constant supervision. The question guiding this review was: For pediatric patients undergoing general anesthesia, which pharmacological and nonpharmacological interventions decrease the occurrence of emergence delirium in the PACU?

Literature Review: A keyword search was done of the PubMed and the Cochrane Database of Systematic Reviews (1990-2014). The websites of professional and governmental organizations and reference lists of located sources were examined for additional evidence. Evidence was restricted to full text systematic reviews (SRs) of human randomized and nonrandomized controlled trials along with human clinical trials meeting the inclusion criteria not included in the SRs. The evidence was appraised and leveled using the method proposed by Melynck and Fineout-Overholt.

Results: A total of 258 potential sources were located with 14 meeting the inclusion criteria: 2 SRs and 12 human clinical trials not included in the SRs. The 2 SRs included 47 studies with over 1,400 subjects. Interventions examined included preoperative medication, parental presence during induction, and the use of intraoperative opioids or other intravenous agents such as propofol. Analysis by the authors of one of the SRs suggested there was a high risk of unpublished negative results. Unfortunately there was inconsistent use of a validated scale to measure PED. Other shortcomings of the located evidence included methods of determining adequate sample sizes and lack of blinding.

Conclusions: It is important to first determine which children are at a higher risk of experiencing PED. The evidence was not conclusive in determining if the use of premedication with those higher risk children decreases PED. Careful use of intraoperative medications such as analgesics, propofol and dexmedetomidine may help reduce the incidence of PED. The importance of using a validated tool to measure PED cannot be overemphasized. Two scales were identified, one for use with younger children and the other with teenagers.

Propofol Abuse Among Anesthesia Providers: Increased Control Versus Standard Practice

Geoffrey P. Simpson, RN, BSN, CCRN

Texas Christian University School of Nurse Anesthesia

Introduction: The purpose of this study is to evaluate the diversion and abuse rate of propofol among anesthesia providers by comparing current standard regulation and control methods versus increased control and wasting policies similar to opioids and benzodiazepines. The synthesized literature will be used to support the hypothesis that increased regulation and control of propofol can lead to decreased diversion and abuse by anesthesia providers.

Literature Review: A review of literature was conducted and multiple databases were searched between the years 2000 and 2014 including Medline, CINAHL, Pubmed, and Google Scholar. Keywords searched included propofol, diprivan, abuse, misuse, diversion, anesthesia, dependency, and death. No inclusion or exclusion criteria were included.

Results: A 2007 study in which 126 academic anesthesiology and nurse anesthesia programs in the United States were surveyed about the incidence of propofol abuse in their academic program was reviewed. A 100% survey response rate was achieved. Of these 126 academic anesthesia programs, 71% (90 out of 126) did not regulate or control the wasting of propofol. Among the 23 programs in which propofol abuse was reported, only 3 of these has pharmacy control and regulation at the time of abuse.

Conclusions: Based on the available research, it is recommended that an increased regulation and control of propofol could prove beneficial to decreasing the incidence of abuse and diversion by anesthesia providers.

Reducing Intravenous Narcotic Documentation Errors on the Electronic Anesthesia Record

John M. Borza, CRNA, DNP, MBA

Robert Morris University

Introduction: Intravenous narcotic documentation errors on the electronic anesthesia record, collectively known as medication errors, may result in patient morbidity or mortality. Inaccurate or incomplete documentation can lead to overmedication or undermedication, resulting in potential harm. The purpose of this project was to determine if medication documentation errors on the electronic anesthesia record can be reduced through the clinical intervention of increasing computer access in the postanesthesia care unit.

Literature Review: A review using PubMed, CINAHL, Google, and hand searching references. Phrases used to search included medication reconciliation methods AND anesthesia, medication reconciliation, causes of reconciliation errors, anesthesia AND safety AND decreased morbidity, and development of medication reconciliation process. Twenty-seven articles were included in the analysis. The evidence level and quality of the articles were based on the Johns Hopkins Evidence Level I-V and Quality Rating Scale A-C. The results included 2 articles at level I (B-C) and 1 article at level II (A). The majority of the articles ranked at levels III (A-C) and IV (A-C). Three articles ranked at level V (A-B).

Results: Preintervention and postintervention compliance rates and medication errors of schedule II and IV controlled substances were collected from January 2013 and April 2014. A total of 4,107 anesthetic cases were included in the study. Medication errors decreased from a combined January/February 2013 error per 1,000 rate of 23.6 to an error per 1,000 rate of 14.9 in March 2014 postintervention of computer access at patient bedside in the postanesthesia care unit. January error rate was 30.0 and February was 16.7 per 1,000, respectively. March compliance rate increased to 98.5% from the combined rate of 97.6% for January/February. January compliance rate was 97.0% and February was 98.3%. The error percentage rate decreased in March to 1.48% from 2.36% for January/February combined. January error percentage rate was 3.0% and February was 1.67%. Comparing the medication error rate to the national average, real time bedside computer access reduced from 3.15 times the national average in January/February combined to 1.98 times the national average for the intervention month (March). January represented 3.99 times the national average, whereas February showed 2.23 times the national average. March showed a significant reduction in error percentage when compared with January 2013, $Z = 2.69$, $p = 0.007$. Thus, we are more than 99% confident that March produced a smaller proportion of errors than did January. March also showed a reduction in error percentage when compared with February; however, the difference in the 2 proportions did not achieve statistical significance, $z = 0.38$, $p = 0.699$. Comparing March with combined January/February shows a significant reduction in error percentage, $Z = 2.45$, $p = 0.04$.

Conclusions: The evidence in the literature supports increasing computer access to reduce the number of medication errors. The plan for this quality improvement project is to increase computer access in the postanesthesia care unit to facilitate accurate documentation of intravenous narcotic medications. This quality improvement project will compare narcotic medication documentation errors over a 3-month period after initiation of the clinical intervention with narcotic medication documentation errors prior to the project, using a chart review.

Respiratory Distress in a Child Following Airway Reconstruction: Could the Nasogastric Tube Be the Culprit?

Jennifer L. Priest, RN, BSN, CCRN; James S. Furstein, CRNA, DNAP; Wm. Terry Ray, CRNA, PhD, MNSc

University of Cincinnati

Introduction: Nasogastric (NG) tubes are routinely utilized for a variety of medical indications. While several complications secondary to NG tubes are widely known, serious complications are infrequent. Nasogastric tube syndrome (NTS) is a rare yet life-threatening complication of an indwelling nasogastric tube that may initially present as throat pain, stridor, dyspnea, or complete loss of vocal cord abduction with subsequent airway compromise. This case study reviews the successful course of a microlaryngoscopy, bronchoscopy and esophagoscopy under general anesthesia for a pediatric patient with NTS.

Literature Review: A retrospective chart review of a case previously performed at Cincinnati Children's Hospital Medical Center (CCHMC) was conducted after IRB approval was obtained. In addition, a systematic review of the literature was performed in April 2014 with CINAHL (1937-present) and PUBMED (1950s-present) databases. The keywords used for the literature review were "nasogastric tube syndrome" and "laryngeal injuries," respectively.

Results: A 13-month-old patient with Down syndrome presented emergently to the operating room for microlaryngoscopy, bronchoscopy and esophagoscopy (MLBE) due to acute respiratory distress of unknown etiology 1 week posttracheoplasty. The patient was acutely heliox dependent and exhibited severe retractions, tachypnea, and significant stridor. Upon MLBE otolaryngology noted significant supraglottic edema, left vocal cord paralysis, and paradoxical movement of the right vocal cord. Following balloon dilatation of the edema, the NG tube was discontinued and patient was returned to the floor for close observation. The patient was started on TPN, and the improvement in respiratory status following removal of the NG tube was consistent with NTS.

Conclusions: The earliest report of NTS dates to 1939 when 2 cases of cricoid chondritis were described. Since that time NTS has rarely been reported in the pediatric population, with only 2 reports noted in the literature as of 2013. The common effect of all 3 accepted mechanisms of NTS is pressure against the posterior cricoid lamina resulting in trauma and ischemic necrosis culminating in infection of the mucosa, posterior cricoarytenoid muscle, and cartilage. After reviewing the current literature, it is essential that a prompt, definitive diagnosis be made to achieve optimal outcomes.

Retrospective Analysis of Glucose Monitoring and Treatment of Patients Undergoing Vascular Surgery

Suzanne R. Morrison, CRNA, DNP; Dianxu Ren, MD, PhD; John O'Donnell, CRNA, DrPH; Richard Henker, CRNA, PhD

University of Pittsburgh

Introduction: Patient outcomes including length of stay, stroke, renal insufficiency, and mortality have been shown to improve with glycemic control. Studies of improved glucose control have demonstrated a net annualized saving of \$1,339,500. Even though the benefits of glycemic control are well documented, accessibility to glucometers in the operating room continues to be a barrier to change. Intraoperative glycemic control continues to be an area for quality improvement initiatives. The purpose of this project was to justify a dedicated glucometer for our anesthesia department.

Literature Review: The incidence of diabetes has continued to rise from 12 million in 2000 to 20.9 million in 2014. Glycemic control in patients undergoing coronary artery bypass surgery and in critically ill adult patients significantly improves mortality and morbidity. In 2013, Coan et al concluded that intraoperative glucose monitoring seldom occurred, despite prolonged periods of anesthesia and deterioration of glycemic control. This is similar to Maser's analysis in 1996 that concluded that 67% of diabetic surgical patients did not have intraoperative blood glucose monitoring.

Results: All 101 patients had a blood glucose documented preoperatively. Two patients had preoperative blood glucose levels less than 70 mg/dL. Seventy-two patients had a preoperative blood glucose level in the normal range of 70 to 138 mg/dl. Twenty-seven patients had a blood glucose level greater than 140 mg/dL preoperatively. Thirteen of the 27 patients with blood glucose of greater than 140 mg/dL were also in the subset of greater than 180 mg/dL. Blood glucose monitoring in the operating room was not performed on 21 of 29 (72%) patients that had abnormal blood glucose values preoperatively. Nine patients were treated during the perioperative period. Threshold for treatment of hyperglycemia by the anesthesia providers was 222 mg/dL.

Conclusions: Practices observed do not adhere to recommendations or best practice. We continue to struggle with intraoperative monitoring of blood glucose levels as the incidence of diabetes continues to rise. Anesthesia providers need to have glucose monitors readily available so that intraoperative measurements can occur. Our analysis was successful in justifying the need for a dedicated glucometer for our anesthesia department. The next step in our project is to establish guidelines for intraoperative blood glucose monitoring. Implementation of a standardized approach may improve care.

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Role of Methylene Blue in Perioperative Anaphylactic Shock

Kendall Winston, RN, BSN

Columbia University, School of Nursing

Introduction: Anaphylactic shock (AS) in the perioperative period is associated with a significant amount of anesthesia-related morbidity and mortality. AS, characterized by arterial hypotension and excessive vasodilation, is thought to be mediated by the nitric oxide-cyclic guanosine monophosphate (NO-cGMP) pathway. Epinephrine, the first-line treatment for AS, is less effective in treating refractory hypotension and has deleterious side effects. Methylene blue (MB), a selective inhibitor of the NO-cGMP pathway, may counteract the vasodilatory effects. The purpose of this inquiry is to evaluate the role of MB as an agent to mitigate hemodynamic compromise from AS during anesthesia.

Literature Review: Ovid MEDLINE, PubMed, and Cochrane online databases were searched using keywords methylene blue, anaphylaxis, shock, and nitric oxide to identify possible relevant studies. In addition, MB was researched in terms of dosing, side effects, anaphylactic shock, and anesthesia. A total of 473 results were obtained. Inclusion criteria were publications in English, case series, observational studies and controlled trials within the last 10 years. Nonpublished literature, animal trials and studies with pediatric patients younger than 16 years old were excluded. A hand search of references from relevant studies was then conducted. Eleven articles were included.

Results: MB has shown to be effective in improving hemodynamic compromise mediated by the NO-cGMP pathway. Studies demonstrate the use of MB in the setting of shock was effective in decreasing the acute vasodilatory response as well as increasing systemic vascular resistance and mean arterial pressure. In the setting of vasoplegia syndrome and refractory hypotension, MB administration was associated with decreased vasopressor requirements, less administration of blood products, and reduced mortality rates. The anaphylaxis case series all presented clinically relevant MB reversal of hypotension. While administration of MB is not benign, a dose defining study recommends the use of 1 to 3 milligrams per kilogram of methylene blue to transiently elevate hemodynamic parameters without unwanted side effects.

Conclusions: Current evidence supports the use of methylene blue to acutely treat hemodynamic changes from nitric mediated reactions. MB is shown to be most effective in improving hemodynamics in refractory hypotension, as well as decreasing the use of vasopressors. Decreasing the amount of intravenous epinephrine during AS decreases the risk of the potentially fatal side effects, including arrhythmias, angina and cerebral hemorrhage. Further research through prospective randomized studies is warranted to define the role of methylene blue as a first-line adjunct for treating perioperative AS.

Safer Patient Handoffs in the Children's Perioperative Areas Using SBAR Flow Sheet

Christina Crotts, CRNA, MS; Rhonda Tucker, CRNA, MS; Amanda Lornic, MD; Maria Sullivan RN, MSN, CNOR; LeighAnn Chadwell, RN, BSN

Monroe Carell Jr. Children's Hospital at Vanderbilt University Medical Center

Introduction: Excellent patient care is a goal that we strive for every day. Each surgical patient will interact with numerous providers throughout their stay. An essential aspect of providing excellent care is ensuring that all providers have an understanding of the patient's medical needs. This will include multiple handoffs that take place during the preoperative period, intraoperative, and postoperative periods. Our institution sought to improve handoffs through the use of a streamlined flow sheet and a written prepopulated SBAR (situation, background, assessment, recommendation) form. A multidisciplinary team determined the critical items to be included on the flow sheet.

Literature Review: In 2005, a Joint Commission analysis found that 70% of sentinel events were caused by communication breakdowns, half of which occurred during handoffs. According to Amato-Vealey et al, the surgical patient is more vulnerable to handoff errors than patients in other clinical specialties. Transitions between these phases are considered high-risk time frames. According to Boat et al, it was found that the reliability of intraoperative anesthesia handoffs improved from 20% to 100% with use of the intraoperative handoff checklist. Similarly, with the introduction of a standardized PACU checklist, the reliability of PACU handoffs improved from 59% to greater than 90%.

Results: Data was gathered before and after the implementation of the SBAR flow sheet through direct observations in the PACU. Critical elements were identified from that data collection. A streamlined SBAR flowchart was developed with the multidisciplinary team. All staff were educated about the process by both email and through verbalization during a meeting with all staff members. The staff members included were anesthesia care providers (CRNAs, SRNAs, residents and anesthesiologists), OR circulators, and all PACU nursing staff. Six weeks after implementation of the handover tool, another data collection was obtained. An evaluation tool was also administered at that time to determine the overall satisfaction of the new handover tool.

Conclusions: There was significant statistical improvement in 16 of 21 critical elements. The analysis also identified areas for future improvement. To increase compliance, future teaching is scheduled and further observations scheduled after 6 months. The evaluation tool showed that 93% of anesthesia, 100% of circulators, and 93% PACU staff felt that the handoff tool was effective. This shows that both overall satisfaction of providers and potential for improved patient safety have been obtained with a standardized handoff tool.

Securing the Endotracheal Tube With Adhesive Tape: A High-Risk Practice?

Lois J. Krug, CRNP, ARNP; Melissa D. Machan, CRNA, ARNP, DNP; Jose Villalba, MD

Barry University

Introduction: Preparing the anesthetic location is a prerequisite to the administration of anesthesia. In order to minimize the induction time, anesthesia providers precut the adhesive tape and adhere it to the gas machine during this preparation. Once the patient is intubated, the provider can quickly, efficiently secure the endotracheal tube (ETT) with tape. The practice of securing the tape appears to be a benign task. Yet, research suggests that this may not be the case. In fact, securing the ETT in this manner could be a high-risk practice that increases the patient's exposure to pathogens and the risk of infection due to contamination of the tape, the gas machine, and the anesthesia provider.

Literature Review: The online electronic databases searched included MEDLINE/PubMed, Cochrane Library, CINAHL, and SUM Search. A manual search of the reference lists of all articles obtained from any reports of research not already identified were reviewed. The US Food and Drug Administration Medical Device Classifications, CDC Guidelines, and the US Federal Register were searched, as well. The keywords, used alone and in combination, were: anesthesia, anesthesia equipment, contamination, disinfection, hand hygiene, and operating room. International English language articles published between 1974 and 2013 were searched.

Results: As a noncritical item, Class I medical device, surgical adhesive tape needs disinfection between uses. However, it disintegrates with disinfection. Regardless of recommendations, it is reused without further consideration. The tape, outside of its original packaging, became contaminated with pathogens. Direct patient contact with the gas machine is not required in order for transmission to occur. Anesthesia providers were identified as the origin of bacterial transmission in 12% of cases. Pathogens are on the hands of the anesthesia providers 66% of the time, and anesthesia providers fail to practice hand hygiene 82% of the time. Lastly, the tape drops to the floor, which harbors pathogens despite cleaning in 41.6% of the time; it is retrieved and used again.

Conclusions: The evidence confirms that the currently used tape and the anesthesia gas machine are contaminated. The anesthesia providers suboptimally practice hand hygiene leading to contamination. All elements involve the tape and its potential to increase the patient's exposure to pathogens through the taping practice and pose a significant risk to the patient. Being unaware of these findings, most anesthesia providers fail to relate their significance with anesthesia delivery. Directions and taping guidelines for the safe handling and application of the surgical adhesive tape have yet to be developed for the anesthesia provider.

Should the Use of an LMA Be Contraindicated in Obese Adult Patients With or Without Diagnosed Obstructive Sleep Apnea?

Yvette Hooks, RN, BSN; Victoria Ladele, RN, BSN; Joseph E. Pellegrini, CRNA, PhD

University of Maryland

Introduction: Many practitioners argue that it is safe to use a laryngeal mask airway (LMA) in obese patients with/without a history of obstructive sleep apnea (OSA), while others are reluctant to use an LMA in this patient population. The purpose of this paper is to discuss whether an LMA can be safely used in obese patients with/without OSA.

Literature Review: A search was conducted in PubMed, CINAHL, and EBSCO-Host using the PICOT question: Is the use of a LMA (I) in obese adult patients with OSA (P) as safe in those without OSA (C) presenting for elective surgery, as measured by postoperative complications (O).

Results: Five investigations were found which included 1 retrospective, 1 cohort, 2 prospective and 1 case control study for a total of 536 patients enrolled. All subjects enrolled secondary to obesity, history of OSA or both. On analysis it was noted that patients with OSA were found to have more post-operative complications as well as a higher frequency of lower esophageal sphincter pressure compared to non-OSA patients.

Conclusions: Based on the literature review, we recommend that the use of a LMA in obese OSA patients should be relatively contraindicated. However, there is a need for a larger number and increased quality of studies that report outcomes involving the use of LMAs in people with OSA.

Simulation in the Prevention of Medication Errors by Nurse Anesthesia Students

Jamie C. Weglarz, RN, BSN, BA, CCRN; Ann B. Miller, CRNA, DNP, ARNP

Florida Gulf Coast University

Introduction: Medication errors are a preventable and significant cost to patients and medical facilities in the United States. According to the US Food and Drug Administration, medication errors cause at least 1 death each day and injure 1.3 million people annually in the United States. Simulation-based training is highly regarded as an educational tool in aviation and the military to prepare teams for emergencies. Use of simulation-based training is the future of nurse anesthesia education with the goal of decreasing medical errors and increasing patient safety.

Literature Review: A comprehensive search of the literature was conducted using PubMed, Cochrane Database, Medline, Cumulative Index to Nursing and Allied Health Literature, Science Direct, and the Institute of Medicine report. Keywords included simulation, medication errors, nurses, nursing students, and student registered nurse anesthetists. Ten peer-reviewed research studies conducted in the United States or Canada and in English were selected for inclusion. High-fidelity simulation provides nursing students the opportunity to safely practice clinical skills, model emergency situations, and learn in a nonthreatening educational environment.

Results: Analysis of current research provides statistically significant results showing reduction in medication errors after simulation interventions among student nurses and critical care nurses. When patient simulators are used in nursing curricula, researchers concluded the simulated situation provides safe practice, aiding the transfer of learning to real-life situations. Simulation also improves self-confidence in nursing students and reinforces knowledge learned in didactic education.

Conclusions: The results of the literature review support simulation curriculum to be implemented in nurse anesthesia programs. Additional research needs to be conducted on nurse anesthesia curriculum in support of simulation-based learning to improve patient safety. Research supports implementation of anesthesia curriculum using high-fidelity simulation integrating real-life clinical anesthesia scenarios, medication calculation, and recognition of medication errors built into the scenario. Models, frameworks, and patient clinical scenarios need to be structured and developed for graduate nurse anesthesia student simulations in all nurse anesthesia programs.

Spinal Anesthesia in the Prone Position: Avoiding the Pitfalls

Randall W. Klotz, CRNA, MEd, MSN; Loraine S. Silvestro, PhD; Paul N. Austin, CRNA, PhD
Texas Wesleyan University

Introduction: Rectal procedures are performed using local, general, and spinal anesthesia with the patient in the prone jackknife position. Spinal anesthesia is attractive as it is very efficacious while not altering consciousness. The question guiding this evidence-based review was: For surgical patients undergoing surgery in the prone jackknife position, does the use of hypobaric or hyperbaric solutions result in a decrease in unwanted cephalad spread of the local anesthetic solution, avoiding cardiac arrhythmias or cardiac arrest.

Literature Review: A keyword search was done of online databases including PubMed and the Cochrane Library. Websites of professional and governmental websites were also examined. Evidence included systematic reviews with and without meta-analysis, evidence-based practice guidelines, human clinical studies, and case reports. The evidence was appraised and leveled using the method proposed by Melnyk and Fineout-Overholt.

Results: Fourteen of the 40 possible evidence sources met the inclusion criteria. The 14 sources included patients undergoing elective cesarean section, open reduction internal fixation/total hip arthroplasty, endoscopic urologic procedures, anorectal/perirectal surgeries, and those in which the effects of positioning and baricity were examined. Anorectal/perirectal surgeries, in the jackknife prone position, accounted for the direct evidence sources. Surgeries performed in the supine or lateral position accounted for the indirect evidence sources. Isobaric and hyperbaric solutions resulted in significant cephalad spread in the jackknife prone position, whereas hypobaric solutions did not.

Conclusions: The evidence suggests that baricity and patient position (posture) have an effect on level of blockade and suggests that hyperbaric or isobaric local anesthetic (LA) administered in the jack-knife prone position could result in unstable hemodynamic variables, resulting in bradycardia, hypotension or cardiac arrest. The use of hypobaric LA, administered in the jackknife prone position, represents a suitable and safer alternative to avoid potential complications seen with isobaric or hyperbaric LA solutions in patients undergoing anorectal/perirectal surgery in the prone jackknife position.

The Application of Active Teaching Strategies to the Development of a Nurse Anesthesia Course in Crisis Management

Jane E. Motz, CRNA, DrAP; Lynn L. Lebeck, CRNA, PhD; Kelley A. LaBonty, CRNA

University of Michigan-Flint

Introduction: Use of simulation for the enhancement of learning is becoming increasingly important. It is impossible to expose a student to all of the problems they will be expected to manage in their practice. Clinical training can only offer a limited exposure related to the inability to replicate adverse events in the clinical setting. To become an expert, a practitioner must practice skills repeatedly. Education in the management of complex and dynamically changing environments is an essential element in the preparation of safe practitioners. Crisis management and team communication needs have led educators to investigate alternative methods to enhance student performance.

Literature Review: Using simulation to acquire the necessary cognitive, affective, and psychomotor skills, and develop practice expertise is established in the literature. The concept of Deliberate Practice focuses on improving performance and addresses the importance of debriefing or evaluating experiences to enhance psychomotor skills and enable students to develop expertise. The development of realistic simulation scenarios requiring complex decision making, as well as teamwork and communication are expected to be the routine means to educate providers in crisis management in the future. Simulation education has been utilized as an active teaching strategy for the development of teamwork skills.

Results: The previous crisis management course, ANE517, was redeveloped to incorporate active teaching strategies and apply learning theories. In the course, students were familiarized with associated principles related to adverse anesthesia events including triggering events, preparedness, vigilance, problem solving, and prevention. Participants were introduced to concepts such as dynamic decision making, critical thinking, and situational awareness for the purpose of enhancing skills for the management of adverse anesthesia events. Crisis management and communication principles and Deliberate Practice concepts were incorporated into simulation scenarios. Student feedback indicated that the reformatted ANE517 was well received and they appreciated maintenance of a safe, relaxed simulation lab learning environment.

Conclusions: The application of learning theory, combined with active teaching strategies, is successful in promoting student engagement, as well as assists students to develop necessary cognitive, affective, and psychomotor skills necessary to manage crisis situations in anesthesia. Future ANE517 courses will include an increased emphasis on the team communication and situational awareness. Students can apply concepts and techniques learned through reality based high-fidelity training scenarios toward the delivery of safe anesthesia care.

The Effectiveness of High FiO₂ in Preventing Postoperative Surgical Site Infections in Adult Patients Undergoing Abdominal Surgery: A Systematic Review

Christopher K. Yancey, RN, BSN; Kelsey M. Merrick, RN, BSN

Texas Christian University

Introduction: Surgical site infections are frequent and serious complications of abdominal surgery. Therefore, interventions that aim to reduce the incidence of surgical site infections are of paramount importance for patients and hospitals. Despite the fact that a surgical site infection may not be diagnosed for days or weeks after surgery, a wound infection is most likely established in the first several hours after bacterial contamination of the tissue. Thus, perioperative interventions that aim to prevent surgical site infections can have a direct influence on the occurrence of a surgical site infection.

Literature Review: The comprehensive search strategy aimed to find both published and unpublished studies from 2000 to 2013, published only in the English language. The search strategy was not limited to full-text only articles. An initial search of MEDLINE and CINAHL was undertaken, followed by analysis of the text words contained in the title and abstract and the index terms used to describe the article. Grey literature was searched using Google Scholar. A second search using all identified keywords and index terms were undertaken across all the following databases: CINAHL, Cochrane, MEDLINE, and Google Scholar. Thirdly, the reference lists of identified articles were hand-searched for additional studies.

Results: Eleven RCTs were included in the meta-analysis divided into 2 groups, abdominal surgeries and cesarean sections. In the abdominal surgery group it was estimated that a statistically nonsignificant ($p=0.24$) reduction in surgical site infections was present in the treatment group ($RR=0.77$). The results are interpreted at the 95% confidence interval as a statistically nonsignificant DeSimonian and Laird relative risk ratio reduction in surgical site infections. In the cesarean section group it was estimated that a statistically nonsignificant ($p=0.30$) increase in surgical site infections was present in the treatment group ($RR=1.15$). The results are interpreted at the 95% confidence interval as a statistically nonsignificant DeSimonian and Laird relative risk ratio increase in surgical site infection.

Conclusions: Based on the results of this review, administration of 80% oxygen does not significantly reduce surgical site infections in patients undergoing abdominal surgery and could possibly increase the risk of surgical site infection in women undergoing cesarean section. Therefore, it is not recommended that anesthesia providers routinely use increased oxygen concentrations with the intention to decrease the risk of infection. Further research is indicated to establish clear, evidence-based guidelines regarding the use of 80% oxygen in the prevention of surgical site infections.

The Effects of Intraoperative Cell Salvage Devices on Autologous Blood Transfusions

Joseph C. Barnes, RN, BSN; Ann B. Miller, CRNA, DNP, ARNP

Florida Gulf Coast University

Introduction: The purpose of this evidence-based quality improvement project was to gather information on the state of intraoperative cell salvage (ICS) use and its effect on the reduction of allogeneic blood transfusion in healthcare settings. The negative effects of allogeneic blood transfusions including allergic reaction and transfusion related lung injury have been well documented, therefore resulting in alternatives to bank blood transfusions. Specifically, a literature review aimed to investigate alternatives to allogeneic blood transfusions through ICS in a multitude of surgeries was conducted.

Literature Review: Data for this literature review was obtained from PubMed, Science Direct, and Cumulative Index to Nursing and Allied Health Literature (CINAHL). Keywords utilized included intraoperative cell salvage, blood transfusion, blood cell salvage, and cell saver. One meta-analysis, 2 systematic reviews, 5 retrospective cohort studies, and 2 prospective studies were utilized based on the following criteria: English language, full text, 2009 to present, adult patients, intraoperative blood loss.

Results: Research studies revealed that utilization of ICS can have a direct effect on reducing autologous blood transfusions resulting from surgical blood loss. Specifically, the articles suggest that ICS is safe and cost effective in orthopedic, obstetric, vascular, and oncologic surgeries.

Conclusions: The results of this study provide evidence to support that ICS can be useful in reducing allogeneic blood transfusions in multiple surgical procedures. ICS systems have emerged as intraoperative tools that are cost effective and have been shown to reduce the blood requirement by up to 60%.

The Effects of Music Therapy on Perioperative Pain and Anxiety

Katherine S. Register, RN, BSN, BA, CCRN; Ann B. Miller, CRNA, DNP, ARNP

Florida Gulf Coast University

Introduction: Current medical practices for the treatment of pain and anxiety rely heavily on pharmacologic therapies, which are costly, have unwanted side effects, and further patient discomfort. Music therapy is a noninvasive, inexpensive, and safe intervention that can be used as an adjunct to traditional drug-based therapy for surgical patients. Studies examined in this literature review help to establish support for bringing music therapy into the operating room as a standard of care.

Literature Review: A thorough literature review was performed by searching PubMed, ScienceDirect, DynaMed, and ProQuest Health and Medical Complete databases. Keywords utilized for examination of current research included music therapy, perioperative, pain, and anxiety. To obtain the best empirical evidence, articles reviewed included peer-reviewed journal publications from the past 10 years. Inclusion criteria consisted of adult surgical patients with no hearing impairments. Music therapy was defined as nature sounds, classical music, instrumental music, acoustic music, and hemispheric synchronized sounds.

Results: The empirical evidence supports the use of perioperative music therapy as an adjunct to standard pharmacologic therapies. Research demonstrates that perioperative music therapy can decrease analgesic and anesthetic requirements, blunt the hemodynamic response to emergence from anesthesia, and attenuate the endocrine response to surgical stimulation. In addition, patients receiving music therapy during surgical procedures reported lower postoperative pain scores, less anxiety, and higher patient satisfaction scores.

Conclusions: Research supports that music therapy in conjunction with anesthesia has many benefits for surgical patients. The usefulness of perioperative music therapy is evident in conjunction with regional anesthesia and intravenous sedation. Future studies will focus on general anesthesia in conjunction with music therapy and hemispheric synchronized technology. Research supports implementation of music therapy as a standard of care for all surgical patients.

The Effects of Simulated Pediatric Anesthesia Clinical Experiences on Student Registered Nurse Anesthetists' Anxiety as Measured by the STAI

Matthew S. McCoy, CRNA, DNP

Villanova University

Introduction: Student registered nurse anesthetists (SRNAs) often experience stress during clinical education, and some students endure high levels of anxiety regularly. The pediatric anesthesia rotation is one of the more anxiety producing clinical rotations for the SRNA. High levels of anxiety can greatly decrease successful learning. Simulated clinical experiences relieve student anxiety while increasing self-confidence. Twenty-one SRNAs were enrolled in a pretest/posttest, single-group, evidence-based project to measure the effects of 3 simulated pediatric anesthesia clinical experiences on SRNA anxiety at the start of the pediatric anesthesia rotation.

Literature Review: Wildgust (1986) noted that senior SRNAs ranked the pediatric anesthesia rotation as extremely stressful. Other variables such as first intubations, adapting to a new clinical environment, performing clinical skills, theory gap, and faculty evaluation have all been indicated to cause anxiety, with fear of making a clinical error the highest anxiety-producing situations (Moscaritolo, 2009; Rhodes and Curran, 2005; Wildgust, 1986). When students lack self-confidence in their clinical abilities, they will often focus on their anxiety and feelings of concern about making a mistake (Rhodes and Curran, 2005). Chipas et al (2012) note that students in an integrated program experienced more anxiety.

Results: A paired-samples t-test was conducted to compare mean anxiety scores presimulation and postsimulation. Scores for the state-trait anxiety inventory (STAI) can vary from a minimum of 20 to a maximum of 80. Results indicate a statistically significant difference in mean anxiety scores presimulation ($M = 43.9$) and postsimulation ($M = 38.2$) ($p = 0.02$). These results indicate that simulated clinical experiences can decrease SRNA anxiety at the start of a primary pediatric anesthesia rotation. The mean postsimulation anxiety scores ($M = 38.2$) were significantly lower than the mean presimulation anxiety scores ($M = 43.9$). Although a small sample size, the results indicate that participation in simulated clinical experiences decreased SRNA anxiety in the pediatric rotation.

Conclusions: The results obtained from the project have many implications for not only nurse anesthesia practice but also for all nursing and allied health specialties. Projects that successfully decrease SRNA anxiety have the ability to remove at least one obstacle to the learning process and ultimately increase clinical performance. By using simulated clinical experiences to decrease SRNA anxiety, students should become less hesitant when participating in the pediatric clinical environment. In addition, the simulation component can be adjusted to meet the demands of different clinical environments.

The Impact of Inhaled Anesthetic Gases on Climate Change and the Environmentally Sensitive Alternatives

Peta Gaye T. Johnson, RN, BSN, BS, CCRN; Ann B. Miller, CRNA, DNP, ARNP

Florida Gulf Coast University

Introduction: Volatile anesthetics have the potential to be large contributors to climate change. Climate change has a significant negative impact on the environment, human health and society. Various alternatives exist to reduce the environmental load of anesthetic gases. The purpose of this quality improvement project is to provide an overview of the empirical evidence on the climate change impacts of 3 anesthetic gases: sevoflurane, isoflurane and desflurane and describe viable options that prevent volatile gases from being released into the atmosphere.

Literature Review: A literature review was conducted on the climate change effects of the anesthetic gases, sevoflurane, isoflurane and desflurane. Keywords utilized in the literature review were inhaled anesthetic gases, global warming potential, environmental pollution, ozone depletion potential, and climate impact. Atmospheric lifetimes, global warming potentials and ozone depleting potential values of each anesthetic gas were analyzed. Furthermore, alternatives to reducing and preventing the release of anesthetic gases into the atmosphere were assessed.

Results: The literature review shows that the atmospheric lifetimes, global warming potential, and ozone depleting potential values support anesthetic gases' negative impact on climate change. The overall contribution of anesthetic gases to climate change is dependent on the ecological effects of the anesthetic gases and the quantities emitted into the atmosphere. Low flow anesthesia; choosing anesthetic gases with lower environmental impact; using alternatives to volatile anesthetics and capturing and recycling anesthetic gases are methods to reduce the environmental impact of volatile anesthetics.

Conclusions: Anesthetic gases have a cumulative effect on climate change, which is pertinent to the ecological well-being of the planet. The negative human health, societal and environmental impacts are even more significant with the increasing use of volatile anesthetics globally. Techniques for reducing anesthetic gas emissions into the atmosphere can play an important role in reducing climate change caused by volatile anesthetics. The alternatives have the ability to shape anesthesia practice into a more environmentally sensitive field.

The Timing of Ondansetron Administration in Preventing Postoperative Nausea and Vomiting

Julie Hudson RN, BSN, CRNA; Saheel Patel RN, BSN, CRN; Joan Choili RN, BSN, CRNA

University of Maryland

Introduction: Postoperative nausea and vomiting (PONV) is one of the most common perioperative complications and ondansetron, a serotonin 5HT-3 antagonist, has been shown to be an effective antiemetic drug. The most effective timing of ondansetron administration to prevent PONV is unclear. The purpose of this poster is to describe the evidence on the most effective timing of ondansetron administration.

Literature Review: The PICOT question used to search literature databases PubMed, CINAHL, Science Direct, and Cochrane was: In adult surgical patients undergoing general anesthesia (P), does administering ondansetron before surgical incision (I) result in less PONV (O) and less time spent in postoperative acute care unit (PACU) (T) compared to administration 30 minutes prior to skin closure (C).

Results: Three randomized double-blinded placebo studies found that administering ondansetron 30 minutes prior to skin closure or before the end of surgery was more effective in prevention of PONV in the PACU.

Conclusions: It is recommended from this evidence that ondansetron be administered at the end of surgery to prevent PONV.

To Cough or Not to Cough...

Michele Y. Lowman, RN, BSN; Teresa A. Luz, RN, BSN; Tara L. Traczyk, RN, BSN

University of Maryland, School of Nursing, Nurse Anesthesia Program

Introduction: Coughing during emergence can lead to increased blood pressure, increased intracranial pressure, increased intraocular pressure, and strain on surgical incision sites. A current mechanism for attenuating this response is the application of laryngotracheal topical lidocaine. The purpose of this paper is to describe the evidence on the effectiveness of the application of topical lidocaine on decreasing these side effects of endotracheal intubation.

Literature Review: Google Scholar, CINAHL, MedLine, and PubMed databases were searched using keywords from the following PICOT question: Do surgical patients undergoing general anesthesia with endotracheal tube intubation (P) receiving laryngotracheal topical lidocaine (I) have a lower incidence of cough (O) on emergence (T) when compared with patients who receive no topical lidocaine (C)? Six randomized control trials (RCTs) that answered this question were critically appraised.

Results: The results of 4 RCTs found a statistically significant lower incidence of cough during emergence in patients with topical lidocaine spray compared with no lidocaine spray. In comparing the use of intracuff lidocaine to intracuff air or saline, 2 RCTs found a statistically significant lower incidence of cough on emergence, while 1 RCT showed no statistically significant difference.

Conclusions: It is recommended from this evidence that topical lidocaine be used intraoperatively during general anesthesia with endotracheal intubation to decrease the incidence of cough during emergence.

Tonsillectomy and Ketorolac

Lesley Phillips-Reed, CRNA, MS, MNSc; Ricardo E. Rodriguez, PhD; Paul N. Austin, CRNA, PhD
Texas Wesleyan University

Introduction: Postoperative tonsillectomy pain is a frequently occurring complication and is challenging to manage. Currently use of the nonsteroidal anti-inflammatory drug (NSAID) ketorolac in tonsillectomy remains limited because of potential for causing postoperative bleeding. A search strategy focused on locating evidence from higher level sources addressing this question: For persons of any age undergoing a surgical tonsillectomy, does a weight-appropriate single dose of intravenous ketorolac, compared with no ketorolac, affect the incidence of postoperative hemorrhage?

Literature Review: A keyword search was conducted using online databases including PubMed and the Cochrane Library to locate high level evidence sources examining the complication of postoperative hemorrhage in the tonsillectomy patient following the administration of an NSAID, such as ketorolac. This was considered appropriate due to similar mechanism of action in causing bleeding among NSAIDs. Randomized controlled trials (RCTs) included in appraised systematic reviews (SRs) were not separately appraised. The evidence was appraised and leveled using the method proposed by Melnyk and Fineout-Overholt.

Results: The initial search revealed 86 evidence sources based on the search terms. Five SRs with meta-analysis ultimately met the inclusion criteria, and all RCTs located were included in the SRs. Notably a Cochrane Review was located that included 15 studies involving NSAIDs with 1,101 pediatric subjects. Ketorolac was the intervention drug in 5 studies involving 359 subjects and focused on perioperative bleeding requiring surgical intervention. The 4 other SRs included many of the same studies as the Cochrane Review, along with prospective studies and studies involving adult subjects.

Conclusions: The evidence was not clear on the increased risk of bleeding after tonsillectomy when NSAIDs such as ketorolac are administered. The 2013 Cochrane Review concluded there is insufficient evidence to exclude an increased risk of bleeding when NSAIDs are used with these patients. The authors of the remaining 4 SRs varied in their conclusions, ranging from NSAIDs are safe in this setting to these drugs should be not be used with tonsillectomy. Due to the high stakes nature of postoperative tonsillectomy bleeding, ketorolac should be avoided as researchers continue to examine this problem.

Ultrasound Guided Cannulation of the Internal Jugular Vein: A Systematic Review

Margaret E. Finnigan, RN; Kathryn A. Harris, RN

Virginia Commonwealth University

Introduction: Millions of central venous catheters are placed in the United States each year, with varying complication rates. There is a growing body of evidence and research informing a practice transition from using landmark techniques to real-time ultrasound (US) guidance for placement of central venous catheters, specifically for the internal jugular vein (IJV). A systematic review of the literature was conducted looking at safety and best practice for placing catheters in the IJV comparing landmark techniques to real-time US.

Literature Review: MedLine, Pubmed, CINAHL, Cochrane Library, and National Guideline Clearinghouse databases were searched (since 1990) for retrospective studies, randomized controlled trials, systematic reviews, meta-analyses, and consensus practice guidelines using the search terms IJV, anatomical variation, carotid artery, landmark technique, ultrasound-guidance, safety and complication rates. Exclusion criteria involved studies related to the pediatric population and inexperienced practitioners.

Results: US allows direct visualization of the vessels of the neck and the surrounding structures. Aberrant anatomy is seen in 8.5% of patients and increases the risk for complications when using landmark techniques. US allows the provider to assess unique anatomy, venous flow, and identify potential thrombosis. Identification of abnormalities and variation prevents complications. US guided cannulation permits direct visualization of the needle as it enters the vein. This results in higher first attempt success rate of IJV cannulation and fewer carotid artery punctures. The use of US decreases the time to successful cannulation. Implementing real-time US as the standard of care for cannulation of the IJV improves patient safety and reduces healthcare costs.

Conclusions: Direct visualization with US results in decreased time to successful cannulation, higher first attempt and overall success rates, decreased complications, and reduced overall costs when compared to landmark techniques alone. There is a clear benefit to using US for cannulation of the IJV as evidenced by increased patient safety and decreased costs. US is evolving as the standard of care in IJV cannulation.

Uses and Abuses of the Glidescope* Video Laryngoscope

Stephanie L. Odom, RN, BSN; Tammy L. Carroll, CRNA, ARNP; W. Patrick Monaghan, PhD, CLS, SBB
University of North Florida

Introduction: The utilization of video assisted laryngoscopy has grown dramatically over the past 10 years. Prior to analysis of outcomes data, practitioners are adopting this technology in hopes that the devices will improve the management of difficult and normal airways. A growing list of oropharyngeal injuries have been reported following the use of the Glidescope with tracheal perforation listed as one of the more serious consequence of utilization. With increasing use among anesthesia practitioners, this list is likely to grow. The purpose of this review is to identify pitfalls with Glidescope use, determine methods to avoid further injuries, and evaluate the need for practitioner training.

Literature Review: An extensive literature review was conducted through MEDLINE, CINAHL, PubMed, and the Internet to identify reports of injuries that occurred while using the Glidescope video laryngoscope. Each case study was reviewed individually to determine the probable cause and mechanism of injury and common trends were identified. Additional literature reviews sought to identify clinical scenarios and recommendations for avoiding such injuries and to evaluate the need for practitioner training.

Results: In total, 13 case studies were found describing injuries that occurred while using the Glidescope video laryngoscope. Several common trends were identified; the most common being the blind advancement of the endotracheal tube through the oropharyngeal cavity. Additional common behaviors that may have contributed to injury include use of the Glidescope rigid stylet, improper advancement of the endotracheal tube and stylet through the laryngeal inlet, and unnecessary force applied to posterior soft tissues making related structures more susceptible to perforation. Further data found in the literature review identified several suggested safe practices that, when applied appropriately, would not only increase the success of intubation using the Glidescope video laryngoscope but also could significantly decrease the incidence of injury.

Conclusions: A common misconception exists that there is little to no learning curve associated with tracheal intubation using the Glidescope; however, several injuries have occurred as a result of improper use, arguably due to a lack of training. Institutions that have employed formal training on the proper use of the Glidescope report a conspicuous absence of patient injuries and rescue airway use. As emphasized by Pacey, proper instruction and training is required to develop the skills needed for the proper use of the Glidescope. More formal hands-on practice and close supervision of novice users should be encouraged.