

2018 Poster Abstracts



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A1

A Content and Thematic Analysis of Closed Claims Resulting in Death

Anne Marie Hranchook, DNP, CRNA; Lorraine M. Jordan, PhD, CRNA, CAE, FAAN; Marjorie Geisz-Everson, PhD, CRNA, FNAP; Maria Hirsch, DNAP, CRNA; Robert W. Matthews, PhD, CRNA

Oakland University

Introduction: Qualitative research methodology can be an effective approach to providing clarity and an understanding of anesthesia adverse events. Using content and thematic analysis, closed claims where the outcome was death were reviewed. The purpose of this study was to identify themes that would provide unique insights into the events leading up to death with a focus on the role anesthesia may or may not have had in the outcome.

Literature Review: Mortality attributable to anesthesia has declined significantly over time. The reasons include the introduction of respiratory monitoring, use of evidence-based practice guidelines, and advances in teamwork and education. Although anesthetic mortality has improved, studies evaluating the contribution of anesthesia to perioperative mortality are needed to enable improvements in quality and safety.

Methodology: This study was IRB approved by the American Institute of Research. Content and thematic analysis, a qualitative framework approach, was employed to analyze closed malpractice claims. Through this method, patterns, features, and themes specific to the sample could be identified facilitating interpretation and understanding of a dataset.

Data Collection & Methods: In 2015, the insurer, CNA, made available to the AANA Foundation Closed Claim Research Team 245 closed claim files. Of the 245 files, an adverse event leading to death occurred in 87 of the claims. Applying a qualitative thematic framework approach, data from each file were extracted and entered onto a previously validated closed claim instrument. The instrument has 4 distinct sections including the reviewer's narrative, reviewer's assessment, listing of accusations, and a description of key lessons learned. From the narrative, code words capturing the phenomena of interest were generated. Through analytical reflection of the data set, themes were identified. Prior to data entry, all research claim reviewers participated in a protocol session and interrater reliability was established.

Results & Data Analysis: All claims were analyzed adhering to the described method. Four major themes emerged from the thematic analysis: (1) patient factors, (2) anesthesia provider factors, (3) environmental factors, and (4) team/group factors. In addition, 16 subthemes were identified. Excerpts demonstrating evidence of the major themes were drawn from the claims.

Discussion & Conclusions: The AANA Foundation researchers identified 87 deaths resulting in closed malpractice claims during a 10-year period. Major events leading to death were categorized as respiratory, cardiac, and drug related. The major themes contributing to events leading to death include patient, provider, environmental, and team/group factors. The analysis of these claims exposed important and previously unappreciated aspects of adverse outcomes in cases involving CRNAs.

A2

A Thematic Analysis of the Obstetric Anesthesia Cases From the AANA Foundation Closed Claims Databank

Beth Ann Clayton, DNP, CRNA; Marjorie A. Giesz-Everson, PhD, CRNA, FNAP; Bryan Wilbanks, PhD, DNP, CRNA

University of Cincinnati

Introduction: Maternal morbidity and mortality rates are rising in the United States. Understanding parturient and neonatal complications and causes of death is critical to determine corrective actions. A qualitative analysis of obstetric anesthesia closed claims data affords the opportunity to identify patterns of injury and/or outcomes, precipitating events, differences in anesthesia technique, variations in infant delivery modes, and the settlement payments made to the obstetrical patients.

Literature Review: The US pregnancy-related maternal mortality rate increased from 7.2 deaths per 100,000 in 1987 to 17.8 deaths per 100,000 live births in 2011. The World Health Organization reports that the majority of countries have decreased their maternal mortality ratios. In 2015, the United Nations ranked the United States 47th in the world for maternal mortality behind the majority of European countries and several Asian and Middle Eastern countries.

Methodology: The AANA Foundation closed claims database was queried for obstetric claims. The database contains quantitative and qualitative data comprised of malpractice claims from the years 2003 to 2012, which are considered closed (ie, completed the entire litigation process and the payout, if any, was disbursed) and involved either a certified registered nurse anesthetist (CRNA) or a student registered nurse anesthetist (SRNA).

Data Collection & Methods: The team leader conducted a manual query of the AANA Foundation closed claim database (N = 245) for obstetric related events. For this study, inclusion criteria consisted of malpractice claims involving obstetric events and/or neonatal events that occurred during or immediately postdelivery. Exclusion criteria included the following: nonobstetric claims, nonanesthesia related adverse outcomes, dismissal of anesthesia provider, or insufficient evidence correlating the negative outcome to anesthesia care. A descriptive analysis of the 21 obstetric closed claims was conducted using SPSS version 19 (SPSS Inc, Armonk, New York). A thematic analysis to identify emerging themes was also conducted.

Results & Data Analysis: The most common adverse maternal outcomes identified were maternal death (8/18) and maternal peripheral nerve injury (4/18). Maternal hemorrhage accounted for the greatest number of maternal deaths (3/8). All neonatal claims (3/3) involved hypoxic encephalopathy. The majority of maternal cases were identified as nonemergent (15/18) and involved relatively healthy patients (15/18 identified as physical status 2). A thematic analysis revealed the following themes related to poor outcomes: care delay, communication, documentation, hemorrhage, and lack of vigilance.

Discussion & Conclusions: A thematic evaluation of obstetric anesthesia closed claims offers insight into the factors contributing to maternal and neonatal morbidity and mortality. Lessons learned from this analysis include adverse outcomes are mitigated by: identification of potential triggers, preparedness with protocols and drills, and timely recognition and treatment of clinical events. In addition, streamlined communication and thorough documentation facilitate effective care.

A3

Sr Yvonne Jenn: A Pioneer in Nurse Anesthesia Education

Denise Jenn, BSN, RN; Janet Dewan, PhD, MS, CRNA

Northeastern University

Introduction: Sr Yvonne Jenn was a pioneer in nurse anesthesia education and respiratory therapy who followed a vocation. She founded the St Francis School of Anesthesia and served as director for 40 years. Her innovation and quest for knowledge kept the school at the forefront of the changing profession. She mentored many leaders and also helped respiratory therapy move into a profession in its own right.

Literature Review: Literature review included AANA and Franciscan Sisters of Perpetual Adoration archives. This uncovered articles with personal interviews and records of her life and accomplishments. A transcribed AANA interview from 1996 and 3 publications from St Francis Hospital were reviewed. Two nurse anesthesia texts were consulted for historical context.

Methodology: Historical biography methods were used in this project. Content of resources is explored using realism (empiric) and constructionist (interpretive) approaches. Sources were vetted and statements by one individual were corroborated by second sources. Transcribed interviews underwent document analysis.

Data Collection & Methods: After initial literature and transcript review, the researcher conducted telephone and in-person interviews with former students and colleagues, including Patrick Downey, Rodney Lester, Louis Heindel, Judy Hanley, and Barb Jochman. This included inquiry into Sr Yvonne's character, teaching methods, professional activities, and personal influence. The researcher also spoke with Evan Koch for historical perspective within the profession. Trudy Watson, the historian for the American Association of Respiratory Care, provided a perspective of Sr Yvonne's contributions to the profession of respiratory therapy. Notes were taken during interviews and transcribed. Direct quotes were reverified.

Results & Data Analysis: Sr Yvonne's tenure spanned 40 years. She was an early adapter to many new therapies, including the intraoperative use of curare. She served as president, secretary and treasurer of Wisconsin Association of Nurse Anesthetists, was on the Board of Directors of the AANA, and helped write the Code of Ethics. She was 1 of 9 charter members of the AART and served as registrar for 10 years. She graduated a number of successful CRNAs: 3 AANA presidents, 1 executive director, 18 state presidents, and many accomplished clinicians. She was described as brilliant, strict, and generous.

Discussion & Conclusions: Sr Yvonne's faith was a driving force behind her career. Her vocation enabled her professional role and demanded excellence. Her unassuming, humble nature, uncompromising standards and sharp clinical mind gained trust and recognition from colleagues. Sr Yvonne is recognized as a leader in nurse anesthesia education. Her legacy continues through her students and those they influence.

A4

A Comparison Between Ultrasound-Guided Peripheral Nerve Block With and Without the Clear Guide ONE System During Simulation

Shayne Hauglum, PhD, CRNA, ARNP; Connie Tran, BSN, RN, CCRN; Christina Vera, DNP, CRNA, ARNP

University of Miami School of Nursing and Health Studies

Introduction: Transversus abdominis plane (TAP) blocks are a component of multimodal analgesia that requires knowledge of anatomy and hand-eye coordination, a skill that is both difficult to teach and master. The aim of this study was to determine if the Clear Guide One guidance system, which provides optical tracking through the addition of a navigate accessory on the ultrasound probe, enhanced TAP block performance by novice student registered nurse anesthetists compared with traditional ultrasound.

Literature Review: Use of computer assistance guidance technology for ultrasound instrument guidance has been shown in a number of studies to successfully improve procedural accuracy, number of needle redirections, and time to target performance. These improved metrics suggest this technology may emerge as a valuable tool in training medical providers to utilize ultrasound for procedures.

Research Design: This study was a simulation-based observational crossover study that investigated the use of computer-assisted instrument guidance (CAIG) as an educational tool for student registered nurse anesthetist learners enrolled in a 3-year BSN to DNP anesthesia program.

Methods: Twenty-six novice nurse anesthesia students enrolled in a BSN-DNP nurse anesthesia training program were assessed in their performance of TAP block. The experiment was conducted during regularly scheduled simulation based workshops. Students were randomly assigned into 1 of 2 groups. One group performed the TAP block using traditional ultrasound guidance, while the other group performed the TAP block with the Clear Guide One computer-assisted guidance system.

Data Collection: Each participant's performance was assessed based on a task-specific checklist survey tool (TSCST) and a global rating scale (GRS). In addition, time to perform and number of insertion attempts were recorded. A preprocedure survey was used to acquire demographics followed by a postprocedure survey to assess overall experiences.

Results & Data Analysis: Participants produced higher mean scores for all items in the GRS and overall performance ($p = 0.010$). Significant lower differences were noted in the CAIG group in the time taken to perform the TAP block ($p = 0.037$) and number of attempts ($p = 0.002$). Postsurvey results show nurse anesthesia students preferred the Clear Guide technology (76%). On a 10-point Likert scale, those who strongly scored at 8 or above, 68% reported the CAIG increased the speed and accuracy, 80% reported enhanced needle position confidence, 88% reported an enhanced overall experience, and 68% felt improved psychomotor skills compared with ultrasound alone.

Discussions & Conclusions: The Clear Guide system has shown favorable results in observed novice nurse anesthesia student performing TAP blocks on an animal model. Number of attempts and time to perform the procedure was significantly lower. Overall performance was significantly enhanced with the use of the CAIG. Users indicated a strong impression of the CAIG and indicated a strong preference for the CAIG for their overall ultrasound-guided block experience when compared with ultrasound alone.

A5

Acute Pain Service Effect on Duration of 829 Continuous Catheters

Blaine Goodman, BSN, RN; Collin Dobson, BSN, RN

Webster University

Introduction: Few studies have addressed the incidence of continuous catheters that function through postoperative day 2 and the reason(s) for their failure. Through the placement of continuous catheters, the acute pain service can offer patients prolonged pain management. This study aims to evaluate how many continuous catheters placed by acute pain service function for 48 hours in patients undergoing shoulder, knee, and foot surgery, and the reasons for the failure.

Literature Review: There is a body of research indicating that acute pain service leads to improved patient outcomes postoperatively. These services frequently use local anesthetic infusions for perioperative pain management. Literature regarding local anesthetics, pain pathways, continuous catheter infusions versus single injection, and local anesthetic tachyphylaxis, were also reviewed focusing on patient outcomes.

Research Design: Single-site, nonrandomized between subjects, and cross-sectional retrospective chart review comparing the effect of acute pain service versus nonacute pain service on the number of continuous catheters placed for brachial plexus, sciatic, and femoral blocks that function at 48 hours.

Methods: Sample included patients for orthopedic surgery with physical classification of 1 to 3 who received a continuous peripheral nerve block for postoperative pain management and excluded patients with no postoperative follow-up at 48 hours. All blocks were placed by a certified registered nurse anesthetist or student registered nurse anesthetist.

Data Collection: All data was collected at Phelps County Regional Medical Center for calendar years 2016 to 2017 using current procedural terminology codes: 64448, 64446, 64416. Demographic data was obtained along with catheter duration and reason for premature removals. Data was entered into a password-protected Excel spreadsheet with no patient identifiers.

Results & Data Analysis: Chi-squared statistical analysis was used to compare the number of continuous peripheral catheters that remained functional for 48 hours placed by the acute pain service and nonacute pain service. No statistical significance was found between the 2 groups. Further analysis utilizing a chi-squared test found the following failure rates (less than 48 hours) for continuous brachial plexus nerve block approach via interscalene (12%), axillary (15%), and supraclavicular (13%); continuous femoral nerve block (22%); and continuous sciatic nerve block (22%).

Discussions & Conclusions: Few studies have addressed continuous peripheral nerve blocks functioning for greater than 24 hours. Although this study failed to show a statistically significant difference between acute pain and nonacute pain service, it demonstrated how many continuous peripheral nerve blocks functioned for 48 hours. This data may be useful for enhanced recovery after surgery protocols.

A6

An Investigation of the Pathophysiological Mechanism of Amniotic Fluid Embolism: The Effect of Amniotic Fluid on Platelet Aggregation

Ryan Ballard, BSN, RN; Nathan Simmons, BSN, RN; Ryan Weeks, BSN, RN; Vicki Coopmans, PhD, CRNA; Ron Gaddis, PhD

Webster University

Introduction: Amniotic fluid embolism (AFE) is a rare and often fatal obstetric condition. Despite high morbidity and mortality rates, the pathophysiology of AFE is not fully understood. Multiple theories of the pathology of AFE have been presented (obstructive, immunologic, platelet activation). This study focuses on the platelet activation theory of AFE proposed by Barbara Leighton, MD.

Literature Review: Early, severe pulmonary hypertension leading to acute right heart failure has been reported with transesophageal echocardiogram (TEE) in AFE. Dr Leighton proposes that with AFE, platelets are activated, leading to the release of serotonin and production of thromboxane-A₂, both potent pulmonary vasoconstrictors, and resulting in the cardiopulmonary manifestations of AFE.

Research Design: This ex vivo experimental design involved laboratory analysis of matched samples of amniotic fluid (AF) and whole blood (WB). Using WB aggregometry, platelet aggregation was measured via electrical impedance and platelet activation using luminescence to detect adenosine triphosphate (ATP) release.

Methods: Venous blood and AF samples were collected from 11 consented female donors undergoing scheduled cesarean delivery. Blood and AF samples were transported to the laboratory for immediate analysis.

Data Collection: Data on electrical impedance and luminescence were collected by exposing WB to increasing concentrations of AF, with and without the aggregating agent adenosine diphosphate (ADP), compared with control. Demographic data, hemoglobin, hematocrit, platelet count, and sex of fetus were also obtained.

Results & Data Analysis: Testing with AF and WB with no ADP had no appreciable effect on the level of aggregation or ATP release ($P < 0.05$). An EC₅₀ dose of 10 μ M of ADP was used to test for changes in platelet activity in the presence of a known aggregant. The result from the tests with WB, AF, and ADP had variable results within the sample population with the averages not meeting the threshold for significance ($P < 0.05$). Some individual samples did show an increase in platelet activity, while others showed a decrease in platelet activity.

Discussions & Conclusions: In this study, AF did not consistently cause a predictable change in platelet aggregation or ATP release. Further testing of the differences in AF protein content may give further insight to why the results varied between individuals. Future research on the effect of direct exposure of AF to cultured pulmonary arterial smooth muscle and endothelial cells is recommended.

Source of Funding: This research was funded through the Webster University Faculty Research Grant program.

A7

Decreased Same-Day Admissions for Shoulder Arthroscopy Using an Enhanced Recovery Protocol

Charlie Krone, BSN, RN; Sean Stacey, BSN, RN

Webster University

Introduction: Unanticipated hospital admissions are a quality indicator as well as an economic burden to patients and hospitals. Readmission rates may be linked to perioperative usage of opioids. Implementing enhanced recovery protocols that utilize opioid-sparing strategies may improve patient outcomes and decrease unanticipated admissions.

Literature Review: The literature review consisted of over 70 sources, many pertaining to enhanced recovery after surgery (ERAS) protocols and their impact. Topics researched also included shoulder arthroscopy complications, opioid complications, ERAS components with emphasis on opioid sparing modalities, and the potential impact of ERAS protocols on admissions and readmissions following surgery.

Research Design: This study was a single site, nonrandomized, retrospective chart review that was designed to determine the impact of an enhanced recovery protocol on unanticipated hospital admissions. IRB approval was obtained through Webster University and Phelps County Regional Medical Center.

Methods: A retrospective chart analysis was performed on patients meeting inclusion criteria of shoulder arthroscopy. Groups were separated into a control group (n= 140) and an experimental group (n=216) that received an ERAS protocol. Exclusion criteria for the ERAS group were patients that received any perioperative opioid other than hydromorphone. All anesthesia care was provided by CRNAs for 2 surgeons.

Data Collection: Patient data was obtained via a CPT code search for shoulder arthroscopy from January 1, 2016 to November 17, 2017. Patients were randomly assigned numbers and recorded into spreadsheets based on inclusion and exclusion criteria. Same-day, 30-day, and 60-day admissions were recorded for both groups.

Results & Data Analysis: In the ERAS group, 5 patients became unanticipated admissions after surgery compared with 13 in the control group. A chi-square test using a 95% confidence interval was used to compare the significance of unanticipated admissions between the 2 groups. Results found that the ERAS group had a significant decrease in same-day admissions. No significance was found in 30-day and 60-day readmissions. A 2-tailed t test was used to analyze postinduction vital signs. There was no significance found in MAP ($p=0.4510$) or HR ($p=0.7127$) between the 2 groups.

Discussions & Conclusions: Analysis showed a statistically significant decrease in same-day admissions for the ERAS group over the non-ERAS control group. Of additional importance, no significant increase was seen in hospital readmissions and emergency room visits within 30 and 60 days postsurgery. Using an ERAS protocol for shoulder arthroscopy can provide a significant reduction in same-day hospital admissions.

A8

Dexamethasone for Postoperative Nausea and Vomiting Prophylaxis in Laparoscopic Gynecology Patients: A Comparison of Guidelines to Clinical Practice

Krista D. Hord, BSN, RN; Sean A. Newbry, BSN, RN; Rachael L. Sharp, BSN, RN; Shakesha L. Williams, BSN, RN; Michele M. Ballister, DNP, CRNA, APRN, CHSE

Medical University of South Carolina

Introduction: Postoperative nausea and vomiting (PONV) is an adverse effect of anesthesia that contributes to patient dissatisfaction, morbidity, and hospital cost. Dexamethasone is administered as part of a multimodal approach to reduce PONV. This project compared current clinical practice with recent literature related to the dose and timing of dexamethasone administration by anesthetists for PONV prophylaxis.

Literature Review: Dexamethasone has been promoted to reduce PONV. The Society for Ambulatory Anesthesiology (SAMBA) published guidelines in 2014 recommending 4 mg to 5 mg of dexamethasone intravenous push be administered at induction for PONV prophylaxis. The Society of Obstetricians and Gynecologists of Canada (SOGC) recommend 5 to 10 mg IVP given before induction.

Research Design: A retrospective chart review analyzed the dose and timing of dexamethasone administration at an academic medical center over a 2-year period.

Methods: Inclusionary criteria were females that underwent laparoscopic gynecologic surgery and received dexamethasone. The administration of dexamethasone was appropriate if the dose and timing were in line with at least 1 of the published guidelines. Mean and mode were calculated, and a t-interval test and a z-interval test were conducted with the results to determine confidence intervals.

Data Collection: Any private health information and patient-specific identifiers were removed from data collected. Information gathered consisted of patient age, weight, dose of dexamethasone administration, time of dexamethasone administration, and induction time.

Results & Data Analysis: In a review of 77 medical records, 7 patients received dexamethasone for PONV prophylaxis in accordance with Society for Ambulatory Anesthesia (SAMBA) guidelines. Almost 12% (11.7%) of patients received dexamethasone in accordance with any of the published recommendations. The most common dose was 10 mg. The average time of administration was 63 minutes after induction (± 69), with a maximum time of 293 minutes. The earliest administration time was 5 minutes before induction.

Discussions & Conclusions: This study highlights a difference between literature and clinical practice related to dexamethasone administration for PONV prophylaxis. A need for clarification and additional education among anesthesia providers related to the appropriate administration of dexamethasone exists and may be helpful in identifying barriers to appropriate administration.

A9

Effect of Sevoflurane on Neprilysin Concentration in Differentiated PC12 Cells

Rita Duke, BSN, RN; Megan Weber, BSN, RN

Webster University

Introduction: Representing one of the fastest growing populations, the elderly carry an increased risk of postoperative cognitive dysfunction (POCD). Anesthesia administration has been associated with pathologic changes that augment or accelerate Alzheimer's disease (AD) and neurologic dysfunction. Impaired cognition after surgery may be an unmasking of AD symptomatology secondary to the perioperative process.

Literature Review: It is currently understood that neurologic dysfunction in AD is secondary to beta amyloid accumulation and hyperphosphorylation of tau. Sevoflurane has been associated with decreased expression of neprilysin (NEP), a primary enzyme in beta amyloid clearance. The effect of sevoflurane on cellular NEP concentration remains to be determined.

Research Design: Pre-experimentation included cell culture and differentiation. Treatment group was exposed to sevoflurane, with control group remaining unexposed. Pellet preparation for enzyme studies was performed 24 hours postexposure. Enzyme studies were performed on both treatment and control groups.

Methods: PC12 cells were grown in culture and differentiated through NGF exposure for 4 days, with at least 70% differentiation at the time of sevoflurane administration. Treatment group received 2% sevoflurane for 1 hour with the control group remaining unexposed; both received 21% FiO₂. Lowry protein assay, ELISA, and SDS polyacrylamide gel electrophoresis (PAGE) were conducted.

Data Collection: In Lowry assay, protein was measured via spectrophotometry at wavelength of 720 nm. Standard curve of albumin was used to interpolate sample protein concentrations. NEP was quantified in ELISA using standard curve specific to NEP. Electrophoretic mobility of proteins was examined in SDS PAGE.

Results & Data Analysis: When standardized for differences in overall protein concentration, sevoflurane-exposed cells had significantly less NEP than control group (control = 1.031 ng of NEP/mcg of protein/mL, treatment = 0.4093 ng of NEP/mcg of protein/mL, $p=0.0148$). Protein matching NEP electrophoretic mobility was identified in SDS PAGE.

Discussions & Conclusions: Exposure of differentiated PC12 cells to 2% sevoflurane for 1 hour significantly reduced NEP content. NEP is a crucial enzyme in clearance of beta amyloid, and inhibition of enzymatic activity is associated with cognitive dysfunction and worsening of AD symptoms. Administration of sevoflurane anesthesia could contribute to development or worsening of cognitive dysfunction in AD.

Source of Funding: Webster University allotted \$3,000 for the funding of this project.

A10

Effectiveness of Clinical Decision Support Systems for Glycemic Control in the Perioperative Patient

Haley Gaulke, BSN, RN; Timothy Curry, MD, PhD; Amy Gnagey, CRNA, APRN; Darrell Schroeder, MS
Mayo Clinic School of Health Sciences

Introduction: Glycemic control is an imperative component of reducing the risk of poor outcomes in surgical patients. Insulin is the preferred method for perioperative glycemic control, yet insulin use is a major risk factor for hypoglycemia. Clinical decision support systems (CDSS) ensure providers are aware of insulin administration and improve anesthesia provider performance of blood glucose monitoring.

Literature Review: The use of CDSS provides effective tools to alert providers of blood glucose irregularities. Literature has shown insulin administration, meeting target blood glucose levels, decreasing hypoglycemia, and compliance with institutional policy all increase with the implementation of CDSS. No data are available on the effects of CDSS on frequency of glucose monitoring.

Research Design: This was a quantitative retrospective study using historical cohort controls from our electronic perioperative database. We hypothesized that the implementation of a CDSS specific to glucose monitoring would improve compliance with recommended frequency of glucose monitoring.

Methods: Surgical cases where preintraoperative subcutaneous insulin was administered were included. Two periods were studied: pre-CDSS (N=4267) and post-CDSS implementation (N=7433). Using segmented regression, the last preoperative and all intraoperative glucose measurements were evaluated and considered noncompliant with glucose monitoring if the time between any 2 measurements exceeded 150 minutes.

Data Collection: Data was collected from perioperative database and the electronic health record containing detailed information regarding most aspects of a patient's surgical encounter including time of insulin administration, glucose laboratory values, and CDSS alerts.

Results & Data Analysis: The median time between glucose checks decreased from 137 minutes pre-CDSS to 106 minutes post-CDSS ($p < 0.001$). There was no trend in the percentage of cases that were noncompliant with glucose monitoring guidelines pre-CDSS (slope $p = 0.555$). Following implementation, the percentage of noncompliant cases dropped significantly ($p < 0.001$) and remained consistent (slope $p = 0.542$). The overall percentage of surgical cases that were noncompliant with recommended glucose monitoring guidelines decreased from 71% pre-CDSS to 29% post-CDSS.

Discussions & Conclusions: The implementation of CDSS for glycemic control in the perioperative patient significantly improved anesthesia provider performance on blood glucose management. The use of CDSS promotes patient safety and coordinates care. It enables anesthesia providers to enhance their awareness, employ best practice guidelines, and provide cost-effective care for patients and healthcare institutions.

Source of Funding: No funding was required for this project. Support was provided by The Department of Anesthesiology, Anesthesia Clinical Research Unit, and the Center for Clinical and Translational Services (CCaTS).

A11

Effectiveness of Four-Factor Prothrombin Complex Concentrates Versus Plasma on Vitamin K Antagonist Associated Plasma International Normalized Ratio Reversal: A Systematic Review

Andrew McPhail, BSN, RN; Dominick Jokel, BSN, RN

Texas Christian University

Introduction: The standard of vitamin k antagonist reversal is fresh frozen plasma (FFP). FFP administration can result in circulatory overload, thromboembolic events, inadequate international normalized ratio (INR) correction, and delayed administration. Kcentra, a four-factor prothrombin complex concentrate, was approved for use in 2013 and contains the same clotting factors as FFP (II, VII, IX, X, and proteins c and s). We conducted a systematic review comparing the efficacy of these interventions.

Literature Review: As of December 2017, our literature search yielded 2 randomized controlled trials based on abstract/title and inclusion/exclusion criteria directly comparing the efficacy of FFP to Kcentra for rapid INR reversal in patients anticoagulated with vitamin K antagonist (VKA) therapy.

Research Design: Both articles meet criteria for level 1.c evidence.

Methods: The primary endpoint of our systematic review was INR reversal to less than 1.5 within 30 minutes of product administration. Co-primary endpoints were hemostasis, serious adverse events, thromboembolic events, fluid overload, and death within 45 days. All data were assessed in both articles and assessed similarly.

Data Collection: A total of 374 participants were included between both randomized controlled trials.

Results & Data Analysis: The result of our systematic review reveals Kcentra is 500 times more likely to adequately reach an INR level of 1.5 within 30 minutes of administration than FFP and 110 times more likely to result in adequate hemostasis. Serious adverse events and thromboembolic events were similar between the 2 interventions; however, Kcentra is associated with less incidence of fluid overload and death within 45 days.

Discussions & Conclusions: Based on our review, anesthesia should consider the use of Kcentra as the primary product of choice for rapid INR reduction in patients on warfarin therapy requiring immediate invasive procedure. Rapid INR reduction with of Kcentra will result in less time to surgery and better outcomes. Further research must be done to determine Kcentra's benefit to specific surgical fields, such as cardiothoracic, orthopedic, and neurologic procedures.

A12

Effects of Single Preincision IV Injection of Ketamine on Postoperative Pain in Patients Undergoing Total Knee Replacements

Megan Brennan, BSN; Megan Chambers, BSN; Jill Stulce, PhD, CRNA; Martina Steed, PhD, CRNA
Webster University

Introduction: Currently, opioids are at the forefront of pain management. However, there are many side effects associated with these drugs. There is also evidence of opioid induced hyperalgesia (OIH), or a paradoxical response to opioid agonists, resulting in increased pain. In this study, ketamine was evaluated as an anesthetic adjunct with the aim to reduce postoperative pain and opioid consumption, while also inhibiting this hypersensitization.

Literature Review: Ketamine is an NMDA receptor antagonist with analgesic properties. The NMDA receptor exerts much of its pain processing effects in the dorsal horn of the spinal cord and is also found in the periaqueductal gray. Up-regulation of the NMDA receptor is also closely linked to central sensitization and the development of OIH. By blocking the NMDA receptor, ketamine reduces centrally mediated pain processes and may enhance postoperative analgesia.

Research Design: This study was conducted as a retrospective chart review. Patients who did receive ketamine (0.5 mg/kg) intraoperatively were compared with patients who did not receive ketamine intraoperatively. Morphine consumption over the first 24 hours postoperatively as well as pain scores measured at 12 and 24 hours were compared.

Methods: A total of 222 patients undergoing total knee arthroplasty were included. All received spinal anesthesia and standardized preoperative and postoperative analgesic regimens. In 1 group, a single bolus of 0.5 mg/kg of ketamine was administered intravenously prior to incision. In the control group, no ketamine was administered. Morphine patient-controlled analgesia (PCA) consumption was recorded over the first 24 hours postoperatively. Pain scores were collected at 12 and 24 hours postoperatively.

Data Collection: Through a password-protected electronic charting system, records were reviewed between June 2017 and November 2017. The number of patients in each group totaled 111, which allowed for a large effect size (80%) with an alpha of 0.05 equal to a 95% confidence interval.

Results & Data Analysis: Upon statistical analysis using a paired samples t test, morphine PCA consumption did not differ significantly between groups in the first 24 hours postoperatively ($p=0.3456$). However, after analysis with a Mann-Whitney U test, pain scores were significantly lower in the ketamine group at both 12-hour ($p=0.0477$) and more so at 24-hour ($p<0.001$) collection points.

Discussions & Conclusions: While patients did not consume less opioid postoperatively, patients did report lower pain scores at both 12-hour and 24-hour intervals. The results of this study support a theoretically synergistic effect between ketamine and opioid analgesics. This may occur with the blockade of the NMDA receptor and a resulting inhibition of central sensitization associated with opioid administration and an up-regulation of NMDA receptors.

A13

Efficacy of the Sphenopalatine Ganglion Block for Postdural Puncture Headache

2 Lt Whitney Dorame, BSN, RN; Bobby Schnittker, BSN, RN

Texas Christian University

Introduction: Postdural puncture headache (PDPH) is a painful side effect of purposeful or accidental puncture of the dural membrane and subsequent cerebrospinal fluid leak. Current treatment for PDPH is an epidural blood patch. The sphenopalatine ganglion block (SPGB) offers a less invasive, low-risk alternative treatment for this headache pain.

Literature Review: This review will consider observation studies, individual case reports, cross-sectional studies, experimental study designs including randomized controlled trials, nonrandomized controlled trials, before and after studies, and interrupted time-series studies. In addition, analytical observational studies including prospective and retrospective cohort studies, case-control studies and analytical cross-sectional studies.

Research Design: Systematic review of current literature related to the problem of PDPH treatment compared epidural blood patch and sphenopalatine ganglion block.

Methods: Patients greater than 14 years of age who experience postdural puncture headache were included.

Data Collection: This review will consider analytical observation studies, individual case reports, cross-sectional studies, randomized controlled trials, nonrandomized controlled trials, as well as prospective and retrospective cohort studies.

Results & Data Analysis: Where applicable, research will be pooled in a statistical meta-analysis.

Discussions & Conclusions: SPGB is a noninvasive, low risk, and simple technique that should be considered in the symptomatic relief of PDPH. Based on this review, SPGB was successful in 63.6% of patients with PDPH, avoiding a more invasive alternative. It is recommended to consider SPGB as first-line therapy for PDPH. Current limited evidence demonstrates SPGB provides pain relief for a majority of patients with PDPH. Further research with comparative randomized controlled trials is recommended.

A14

Factors Influencing Engagement in Professional Nurse Anesthesia Organizations: A Pilot Study

Larry Chong, BSN; William Cobb III, BSN; Edward Coomer, BSN; Devin Miller, BSN; Kevin Tirado, BSN; Clifford Gonzales, PhD, CRNA; Kimberly Gordon, MSN, CRNA

Wake Forest School of Medicine, Nurse Anesthesia Program

Introduction: Active engagement between members and their organization helps drive professional welfare and promotion. Membership in a professional nursing organization has been associated with a higher quality of nursing care.

Literature Review: Between 2006 and 2015, membership in the AANA has experienced a decrease of 5% (approximately 2,500 CRNAs out of 50,000). Approximately 50% of nonmembers are new graduate CRNAs, defined as nurse anesthetists with 0 to 10 years of experience.

Research Design: A prospective, descriptive pilot study was conducted among 214 CRNAs in North Carolina with 0 to 10 years' experience. A survey was created to assess the influence of various factors on membership in professional nurse anesthesia organizations.

Methods: A 6-item Likert scale was used to answer 20 questions that were categorized into personal, workplace, and academic factors. Six additional questions explored the impact of cost on membership and engagement; 2 open-ended questions regarding reasons for membership concluded the survey.

Data Collection: A survey was created and delivered through Redcap. The inclusion criteria were comprised of CRNAs with active licenses who had graduated from their anesthesia program from 2008 to 2018, while exclusion criteria were comprised of those CRNAs who had completed their training prior to 2008.

Results & Data Analysis: Employers contributed more often to AANA membership dues for the CRNA 6-10-year group compared with the CRNA 0-5-year group ($p = 0.047$). CRNAs in both groups would attend more education conferences with cost reduction, an event observed at both the state and national levels. Employers of the CRNA 0-5-year group both valued professional activities ($p = 0.025$) and provided free CE credits ($p = 0.011$) more than employers of the CRNA 6-10-year group. Eighty-four percent of respondents would maintain membership even if the employer did not contribute to membership dues.

Discussions & Conclusions: Cost may be a barrier to engagement but not membership. AANA members value continuing education services. Because more employers provide CEs to CRNAs 0 to 5 years after graduation, this group might be less likely to seek CEs from the AANA.

A15

Hemodilution to Estimate Blood Volume: A Pilot Project

Kenneth A. Wofford, PhD, CRNA, DiMM; Matthew D'Angelo, DNP, CRNA; Charles Vacchiano, PhD, CRNA, FAAN

Uniformed Services University of the Health Sciences

Introduction: Perioperative fluid therapy is used to optimize cardiovascular function and promote tissue perfusion. Optimally, a patient is “euvoletic” and possesses a total blood volume (TBV) that supports euvoletmia. Existing methods to assess TBV and estimate patient intravenous (IV) fluid requirements in the perioperative setting are either inaccurate or require specialized equipment and training.

Literature Review: Fluid therapy is guided by physiological signs assessed via noninvasive monitors and less commonly via invasive monitors of vascular pressure. Techniques such as transesophageal echocardiography, Doppler ultrasound, or radiodilution provide more reliable estimation of TBV status, but cost, complexity, expense, time, and/or potential patient risk limit the use of these techniques on a routine basis.

Research Design: A prospective validation design was used. Blood volume was quantified utilizing 2 methods in a fixed order: radiodilution, then hemodilution as described in D'Angelo M, Hodgen RK, Wofford K, Vacchiano C. (A theoretical mathematical model to estimate blood volume in clinical practice *Biol Res Nurs.* 2005;17(5):478-486.)

Methods: After IRB approval and informed consent, 33 healthy male subjects aged 18 to 35 years with normal body mass indexes were enrolled. Blood volume was estimated first via radiodilution with the Daxor Blood Volume Analyzer 100 (Daxor, Inc, New York, New York). Next, a baseline hematocrit (HCT) was assessed, and each subject was given a 500 cc bolus of normal saline to produce mild hemodilution. Six minutes after completion of the bolus, a second hematocrit was assessed.

Data Collection: Total blood volume estimates were derived using radiodilution via the Daxor BVA-100, and from prebolus and postbolus HCT using methods described in D'Angelo et al (2014). Hematocrit was assessed via 3 methods: microimpedance via an i-STAT device, the Duke University Medical Center Lab, and total hemoglobin via near-infrared spectroscopy (SpHb, Masimo Corporation, Irvine, California).

Results & Data Analysis: Mean blood volume estimates were 5568.6 ± 902.2 mL via radiodilution, 8521.2 ± 3526.5 mL via i-STAT, 16411.0 ± 13774.5 via Duke lab, and 15882.0 ± 22371.0 via the Masimo SpHb device. Agreement in estimated blood volume between methods was low (Lin's concordance coefficient, 0.02-0.05). Estimated vascular 'leak' (ie, the amount of normal saline that would need to leave the vascular space to account for the observed differences between blood volume as estimated by radiodilution and blood volume as estimated by hemodilution) ranged from 181.9 mL to 299.7 mL, depending on the method used to quantify hematocrit.

Discussions & Conclusions: Hemodilution with normal saline was not useful in quantifying blood volume in healthy, normovolemic males. The most likely explanation was rapid movement of the saline out of the vascular compartment. Future attempts to utilize this method would need to perform hemodilution with a fluid that is more resistant to extravascular movement (eg, 6% hetastarch or 5% albumin) or identify alternative methods that enable precise estimation of the rate of extravascular movement.

Source of Funding: The project was funded by the TriService Nursing Research Program (Exploratory Research Grant N16-P10).

A16

Implementation of Evidence-Based Perioperative Guidelines During the Management of Patients With Obstructive Sleep Apnea

Deborah Davison, DNAP, MS; Jeffrey Jozwiak, DRPH, MSN; Thomas Cline, PhD, MBA; Karen Pealer, BA Allegheny General Hospital

Introduction: Surgical patients with obstructive sleep apnea (OSA) are at risk for developing perioperative complications. Despite availability of published OSA perioperative guidelines targeted at improving patient outcomes, there is a paucity of evidence in the literature to support their effectiveness. The purpose of this study was to measure the effectiveness of implementing evidence-based OSA guidelines.

Literature Review: Twenty-five percent of surgical patients have OSA, but 90% are undiagnosed. OSA patients have comorbidities that increase their perioperative risk, yet approximately 50% of anesthesiologists do not follow OSA guidelines. Patient deaths have resulted from mismanagement. With better patient ID, use of regionals, opioid-sparing drugs, and early CPAP, patient outcomes can improve.

Research Design: This study was a quantitative, quasi-experimental design with nonrandom matching of subjects. Nonequivalent comparison group design was utilized with the control group managed according to standard guidelines and the research group managed according to evidence-based OSA guidelines.

Methods: Convenience sampling of patients, 40 to 65 years of age, having total knee replacements who scored >3 on the STOP-BANG questionnaire or were diagnosed with OSA, was employed. Patients were randomized into 2 groups: a control group (n=53) and a research group (n=53). Measured outcomes included total doses of intraoperative fentanyl, number of postoperative respiratory events, and time to discharge.

Data Collection: Retrospective data collection was done with prior IRB approval with waiver of consent. Control group data were collected from 2014 paper charts; research group data were collected from 2016 to 2017 electronic records with data entered on a data collection tool and plotted on an Excel spreadsheet.

Results & Data Analysis: Statistical analysis was completed using SPSS version 22. An independent t test compared group fentanyl doses: the research group received less fentanyl (M=116.79 mcg) than the control group (M=227.45 mcg), (p<0.001). A chi-Square test compared group respiratory events: 1.9% of the research group experienced a respiratory event compared with 15.1% of the control group (p=0.015). An independent t test compared group discharge times: time to discharge was shorter in the research group (M=1,392.43 min) than in the control group (M=2,718.79 min), (p<0.001).

Discussion & Conclusions: Results of this study clearly demonstrate the benefits of implementing evidence-based OSA guidelines when managing OSA patients. Intraoperative opioid usage, discharge times, and postoperative respiratory events were significantly less in the research group compared with the control group. These results should encourage all anesthesia providers to follow these guidelines to improve patient outcomes.

A17

Incidence and Risk Factors of Gastric-to-Pulmonary Aspiration in Patients Undergoing Elective Upper Gastrointestinal Endoscopy

Kelsey A. Nelsen, BSN, RN, PHN; Amy Gnagey, DNAP, CRNA, APRN; J. Kyle Bohman, MD; Nathan Smischney, MD; Oludare Olatoye, MD; Rochelle Molitor, MD; Nicholas R. Oblizajek, MD; Adam K. Jacob, MD

Mayo Clinic

Introduction: Gastric-to-pulmonary aspiration is a recognized risk during upper gastrointestinal (GI) endoscopy. It is significant in this population due to manipulation of the oropharynx and underlying gastrointestinal pathologies, but a thorough assessment of this risk is lacking. This study aimed to determine the incidence and risk factors associated with aspiration during elective upper GI endoscopy.

Literature Review: Prospective data have shown an incidence of “high risk” residual gastric material during elective upper GI endoscopy (12.2%). Other prospective data of endoscopic retrograde cholangiography have shown an incidence of cardiopulmonary complications (but not specifically aspiration) of 10.3% (34% of these were fatal).

Research Design: This retrospective, observational study was performed utilizing a robust electronic medical record system at a single, high-volume, tertiary gastroenterology and endoscopy practice. A case-control analysis was performed comparing patients who aspirated and matched controls who did not aspirate.

Methods: Aspiration definition is the presence of gastric contents, bilious secretions or particulate matter in the tracheobronchial tree. All cases were NPO according to the ASA guidelines. Inclusion criteria were age ≥ 18 years having elective upper endoscopy between January 1, 2000, and June 1, 2016. Exclusion criteria were age < 18 years, intubated before arrival to the procedural suite, or preexisting tracheostomy.

Data Collection: Electronic medical records (EMRs) of all patients were searched electronically with an “aspiration sniffer”. Potential aspiration cases were reviewed manually by study personnel. Criteria for aspiration were based on the 1993 study by Warner et al. Disagreements were reviewed manually by a third senior manual reviewer.

Results & Data Analysis: The overall incidence of gastric-to-pulmonary aspiration during elective upper GI endoscopy was 4.6/10,000 cases (0.05%), which is 2 times greater than the risk of aspiration during non-GI surgical procedures under general endotracheal anesthesia (GETA) during the same time period at the same institution (2.4/10,000 cases; 0.02%). In the case-control analysis, gastric outlet obstruction, biliary tree pathology, outpatient antacid use, pancreatitis, and procedure duration were identified as risk factors for aspiration.

Discussions & Conclusions: As the number of elective upper GI endoscopy procedures rise, the potential impact of gastric-to-pulmonary aspiration is becoming more significant. The risk of gastric-to-pulmonary aspiration during upper GI endoscopy remains high. Our analysis revealed several important risk factors for aspiration; procedural duration is also associated with aspiration risk in sedation but not GETA cases.

Source of Funding: This study was funded in part by an investigator-initiated small grant from the Mayo Clinic Critical Care Research Committee.

A18

Investigation of Intraosseous, Endotracheal, and Intravenous Administration of Epinephrine in a Hypovolemic, Cardiac Arrest Swine Model

CPT Brent Duffield, BSN, CCRN; CPT Wayne Blalock, MS; Katelyn Dempster, BSN; CPT Matthew Moore, BSN; CPT Japheth Rauch, BSN; Don Johnson, PhD, RN

US Army Graduate Program in Anesthesia Nursing

Introduction: Cardiac arrest from hemorrhage is the number 1 cause of death from trauma. The chance of survival is decreased 5.5% each minute of delay in administering resuscitation drugs. Therefore, vascular access is essential in achieving return of spontaneous circulation. The veins collapse particularly in a hypovolemic state making vascular access difficult or impossible even for the most skilled provider.

Literature Review: Few studies have compared the intraosseous and endotracheal epinephrine administration on maximum concentration (Cmax), time to maximum concentration (Tmax), and mean concentration. Most of studies did not examine the effects on return of spontaneous circulation (ROSC), and none has used a hypovolemic model.

Research Design: This was a within and between subjects experimental design comparing the effects of different routes of administration of epinephrine on maximum concentration, time to maximum concentration, mean concentration, and return of spontaneous circulation.

Methods: Adult Yorkshire swine (N = 7) were randomly assigned to: humerus intraosseous (HIO), tibial intraosseous (TIO), sternal intraosseous (SIO), endotracheal (ET), cardiopulmonary resuscitation (CPR) + defibrillation, and CPR only groups. They were exsanguinated at 31% of their blood volume, placed into arrest for 2 minutes, then CPR was initiated for 2 minutes, then 1 mg epinephrine was administered.

Data Collection: After epinephrine administration, blood samples were collected every at .5, 1, 1.5, 2, 2.5, 3, 4, and 5 minutes. The samples were analyzed for Cmax and concentration using high performance liquid chromatography. A stopwatch was used to determine the time to ROSC.

Results & Data Analysis: A multivariate analysis of variance (MANOVA) indicated no significant differences in the groups relative to Cmax, Tmax, or time to ROSC among the experimental groups ($p > .05$). A Fisher exact test showed no significant difference in ROSC between HIO, SIO, TIO, and IV groups ($p > 0.05$). There were significant differences between each of the experimental groups and CPR only ($p < 0.05$). CPR + defibrillation and ET groups each had to achieve ROSC, therefore, were not included in the analysis.

Discussions & Conclusions: Rapid administration epinephrine is essential for survival for patients in cardiac arrest. For every 1-minute delay, the chances of ROSC are decreased by 5.5%. It may take several minutes to acquire IV access but takes only about 5 seconds to insert an intraosseous device. Based on the results of this study, the intraosseous should be initiated first saving valuable minutes.

Source of Funding: The funding for this study was provided by the TriService Nursing Research Program.

A19

Investigation of the Anxiolytic and Antidepressant Effects of Crocin, A Compound From Saffron (*Crocus sativus* L.) in the Male Sprague-Dawley Rat

Tomás Eduardo Ceremuga, PhD, MSN, BSN, BA, AD, CRNA, COL(ret); CPT Leah R. Stanley, BSN, RN, CCRN; Melissa P. Ayala, BSN, RN, CCRN; CPT Ryan W. Chicoine, BSN, RN, CCRN; CPT Sung M. Chun, BSN, RN, CCRN; CPT James M. DeGroot, BSN, RN, CCRN; Devin T. Henson, BSN, RN, CCRN; CPT Seth A. Randall, BSN, RN, CCRN; COL Denise M. Beaumont, DNAP, MSN, CRNA

US Army Graduate Program in Anesthesia Nursing

Introduction: Patients with anxiety and depression often seek complementary and alternative medicine, including herbal supplements like crocin, a compound in saffron. Data is limited concerning crocin's pharmacological effects or its potential interactions with other medications. The purposes of this study were to determine the anxiolytic and/or antidepressant effects of crocin and possible activity on the benzodiazepine site on the γ -aminobutyric acid GABAA receptor.

Literature Review: More investigations are critical to inform healthcare regarding pharmacodynamics, side effects, and potential for interactions of herbal supplements to ensure patient safety. Saffron is a popular herb that has been used for centuries as a spice and for its medicinal properties. Crocin, a compound in saffron, has been shown to exert anxiolytic and antidepressant effects, but they are not well understood.

Research Design: Utilizing an experimental prospective between subjects group design, 55 rats were randomly assigned to one of 5 groups (n = 11 per group).

Methods: Fifty-five male Sprague Dawley rats were randomized to 1 of 5 groups: vehicle dimethyl sulfoxide (DMSO), crocin, midazolam, flumazenil + crocin, and midazolam + crocin. Behavioral analyses were conducted 30 minutes after intraperitoneal injection using the elevated plus maze (EPM), followed by the forced swim test (FST). EPM movements were recorded with a video recorder, and data were digitalized using AnyMaze software. FST tests were video recorded.

Data Collection: Based on group assignment, all rats were injected with study medications 30 minutes prior to the behavioral test on the EPM. Mean speed (centimeters/second), mean time mobile (seconds), and open arm time ratio were the main datapoints investigated. After the 5 minute FST, 2 investigators, blinded to treatment groups, measured time mobile and FPO.

Results & Data Analysis: Data were analyzed using a 2-tailed multivariate analysis of variance (MANOVA) and a least significant difference (LSD) post hoc test. In the EPM when comparing mean speed, the crocin group was significantly increased compared with the midazolam + crocin group, and the midazolam group was significantly decreased compared with the crocin, flumazenil + crocin, and vehicle groups. When comparing open arm time ratio, the midazolam group was significantly increased compared with all other groups. In the FST when comparing mean time mobile, the midazolam + crocin group was significantly increased compared with the crocin, vehicle, and midazolam groups.

Discussions & Conclusions: These findings, compared with other studies, showed differences in the anxiolytic and antidepressant effects of crocin. EPM data suggest that crocin may attenuate the anxiolytic effects of midazolam, while sparing psychomotor activity. Moreover, crocin showed a possible drug-drug interaction with midazolam, leading to a significant decrease in behavioral despair during the FST. Further studies should investigate crocin's effects at various receptor sites.

Source of Funding: This study was funded by the American Association of Nurse Anesthetists (AANA) Foundation.

A20

Iron Activation of Cellular Oxidases: Modulation of Neuronal Viability (In Vitro)

LTC Young Yauger, PhD, CRNA; Sara Bermudez, MS; Kimberly R. Byrnes, PhD

United States Army Graduate Program of Anesthesia Nursing

Introduction: Traumatic brain injury (TBI) is a significant health issue with 361,092 service members diagnosed. Increased iron, oxidative stress, and microglia are present within TBI lesions acutely after injury. Administration of massive amounts of blood products by CRNAs among polytrauma casualties occurs frequently and is considered a significant source of nonprotein bound iron.

Literature Review: Microglia are major modulators of the inflammatory response and produce neurotoxic reactive oxygen species (ROS) via NADPH oxidases (NOX). We suspected that iron is a major contributor to neurodegeneration by contributing to oxidative stress through microglia.

Research Design: We hypothesized that iron utilized NOX-derived ROS to accentuate ROS synthesis in activated microglia and reduced neuronal survivability in vitro. Experimental design that utilized immortalized BV2 microglia, 8 pregnant Sprague-Dawley rats for primary fetal mixed neuronal cultures, and PC12s.

Methods: BV2 microglia were exposed to ferrous sulfate, lipopolysaccharide, GSK2795039 or GKT137831 and then subsequently cocultured with primary neonatal rat neurons or immortalized neuron-like PC12s. Coculture conditions were maintained for 24 hours, and cells were harvested for ROS detection, protein quantification, gene expression, and morphologic alterations by immunocytochemistry.

Data Collection: All data were entered into Graphpad Prism for analysis.

Results & Data Analysis: Iron dose dependently amplified ROS production among lipopolysaccharide activated microglia. This increased ROS did not modulate gene or protein expression of microglial polarization markers or cytokine/chemokine production. It exacerbated neurotoxicity among primary neurons and differentiated PC12s, which was reversed with deferoxamine. NOX2 or NOX4 inhibition significantly reversed iron's accentuation of ROS production and subsequently ameliorated neurotoxicity. All comparisons were analyzed by 1-way ANOVA with Tukey post hoc test unless stated otherwise.

Discussions & Conclusions: This data substantiates iron's contributions to oxidative stress within TBI and provides mechanistic insight into NOX2 and NOX4 contributions to this pathology. This research illustrates the importance of iron mitigation or NOX inhibition as possible future treatment modalities for TBI.

Source of Funding: Graduate investigator award, Tri-Service Nursing Research Program. Intramural Grant, Uniformed Services University of the Health Sciences.

A21

Multidisciplinary Airway Crisis Simulation

Sara Pant, BSN, RN; Nicolas Timmerman, BSN, RN; Mary Bakis, DNP, CRNA; Matthew Yockey, MSN, CRNA; Denise Gormley, PhD, RN

University of Cincinnati

Introduction: Airway emergencies are low-frequency high-risk events that are not reliably predictable. These emergencies require prompt, effective interventions by multiple specialties to optimize outcomes and minimize complications. To date, the University of Cincinnati Medical Center does not conduct multidisciplinary airway crisis simulation training.

Literature Review: Multidisciplinary simulations have shown improvement in communication, performance, and teamwork. The American Society of Anesthesiologists Difficult Airway Algorithm (DAA) and Agency on Healthcare Research and Quality Team Strategies and Tools to Enhance Performance and Patient Safety (STEPPS) improve emergency airway management and performance.

Research Design: The study was quasi-experimental in design. Scenarios of emergency airways were assigned to nurse anesthesia students and oral maxillofacial surgery (OMFS) residents. Educational materials were provided to participants before or after the simulations to determine teamwork performance differences.

Methods: Exempt status was obtained via IRB review. Volunteers from the nurse anesthesia program and OMFS residency were placed into 4 groups, with 2 participants per program in each group. Scenarios were conducted in a simulation lab in an operating room after hours. Each participant was team leader once. Team performance was assessed based on airway securement time, teamwork, and DAA fidelity.

Data Collection: Simulations were filmed to determine time from induction to airway securement and DAA fidelity. Two groups received material on DAA and TeamSTEPPS presimulation; the other 2 did not. Teamwork skills were analyzed using a TeamSTEPPS observation tool and comparison made between the study groups.

Results & Data Analysis: Postsimulation surveyors reported 90% were familiar/very familiar with the DAA and agreed/strongly agreed the simulation provided opportunities to learn different ways to participate in airway emergencies. Simulations were reported as realistic and pertinent to practice. Surveyors reported high satisfaction and requested expanding participation with other medical fields. Paired t tests revealed performance scores, and securement times were not significantly improved in the educated groups as compared with those who did not receive materials.

Discussions & Conclusions: Scores and securement times were not significantly improved in educated groups, possibly due to variability in prior participant experiences and small sample size (n=16). Qualitative feedback was positive from participants, who reported training as highly valuable. Continuation, refinement, and expansion of this research would be beneficial to the field of anesthesia, as well as other fields.

A22

Prevalence Among Opioid Tolerant Patients Undergoing Gastrointestinal Procedures at a Large Tertiary Academic Medical Center

Mikayla Mohs, BSN, RN; Jenna Lovely, PharmD, RPh; LaChelle Wieme, DNAP, CRNA, APRN; Mary Marienau, PhD, MS, CRNA; Darrell Schroeder, MS; Paul Carns, MD

Mayo Clinic

Introduction: Opioid use has grown tremendously in the United States in the last decade. While the use of opioids has increased, there remains a lack of scientifically rigorous studies regarding opioid tolerant patients. The primary aim of this study was to determine the prevalence of opioid tolerance among patients undergoing gastrointestinal (GI) surgical procedures.

Literature Review: Opioid tolerance is a complex process leading to difficult perioperative management. While the prevalence of opioid tolerance varies widely, many studies have only evaluated the presence of chronic pain. Consequently, the prevalence and outcomes among patients are not accurately known validating the importance of the presented clinical question.

Research Design: A retrospective chart review study was performed on patients who underwent GI procedures under the direction of anesthesia services utilizing sedation at a large tertiary academic medical center.

Methods: Included were patients ≥ 18 years of age that underwent GI procedures utilizing anesthesia services between January 1, 2014, and December 31 2015. Patients < 18 year of age, prisoners, pregnant women, refusal of medical record for research purposes, and those with incomplete records were excluded. Opioid tolerance was defined as consuming ≥ 60 mg morphine equivalent daily for at least 1 week.

Data Collection: Set datapoints were extracted from a datamart. Patients with morphine milligram equivalents (MME) ≥ 60 were manually reviewed and classified: opioid naïve, opioids less than threshold, opioid tolerant took medications day of procedure, and opioid tolerant did not take medications day of procedure.

Results & Data Analysis: A total of 15,461 patients met inclusion criteria for the study. A total of 4,098 patients were indicated to be taking opioids within 90 days of their procedure. Of those, 2,669 (65%) had complete documentation to determine their daily MME, and 697 of these (26.1%) were found to be opioid tolerant. Assuming an equal frequency of opioid tolerance in those taking opioids with inadequate documentation, the overall prevalence of opioid tolerance was 6.9% (95% CI, 6.5% to 7.3%).

Discussions & Conclusions: The results of this study provide baseline knowledge regarding the prevalence of opioid tolerance. Additionally, the findings aid in identifying recommendations and projections for effective pain management strategies among opioid tolerant patients. The goal is dissemination of these results will enhance the literature and guide further research concerning the opioid tolerant population.

Source of Funding: No funding was utilized for this project. Support was provided by Mayo Clinic's Library Services, Anesthesia Clinic Research Unit DataMart, and Center for Clinical and Translational Services (CcATS).

A23

Respiratory Depression and Oversedation Following Ambulatory Urogynecological Procedures: A Retrospective Analysis

Sinokuthaba Sibanda, BSN, RN, CCRN; Toby Weingarten, MD

Mayo Clinic

Introduction: Postprocedural respiratory depression has not been well characterized in patients undergoing urogynecological procedures in ambulatory surgical centers (ASC). There are concerns about the safety of performing these procedures in ASCs among patients with obstructive sleep apnea (OSA) or morbid obesity. We assess the rate of this complication.

Literature Review: Research has found postoperative respiratory depression is an important contributor for delayed anesthesia recovery with adverse impact on postanesthesia recovery units. Procedures performed in ambulatory surgery centers are less invasive and shorter than those performed in hospital surgical practices, allowing for rapid recovery from anesthesia.

Research Design: This is a retrospective study of adult patients who underwent urogynecological procedures under anesthesia from July 1, 2010, to December 31, 2015, at our ASC. Medical records were electronically abstracted using proprietary software.

Methods: During the study timeframe, 9,141 patients underwent procedures, of which 1,174 had OSA and 520 were morbidly obese. The PACU records were examined for episodes of respiratory depression. Respiratory depression was defined by the occurrence of nursing diagnosed respiratory depression, unplanned reintubation or application of noninvasive positive pressure devices.

Data Collection: Presurgical variables included patient age, sex, weight, history of OSA, history of cardiopulmonary disease, diabetes, cancer, and home use of opioids and benzodiazepines. Medical records were reviewed for type and duration of surgery, type of airway, use of volatile anesthetic, and dose of opioids.

Results & Data Analysis: Data are presented as mean \pm standard deviation for continuous variables, number for categorical variables, and multivariate analysis for associations between respiratory depression and patient characteristics. A total of 9,141 patients underwent procedures, 1,174 had OSA, and 520 were morbidly obese. Respiratory depression complicated 322 procedures. There was increased risk in patients with OSA, male patients, and older patients, but not morbid obesity. Patients who had respiratory depression had higher rates of hospitalization within 48 hours.

Discussions & Conclusions: Obstructive sleep apnea, but not morbid obesity, increased the risk for postprocedural respiratory depression; however, the clinical impact of this complication appears to be low. Generally, procedures performed in ASCs are less invasive than those performed in hospital settings. Patients require fewer opioids and sedating medications that are associated with postoperative respiratory depression.

A24

Running on EMPTY? Accuracy in Evaluating Gastric Ultrasound Images Before and After Brief Training

Jonathan Kline, MSNA, CRNA; Brian Selai, MSN, CRNA; Michele Ardigo, DNP, CRNA; Marilyn Pugh, PhD
Texas Wesleyan University Graduate Programs of Nurse Anesthesia

Introduction: An ideal technique for determining gastric contents should be noninvasive, rapid, and reproducible by even entry-level anesthesia providers. Ultrasound evaluation (UE) of gastric contents may represent an excellent diagnostic tool. These researchers wanted to determine if, after exposure to a brief presentation of UE of gastric contents, student nurse anesthetists were able to recognize different volumes of gastric contents accurately.

Literature Review: The ultrasound evaluation (UE) of gastric contents for preoperative aspiration risk assessment is not a novel concept. Carp et al concluded ultrasound imaging was an effective means of determining gastric contents in the parturient. Perlas et al has published multiple works using fasted surgical patients. Additional studies have found the use of gastric UE beneficial in determining gastric content.

Research Design: The study was a quasi-experimental design using a convenience sample. Pretests and posttests were administered in an interrupted time series with repeated applications.

Methods: The 2017 nurse anesthesia master's cohort attending Texas Wesleyan University were invited to participate in a diagnostic gastric ultrasound assessment (pretest and posttest) in conjunction with corresponding 45-minute didactic instruction on the use of UE to determine the volume of gastric contents prior to induction of surgical patients. The volume estimates choices followed Perlas et al recommendations.

Data Collection: Eight sets of gastric ultrasound images were ordered using a random number table. The assessment included demographic items and UE evaluation of the gastric volume depicted. Additionally, students ranked their confidence in the volume's accuracy. The pretest was administered 1 week before the subsequent didactic instruction and posttest.

Results & Data Analysis: Pretest participants identified the gastric volume in the 8 sets of images with only chance accuracy; average score of 3.08/8 correct identifications (IDs). Posttest students attained an average score of 5.03/8 correct IDs. The posttest mean score was greater than the pretest score [$t(109) = 15.84; P < 0.001$]. For pretest, most students expressed no confidence in their image IDs. For posttest, more than 70% of students indicated that they were "fairly or completely confident" in their assessments of gastric volume. Although students' confidence increased more than their accuracy, confidence levels did not approach grandiosity.

Discussions & Conclusions: A successful study of the recognition of gastric content patterns by entry-level anesthesia providers might imply that this teaching technique is viable to introduce into practice at any level of anesthesia expertise. The study found that nurse anesthesia students are capable of correct identification of empty, normal, and full gastric content ultrasound scans following a brief presentation.

A25

Subanesthetic Intravenous Ketamine Infusion Enhances Fear Memory and Brain Glucose Metabolism (18F-FDG PET) in Male Sprague-Dawley Rats

CDR Kennett Radford, PhD, CRNA, NC, USN; Thomas Park, BS; Shalini Jaiswal, MS; Hongna Pan, MD; Andrew Knutsen, PhD; Lisa Osborne-Smith, PhD, CRNA, CAPT(ret), NC, USN; Bernard Dardzinski, PhD; Kwang Choi, PhD

Uniformed Services University of the Health Sciences

Introduction: Ketamine is the most common battlefield analgesic administered to traumatically injured service members in Afghanistan. However, the impacts of posttrauma ketamine administration on the development of posttraumatic stress disorder (PTSD) are controversial and remain largely unknown. Therefore, we investigated the effects of different doses of intravenous ketamine infusion on fear memory and in vivo regional brain glucose metabolism (BGlUM) in rats.

Literature Review: Most preclinical studies inject ketamine into the abdomen of rodents following fear learning and report either improved, worsened, or no effect on fear memory. Retrospective clinical studies also describe equivocal ketamine effects on stress related disorders. However, no preclinical studies have used the clinically relevant IV route to deliver ketamine and measure effects on brain and behavior.

Research Design: Experimental design was used.

Methods: Male Sprague-Dawley rats received a subanesthetic ketamine infusion (0, 2, 10, or 20 mg/kg over 2 hours) either immediately or 1 day after auditory fear conditioning (3 tone and footshock [0.6 mA, 1 second] pairings). Fear memory retrieval, extinction, and renewal were tested on days 2, 3, and 4 postfear conditioning and ketamine infusion. The effects of ketamine infusion (0 and 10 mg/kg) and fear memory retrieval on BGlUM (brain activity) were measured using 18F-FDG PET scans.

Data Collection: Behavioral data was recorded by an infrared video camera mounted above the behavior chamber. Two observers blind to the treatment conditions scored freezing time and data was scored. BGlUM was measured via an independent imaging facility blind to treatment conditions.

Results & Data Analysis: The ketamine infusion, both immediately after and 1 day after fear conditioning, dose dependently enhanced cued fear memory retrieval, delayed fear extinction, and enhanced contextual and cued fear renewal in rats. The ketamine infusion (10 mg/kg) increased BGlUM in the hippocampus, amygdala, hypothalamus, and midbrain, while decreasing it in the cerebellum of rats. These results indicate that posttrauma ketamine infusion may enhance fear memory through activating brain regions associated with fear and stress. Unpaired t -tests, 1-way and 2-way ANOVAs were used as appropriate. A p value < 0.05 was considered significant.

Discussions & Conclusions: A postfear conditioning ketamine infusion enhanced fear memory retrieval and delayed fear extinction possibly through retrograde facilitation and ketamine induced hyperglutamate excitotoxicity to the medial prefrontal cortex. Ketamine also increased activity in the amygdala, hippocampus, and hypothalamus brain regions. These results suggest that a posttrauma subanesthetic ketamine infusion may enhance fear memory though increased activity in brain regions associated with fear and stress.

Source of Funding: The study was funded in part by the Tri-Service Nursing Research Program (TSNRP), Center for the Study of Traumatic Stress at the Uniformed Services University (CSTS-USU), and Jonas Center for Nursing and Veterans Healthcare.

A26

The Effect of an Education Module on the Knowledge Base of Student Registered Nurse Anesthetists Regarding Evidence-Based Prevention of Surgical Site Infection During Advanced Practice

CDR Valerie J. Diaz, DNP, CRNA, ARNP, NC, USN

Florida International University

Introduction: Student registered nurse anesthetists (SRNAs) are self-directed learners with entrenched safety attitudes and behaviors. Advanced practice nursing education must provide active learning opportunities that integrate the best current evidence with clinical expertise to produce practitioners who deliver safe, patient-centered evidence-based care.

Literature Review: Surgical site infections (SSIs) are preventable but develop in 2% to 5% of the 30 million patients undergoing surgical procedures each year in the United States. Literature suggests preventative management of SSIs is largely based on using evidence-based guidelines that support a safe patient environment during the perioperative period.

Research Design: A pretest-posttest quasi-experiment and education module were delivered to a sample of SRNAs to assess knowledge of prevention of surgical site infections and measure self-directed learning abilities and safety attitudes via a self-directed Learning Instrument and Safety Attitudes Questionnaire.

Methods: A presentation to SRNAs described surgical site infection diagnosing criteria, risk factors, epidemiology, impact on healthcare cost and evidence-based performance measures for SSI prevention. A pretest-posttest quasi-experiment of SRNAs measured SSI knowledge, safety attitudes, and learning ability via a Learning Instrument and Safety Attitudes Questionnaire embedded within the surveys.

Data Collection: Utilizing a web-based survey instrument, Qualtrics, pretest and posttest survey data were collected and stored in a password-protected data cloud. Email notification to subjects prompted survey initiation. The posttest was launched to subjects 24 hours after presentation delivery.

Results & Data Analysis: Pretest and posttest completion rates were 81% and 69.2%. The knowledge pretest had a mean of 58.7 and a median score of 65. The posttest mean was 61.2 and the median was 65. The 1-way ANOVA produced no statistically significant difference between pretests and posttests. Comparative analysis of presentation's learning objectives yielded statistical significance. The survey instrument pretest and posttest means were $X = 3.99$ and $X = 4.32$. A 1-way ANOVA comparing the pretest and posttest groups' mean safety attitude scores revealed no statistical significance.

Discussions & Conclusions: SRNAs are self-directed learners with entrenched safety attitudes and behaviors. Advanced practice nursing education must provide active learning that integrates evidence with clinical expertise to produce providers who deliver patient-centered evidence-based care. Further research is needed to foster evidence-based knowledge and bridge the gap between research utilization and nursing practice.

A27

The Effect of an Educational Program on Thromboelastography (TEG) on Competency Scores in Certified Registered Nurse Anesthetists

Margaret Contrera, DNP, CRNA; Carolyn Murrock, PhD, RN; Christian Burchill, PhD, RN; Nick Farinacci, DNP, CRNA

Cleveland Clinic

Introduction: Blood is given in 20% of major surgeries. Incorporating thromboelastography (TEG) into the transfusion strategy reduces transfusions, improves outcomes, and lowers cost. Interpreting TEG is complex. This DNP project investigated if an educational program about evidenced-based transfusion and TEG improved competency scores and confidence in TEG interpretation and coagulopathy management in CRNAs.

Literature Review: Transfusion is a top 5 overused therapy globally. Transfusion increases short and long-term morbidity, mortality, and cost. Traditional tests are on plasma only, do not measure platelet function, and take an hour. TEG measures real-time whole blood viscoelasticity and platelet function enabling targeted therapy. CRNAs avoid TEG due to complexity.

Research Design: A quasi-experimental pretest/posttest design was used to compare competency scores before and after an educational intervention. Secondary outcomes examined practitioner's perceived confidence in TEG interpretation and likelihood of application to clinical practice.

Methods: A convenience sample of 46 CRNAs at an educational anesthesia conference for a major health system in the Midwest attended a 40-minute lecture presentation on evidenced-based transfusion strategies including TEG interpretation and application. Competency and confidence in TEG interpretation and application were measured using preintervention and postintervention surveys that were IRB approved as exempt.

Data Collection: Attendees received the IRB-approved information letter prior to the lecture. Participation assumed consent. The preeducation survey was completed and collected prior to the lecture. The posteducation survey was completed and collected immediately following the educational intervention.

Results & Data Analysis: Pretest and posttest scores were compared using paired t tests to evaluate the impact of the TEG educational program. Mean competency scores in TEG interpretation and coagulopathy management improved significantly ($p < .0001$). The CRNA's confidence in the ability to interpret the TEG ($p < .0001$) and select the most appropriate blood component for transfusion ($p < .0001$) also improved significantly even if the CRNA did not have TEG available in the practice setting. If available, 98% reported increased likelihood of incorporating TEG into practice.

Discussions & Conclusions: CRNAs find TEG analysis challenging. Educational programs improve confidence and competence in TEG interpretation and application to transfusion decision-making and also increase likeliness of incorporation of TEG into practice. Future research should explore the effects of TEG education on actual practice with larger samples of CRNAs and nurse practitioners and on patient outcomes and cost.

A28

The Effect of Debriefing with Good Judgment on Nurse Anesthesia Students' Critical Event Recognition, Response, and Treatment

Carlene McLaughlin, PhD, CRNA

Villanova University

Introduction: This experimental study evaluated the overall effect of a structured method of debriefing compared with the usual method of debriefing conducted during a high-fidelity patient simulation experience in a nurse anesthesia program. The measured outcomes were: knowledge level, ability to recognize and treat critical events, and perceptions of debriefing quality as assessed by the Debriefing Assessment for Simulation in Healthcare student version (DASH-SV).

Literature Review: Research has shown high-fidelity simulation followed by debriefing to be an effective educational strategy for improving clinical performance and increasing clinical knowledge. The majority of debriefing studies have been conducted with undergraduate and graduate nursing students, medical students, and medical residents; however, none have been conducted with nurse anesthesia students.

Research Design: This study used a true experimental design with random assignment of students to 1 of 2 groups.

Methods: A sample of 24 nurse anesthesia students was randomly assigned to either the the usual method of debriefing (control group) or the structured method of debriefing (experimental group). Each group completed a knowledge pretest and posttest, participated in the same 3 simulations that were scored, and received the assigned method of debriefing immediately following the simulation that was assessed for quality.

Data Collection: The Crisis Resource Management Scoring Rubric (CRMSR) evaluated task management, teamwork, and situation awareness during the simulations. The knowledge pre- and post-test assessed changes in the level of knowledge. The DASH-SV assessed the quality of each debriefing method. The demographic form assessed for differences between the groups.

Results & Data Analysis: The within-subjects 2 x 3 RM-ANOVA of the CRMSR categories revealed improved scores over time: task management ($p = .008$), teamwork ($p = .002$), situation awareness ($p < .001$). The within-subjects 2 x 2 RM-ANOVA of the knowledge pretest and posttest revealed an improved level of knowledge ($p < .001$). No significant difference was found between the 2 groups' performances or knowledge level as a result of the method of debriefing. The DASH-SV elements' 2 x 3 RM-ANOVA revealed no significant differences between the 2 groups' debriefing ratings suggesting similar debriefings. The demographic differences were not significant.

Discussions & Conclusions: This research study compared 2 methods of debriefing after simulation and aimed to contribute evidence to teaching strategies utilized in nurse anesthesia education. The results further supported findings in the current literature that support debriefing as an effective educational strategy. Debriefing should be used by nurse anesthesia educators to deliver important concepts to nurse anesthesia students, in order to prepare safe, competent professionals.

Source of Funding: New York Life Doctoral Fellowship/AANA Foundation 2015. NLN Jonas Scholar Cohort VII (2016-2017).

A29

The Effect of Interprofessional Education on Attitudes Toward Healthcare Teams Between CRNA and PA Students

Courtney Brown, PhD, CRNA; Erich Grant, MS, MPAS, PA-C; Caroline Sisson, MS, MPAS, PA-C; Kristin Henderson, DNP, CRNA

Wake Forest School of Medicine

Introduction: Interprofessional education (IPE) has been linked to improved interprofessional collaborative practices and patient safety. The purpose of the proposed study was to determine to what degree an interprofessional inquiry-based learning (IBL) activity alters the 3 main constructs (self-perceived ability to work with others, value in working with others, comfort in working with others) in graduate nurse anesthesia (CRNA) and physician assistant (PA) students.

Literature Review: Interprofessional education (IPE) has been linked to improved interprofessional collaborative practices and patient safety. AHRQ finds that teamwork training improves learners' knowledge and attitudes for interprofessional work (Brock, Abu-Rish, Chiu et al, 2013). To date, there are no studies that evaluated the effect of IPE between PA and CRNA students.

Research Design: This was a cohort, descriptive, mixed methods trial following the intervention of an inquiry-based learning educational learning module administered to graduate physician assistant and nurse anesthesia students

Methods: Both the pretest/posttest survey was delivered electronically. PA or CRNA student admitted to graduate school setting before and after participating in the IBL activity. This survey assessed self-perceived ability to work with others, value in working with others, comfort in working with. The students also completed an overall satisfaction with the IBL activity and a post-intervention survey on self-regulated learning to determine if the modules increased motivation for self-regulated learning.

Data Collection: Both the pretest/posttest survey was delivered electronically to PA or CRNA student admitted to graduate school setting before and after participating in the IBL activity. IBL involves group case studies in which all members of a team contribute in 1) setting learning needs and 2) determining the plan of care.

Results & Data Analysis: There were no statistically significant differences between the 2 groups of students with regard to gender, race, and ethnicity. Both CRNA students and PA students demonstrated a statistically significant difference between baseline and post-IBL event scores. The domains with the greatest mean differences when groups were combined were comfort working with others and values. Other improvements were quality of care and self-perceived ability to work with others. Time did not demonstrate a change within combined groups.

Discussions & Conclusions: There have been no studies identified that evaluated an IBL activity with a combination of CRNA and PA learners. IBL as an IPE model has never been studied in a CRNA sample. The IBL interprofessional event generated positive changes in both CRNA and PA learners collectively and by group, in particular, as it relates to comfort in working with the PA students and the value of working interprofessionally.

A30

The Effects of Hemorrhage on the Pharmacokinetics of Tranexamic Acid in a Swine Model

Michael Loughren, PhD, CRNA; Michael Derickson, MD; John McClelland, MD; Shannon Marko, DVM; Danny Shen, PhD

Madigan Army Medical Center

Introduction: Tranexamic acid (TXA) inhibits fibrinolysis, and its early administration is strongly advocated in patients that are likely to require massive transfusion. The effects of shock on the distribution and elimination of TXA are unknown. This study determines the influence of hypovolemia on the pharmacokinetics of TXA, as well as the impact of drug elimination via hemorrhage in a minipig model.

Literature Review: The CRASH-2 trial and MATTERS study both demonstrated a decrease in mortality in trauma patients that received TXA. In 2013, the Department of Defense Hemorrhage and Resuscitation Research and Development Steering Committee identified optimizing dosing regimens and studying the pharmacokinetics of tranexamic acid in trauma as a research priority.

Research Design: The investigation was a prospective experimental study in Yucatan minipigs. The experiments were performed in adherence to the Guidelines on the Use of Laboratory Animals of the National Institutes of Health. Approval was obtained through the local Institutional Animal Care and Use Committee.

Methods: Normovolemic and hypovolemic (35% reduction in blood volume) swine (n = 4 per group) received 1 g of intravenous TXA for pharmacokinetic analysis. Plasma samples were analyzed by LC-MS and modeled using WinNonLin (Certara USA, Inc). To determine the impact of active hemorrhage on plasma levels of TXA, 1 total blood volume was hemorrhaged and simultaneously replaced while receiving TXA.

Data Collection: For pharmacokinetic analysis, blood (5 mL) was sampled at 14-time points over 4 hours after intravenous infusion of TXA. To determine percentage of dose lost via hemorrhage, 11 blood samples were obtained during the hemorrhage-transfusion period. In addition, the pooled hemorrhaged blood was sampled.

Results & Data Analysis: Both groups peaked after TXA infusion and had a rapid distribution phase. The hypovolemic group had a visibly slower terminal elimination phase. The pharmacokinetic parameters derived from compartmental modeling were compared using an ANOVA. The peak concentration and volume of distribution were not different between groups. Total clearance and renal clearance were significantly lower, and terminal half-life was significantly longer in the hypovolemic group. During the transfusion study, an average of 25% of the TXA dose was lost to hemorrhage.

Discussions & Conclusions: Our study demonstrated that up to 30% of the standard TXA dose can be lost to hemorrhage if a blood volume is transfused within an hour of initiating therapy. Failure to account for TXA lost via hemorrhage could lead to ineffective therapy. Replacement strategies should be developed and tested to find methods of adjusting the current dosing guidelines to maintain therapeutic plasma concentrations.

Source of Funding: TriService Nursing Research Program.

A31

The Effects of Substituting Intraoperative Esmolol for Fentanyl Derivatives on Postoperative Outcomes in Total Knee Arthroplasty Surgeries

Amanda Cafazza, BSN; Brandon Gebke, BSN

Webster University

Introduction: Opioids have multiple negative effects. Enhanced recovery after surgery (ERAS) protocols have been implemented to reduce opioid consumption and have shown to benefit early recovery in total knee arthroplasty patients. The purpose of this study is to evaluate the effect of an enhanced recovery protocol using esmolol instead of fentanyl derivatives on patients' 30-day and 60-day postoperative outcomes.

Literature Review: A thorough search was conducted using multiple resources including MEDLINE, Scopus, and Cochrane Database of Systematic Reviews. Topics searched included total knee arthroplasty (TKA) statistics, opioid complications, ERAS protocols, and esmolol.

Research Design: A retrospective, nonrandomized, single site, and cross-sectional design between subjects, was utilized to determine the effects of fentanyl derivatives, also known phenylpiperidine opioids, on 30-day and 60-day postoperative outcomes in total knee arthroplasty patients.

Methods: Patients undergoing TKA surgery at Phelps County Regional Medical Center (PCRMC) were retrospectively chart reviewed and divided into 2 groups. With all patient anesthetic plans following enhanced recovery guidelines, the control group patients had fentanyl or fentanyl derivatives perioperatively; whereas the experimental group patients received esmolol in substitution for phenylpiperidine opioids as needed.

Data Collection: A chart review was conducted on 206 patients undergoing TKA from January 2016 to January 2018. Discharge day, readmissions, and ER visits at 0 to 30 days and 30 to 60 days were measured on a password-protected spreadsheet to evaluate effects of fentanyl derivatives on long-term postoperative outcomes.

Results & Data Analysis: Statistical significance was found in discharge time using a 2-tailed t test. The experimental group (n=94) had a mean discharge of 2.21 days compared with the control group (n=112) who had a mean discharge of 2.73 days ($P < 0.05$). Additional findings utilizing a chi-square analysis revealed a clinically significant reduction in 30-day and 60-day readmissions and ER visits ($P > 0.05$).

Discussions & Conclusions: Patients who received esmolol intraoperatively as part of an ERAS protocol had a shorter length of stay than patients receiving fentanyl derivatives intraoperatively. Experimental group patients had a decrease in 30-day and 60-day admission and emergency room visits. Using this ERAS protocol for TKA shortens length of stay without increasing readmissions or ER visits.

A32

The Fine Art of Healthcare: Using Visual Thinking Strategies to Develop Interprofessional Skills in Student Nurse Anesthetists

Greta Mitzova-Vladinov, DNP, CRNA, CHSE; Sharifa Lindo, BSN, RN; Stephanie Martin, BSN, RN
University of Miami School of Nursing and Health Studies

Introduction: Visual thinking strategies (VTS) is a technique designed to teach critical thinking, communication, and visual literacy. The Fine Art of Healthcare is an innovative educational program that brings students from various healthcare disciplines at the Lowe Art Museum in the University of Miami. The workshops are tailored to improve observation skills, communication, and empathy by slowing down and interpreting art all for better patient outcomes.

Literature Review: VTS methodology is recently used in medical and nursing education as an innovative teaching strategy for development of visual literacy, critical thinking, and communication skills as well as foster aesthetic empathy of others' experiences. The evidence suggests that VTS may be a valuable tool in building team collaboration and communication.

Research Design: Descriptive study of students' perceptions of Fine Art of Healthcare: a VTS-based multidisciplinary healthcare workshop held at the Lowe Art Museum. Students from DNP nurse anesthesia program, medical and physical therapy, nursing, and psychology students were invited for voluntarily participation in the workshop.

Methods: The session was held in November 2016. Twenty-eight participants from 4 programs were divided into smaller groups. Each group was led by a museum educator trained in VTS. The students are guided to 3 art pieces, where the educators begin the session by asking the 3 open-ended questions foundational to VTS: What is going on here? What do you see that makes you say that? and What more can you find? Unlike other programs, the students have an opportunity to facilitate the sessions.

Data Collection: At the end of the workshop the participants were asked to complete an anonymous survey with 12 questions to evaluate their experience. The responses were collected via Qualtrics link and evaluated. Ten out of the 26 participants were doctor of nursing practice nurse anesthesia students, 10 undergraduate nursing students, 2 doctor of physical therapy students, and 2 medical students.

Results & Data Analysis: Eighty-four percent of the students were exposed to VTS for first time. Overall, the evaluation of the workshop was very positive. Some 65% (65.38%) of them strongly agree that VTS helped them understand how to hone their observational and listening skills. Ninety-two percent agree or strongly agree that looking at and discussing art has merit with regard to collaborative practice. Ninety-six percent agreed or strongly agreed that VTS helped them improve their communication skills. Ninety-three percent found value in the VTS workshop because it provided opportunity to meet and have discussions with students from other disciplines.

Discussions & Conclusions: The arts and humanities have long been recognized as important tools for building multidisciplinary collaboration in health education. There is growing evidence to suggest that integrating the arts into the nursing curriculum can have powerful outcomes. These capabilities proved useful in the nurse anesthesia curriculum by allowing skillful conceptualization, originality, and leveling the playing field for all healthcare students.

A33

The Perceived Value of Certification in Nonsurgical Pain Management

Robyn Ward, MS, CRNA; Mary Anne Krogh, PhD, CRNA; Michael Kremer, PhD, CRNA; Timothy Muckle, PhD; Michael Schoeny, PhD

Rush University

Introduction: Chronic pain is a growing epidemic in America. Challenges in patients' access to care, and reimbursement to certified registered nurse anesthetists (CRNAs) who provide pain services, have resulted in a voluntary subspecialty certification in nonsurgical pain management (NSPM) for CRNAs. The purpose of this study was to explore CRNAs' perceptions of the value of certification in addition to bridging the gap of potential barriers associated with NSPM certification.

Literature Review: In 2011, the Institute of Medicine (IOM) released the report *Relieving Pain in America: A Blueprint for Transforming Prevention, Care, Education, and Research*. A cultural transformation was recommended to address 4 nationwide challenges: pain as a public health challenge, pain care, education, and research. One recommendation was to increase the number of health professionals with advanced expertise in pain care.

Research Design: This was a descriptive, exploratory study.

Methods: The Perceived Value of Certification Tool (PVCT) was administered to 474 CRNAs who claimed NSPM on their recertification applications. Electronic survey delivery was conducted in collaboration with a single staff member of the National Board of Certification and Recertification for Nurse Anesthetists (NBCRNA), a single NBCRNA CRNA staff member, and a single staff member of the Competency and Credentialing Institute during the months of March and April 2017.

Data Collection: Exploratory factor analysis with varimax rotation was conducted on the 18-item PVCT to assess the latent structure of the PVCT and to identify potential constructs of CRNAs' perceptions of the perceived value of certification for CRNAs who practice NSPM. Reliability for 3 identified constructs was assessed using Cronbach's alpha coefficients.

Results & Data Analysis: Of 64 CRNAs who provided data, a 3-factor solution emerged that explained 72.25% of the overall variance: personal satisfaction, professional recognition, and competence, each with excellent to good reliability (F1 alpha = 0.95; F2 alpha = 0.94; F3 alpha = 0.88). Identification of the 3 constructs in this study assist with future efforts of examination validation for the subspecialty of NSPM certification for CRNAs.

Discussions & Conclusions: The 4 highest factor loadings are: (1) promotes recognition from employers, (2) provides personal satisfaction, (3) provides professional challenge, and (4) promotes recognition from other health professionals. These factor loadings represent intrinsic factors linked to personal development, while extrinsic factors are defined by others. One variable, increased salary, did not load on any of the 3 identified constructs, which demonstrates that salary is 1 potential barrier associated with holding the NSPM credential.

A34

The Psychometric Analysis of an Instrument to Measure the Concept of Workload for Certified Registered Nurse Anesthetists

Susan P. McMullan, PhD, CRNA; Patricia Patrician, PhD, RN, FAAN; Dheeraj Raju, PhD

University of Alabama at Birmingham School of Nursing

Introduction: Research indicates CRNA workload is significantly associated with their perceptions of unsafe work setting, poor patient safety ratings, and higher incidence of adverse event reporting. The ability to accurately measure CRNA workload is important for patient safety; there is no instrument to measure CRNA workload. The purpose of this study is to perform psychometric testing on a workload instrument.

Literature Review: High RN staffing ratios and balanced workloads facilitate positive patient outcomes in hospitals. However, the effects of organizational structures such as workload on the outcomes of patients who receive anesthesia have received little attention in nursing research. In order to further evaluate how CRNA workload affects patient safety culture, it is important to determine exactly what comprises CRNA workload.

Research Design: This is a psychometric study. The study was deemed exempt by University of Alabama at Birmingham Institutional Review Board (IRB) and was approved by the AANA Foundation. All data were collected via an electronic survey.

Methods: A 12-item CRNA workload instrument was tested in a population of 2,500 CRNAs. CRNAs who worked full time in the clinical setting and had 1 or more years' experience were randomly selected from the AANA database. Participants were contacted via an email that explained the study and included a link to the electronic survey.

Data Collection: Emails were sent out within 2 weeks of study approval, with a second follow-up email reminder 2 weeks following the first email solicitation. Four weeks after the final email reminder, the survey was closed and psychometric analysis of the new CRNA workload tool was performed

Results & Data Analysis: A total of 268 participants completed the survey; 60% were female with an average age of 48 years and 16 years of CRNA work experience. Eighty percent had a master's degree and 81% practiced in the anesthesia care team. Seven primary practice settings were included. Instrument reliability analysis was conducted; Cronbach's alpha was 0.765. Subscales were determined using exploratory factor analysis and 3 emerged: workload, work demands, and feelings about work. Individual item performance was analyzed using both nonparametric and parametric methods. Both techniques indicated Items 2, 3, 5, 8, 11, and 12 were a good fit to measure workload.

Discussions & Conclusions: The newly developed CRNA workload instrument demonstrated good overall reliability for a new instrument. However, further study is required to determine if items 1, 4, 6, and 7 contribute to CRNA workload. The next step is to further refine the instrument and to determine what, if any, domains of CRNA workload may still be missing from the tool.

Source of Funding: This study was funded by the AANA Foundation Grant.

A35

Trigger Films and Simulation: Educating Nurse Anesthesia Students

Laura Rodgers, DNAP, CRNA; Shawn Fryzel, DNAP, CRNA; Jane Motz, DNAP, CRNA

University of Michigan-Flint

Introduction: Confident decision-making curtails the risk of adverse events in the operating room. Critical thinking skills (CTS) combined with fundamental knowledge are needed for safe anesthesia. Teaching CTS for high-risk/low-frequency events is key in the development of nurse anesthetists. Determining the best teaching strategy is needed. Trigger films may have a positive influence on CTS over lecture alone.

Literature Review: Teaching is a process of generating data in a student, enabling change in the student's behavior. Didactic material provides a student with facts. Trigger films (TFs) can be used as reinforcement or to review situations that students might not encounter. TFs can be put into a curriculum and initiate learning simulations, experiences to generate data within students, for affective behavioral change.

Research Design: The proposed research question was evaluated using an experimental research design. The use of TFs in combination with lecture versus lecture alone on the subject of malignant hyperthermia was investigated.

Methods: Twenty-three student registered nurse anesthetists (SRNAs) received a lecture on malignant hyperthermia (MH) recognition, diagnosis, and treatment. This provided foundational knowledge of the diagnosis and treatment of an MH crisis. Students were randomly placed in 2 study arms. Participants entered into a simulated scenario alone, in an identical simulated operating room. Two independent evaluators reviewed each videotaped session.

Data Collection: Two independent evaluators reviewed each videotaped session using a developed evaluation tool. Each evaluator viewed the videotaped sessions and recorded time to diagnosis of symptoms and time to onset of treatment. Videotapes were kept secure on the B-Line videotaping system with access requiring user names and passwords specific to each user.

Results & Data Analysis: The average of the 2 evaluators' blinded scores was utilized for analysis. A Mann-Whitney-Wilcoxon rank sum test was chosen because each group contained 11 subjects, a relatively small sample size. Analysis was performed utilizing R software. Statistical analysis showed no difference in mean time to decision-making between groups at the 5% level of significance for any variable except cooling. Students indicated that they would like to see TFs used for more routine situations such as preoperative assessment and anesthesia induction as well.

Discussions & Conclusions: Learning is an individual experience. Research documents the uniqueness of each person's way of perceiving and processing information. Participating students reinforced the hypothesis that the TFs group would experience enhanced learning. Citing increasing ease of remembering information, students felt that viewing scenarios would help them make better decisions for diagnosis and treatment.

A36

Using a Checklist to Improve Anesthesia to Postanesthesia Care Unit Handoff

Neil J. Nadel, BSN, RN; Rachel Smith-Steinert, DNP, CRNA; Mary Bakis, DNP, CRNA

University of Cincinnati

Introduction: Communication failure still ranks among the top 3 main causes of sentinel events in healthcare. In this study, a checklist with key patient information was developed and placed in each postanesthesia care unit bay to visually prompt anesthesia providers when giving report to postoperative nursing staff. The goal was to improve the amount of vital patient information shared during report.

Literature Review: After excluding articles that did not meet criteria, 20 articles published in peer-reviewed journals from 2011 to 2017 were included for review in this study. The evidence shows that despite efforts to improve communication, anesthesia-to-postanesthesia care unit handoffs continue to be incomplete and unstructured.

Research Design: A quasi-experimental design was employed to measure how much patient information was relayed during handoff at baseline and again after checklist implementation.

Methods: Seven postanesthesia nurses were recruited and educated to record data on baseline handoff reports from anesthesia providers. A checklist was developed and affixed into each postanesthesia care unit bay, with anesthesia provider education given. Postimplementation handoffs were again recorded by the same nurses. A goal of 30 observed handoffs per phase, or 10% of the weekly surgical patient volume, was set.

Data Collection: Data collection for baseline observations took place for 1 week. Then the checklist was placed in the postanesthesia care unit. Three weeks later, postimplementation data collection took place for 1 week. Thirty-nine handoffs were recorded during the baseline phase, and 34 at postimplementation, 3 weeks after checklist rollout.

Results & Data Analysis: Z-tests (with $p < 0.05$) comparing preimplementation and postimplementation validity were run on each item and on the checklist as a whole. Results were found to be statistically significant for 5 of the 10 checklist items. However, the percentage of affirmative reporting (observers recording that anesthesia providers did verbally report checklist items) increased for each item. As a whole, item reporting increased from 60% at baseline to 84.4% after checklist introduction. This was found to be statistically significant ($Z = -7.2785$, $p = 0$).

Discussions & Conclusions: The use of a checklist to guide the handoff between anesthesia providers and postanesthesia care unit staff did statistically improve the amount of vital patient information reported. The clinical impact of this study is with increased transfer of patient information, postanesthesia care nurses can develop a more complete picture of a patient's clinical status, thus allowing them to deliver safer and higher quality care.

A37

A Comparison of Regional Anesthesia Blocks for Total Knee Arthroplasty

Patrick Gilstrap, BSN, RN; William Lundgren, BSN, RN; Evan Vickers, BSN, RN

University of North Florida

Introduction: The aim of this project is to propose a change of regional techniques for pain management following total knee arthroplasty (TKA). Regional anesthetics such as femoral nerve blocks (FNB) have been shown to reduce quadriceps muscle strength. The adductor canal block (ACB) in comparison provides a comparable sensory block but may allow for earlier ambulation through preservation of quadriceps muscle strength.

Methods: Keywords from the following PICOT question were used to search the CINAHL, PubMed, Cochrane, and Google Scholar literature databases: Do patients undergoing total knee arthroplasty (P) who receive an adductor canal block (I) compared with patients who receive a femoral block (C) have better postoperative outcomes? (O)? Four systematic reviews of randomized clinical trials (RCTs) and 2 RCTs were critically appraised.

Analysis of the Evidence: The results of the systematic reviews and RCTs found that the ACB provided comparable postoperative analgesia to the FNB in patients undergoing TKA. The results also showed that patients who received the ACB had better quadriceps muscle strength than patients who received the femoral block improving postoperative time to first ambulation.

Recommendation for Practice: To implement this change in practice a presentation will be given to anesthesia providers at Halifax Medical Center describing the evidence on the effectiveness of the FNB in providing better quadriceps muscle strength and early mobilization compared with the ACB for TKA. To monitor for whether a change in practice takes place, billable records for regional anesthetics performed and billed for will be reviewed. If more ACBs are performed, surgeons will be asked if patients have a smoother recovery with this block compared with the FNB.

A38

A Comparison of the Analgesic Efficacy and Side Effects of Paravertebral Blockade Versus Thoracic Epidural Blockade for Patients Undergoing Thoracotomy

Kaitlin Sanborn, BSN, RN, CCRN; Kristi Wade, CRNA, DNAP; Jessica Burton-Vigil, CRNA, MS

Albany Medical College Center for Nurse Anesthesiology

Introduction: Patients undergoing major thoracic surgery develop postoperative pain. It is difficult to treat because multiple sensory afferent fibers transmit nociceptive stimuli following thoracotomy. A literature review was conducted to investigate the analgesic effect and adverse outcomes associated with paravertebral blockade versus thoracic epidural blockade in patients undergoing thoracotomy.

Methods: The literature presented in this review was selected from a comprehensive electronic search of the PubMed, CINAHL, and Cochrane library databases through Albany Medical College's Schaffer Library. Key terms used for the search included pain, thoracic, paravertebral, epidural, block, thoracotomy, placement and anesthesia. Broad MeSH terms included thorax, and thoracotomy. They were selected from each database and used to identify further relevant research. Articles published between 2006 and 2016 and in the English language were included. Initially, 101 articles were identified, but only those articles investigating adult patients were selected for inclusion. Four articles are included in the final analysis.

Analysis of the Evidence: Four articles were included in the final analysis: Ding et al (2014), Raveglia et al (2014), Davies et al (2006), and Kobayashi et al (2013). Findings show that patients who received a paravertebral block (PVB) demonstrated fewer side effects when compared with those patients who received thoracic epidural blockade (TEB). PVB was associated with less hypotension, urinary retention, nausea and vomiting, and pruritis. Two studies also demonstrated a significant reduction in postoperative pulmonary complications in patients who received a PVB. Additionally, Davies et al and Ding et al both recorded a significantly lower incidence of failed block in the PVB group versus the TEB group.

Recommendation for Practice: Postoperative pain inhibits early ambulation, pulmonary recruitment, and discharge after thoracotomy. Nurse anesthetists strive to provide the safest, most effective analgesic technique for patients. While both blocks provided comparable analgesia, PVB provided a significant clinical advantage over TEB when considering adverse effects. There are fewer contraindications for PVB placement and more adverse effects with TEB. Larger, prospective, randomized trials comparing adverse outcomes of TEB to PVB for patients undergoing thoracotomy are required. Future studies should standardize placement of catheter, dosing of catheter, type of thoracotomy, and drugs and concentrations of anesthesia.

A39

A Paradigm Shift in the Practice of Airway Management; The Utilization of Ultrasonography in the Detection of Difficult Airway

Lissette I. Rivero, BSN, RN; Ann B. Miller, DNP, CRNA, ARNP; Vicente Behrens, MD

Florida International University

Introduction: Difficult airway management accounts for 39% of all anesthesia-related morbidity and mortality (M&M), making it the most common cause of M&M. The traditional Mallampati airway assessment was found to be inadequate for detecting difficult laryngoscopy and intubation. The addition of ultrasound can provide reliable anatomical airway assessment not possible by clinical examination alone.

Methods: The purpose of this evidence-based project was to answer the following clinical question: In adult patients undergoing endotracheal intubation, does the utilization of ultrasound-guided airway assessment compared with the utilization of standard Mallampati airway classification improve the adequacy of difficult airway detection in the preoperative setting? The search strategy utilized Embase, MEDLINE, and the Cumulative Index of Nursing and Allied Health Literature databases. Inclusion criteria addressed ultrasound-guided measurement of distance from skin to epiglottis, thickness of tongue, and anterior neck soft tissue at the level of the hyoid bone for predicting difficult airway. Fifteen articles were included for analysis and critically appraised.

Analysis of the Evidence: A prospective observational study evaluated anterior neck soft tissue thickness in detecting difficult airway. Anterior neck soft tissue thickness cutoff value of 2.8 cm at the thyrohyoid membrane level correlated with difficult laryngoscopy. A prospective observational double-blind study utilized ultrasound to measure the distance from skin to epiglottis (DSE). A DSE greater than or equal to 27.5 mm is indicative of a difficult intubation. A cross-sectional prospective study assessed hyoid bone visibility on ultrasound. Clear images of hyoid bone were viewed on ultrasound in 96.6% of easy intubations; 72.7% of difficult laryngoscopies did not have a visible hyoid bone on ultrasound.

Recommendation for Practice: The empirical evidence shows that combining clinical screening tests and ultrasound measurements enhance the sensitivity and specificity of preoperative difficult airway detection. Ultrasound measurements of anterior neck soft tissue thickness, epiglottic distance, hyoid bone visibility, and hyomental distance detected difficult airway. An evidence-based practice change utilizing ultrasound serves as a noninvasive accurate method for assessing and detecting difficult airway. A formalized ultrasound protocol will facilitate the measurement of airway structures and predict a difficult airway preoperatively, ultimately changing standard of care in the preoperative airway assessment.

A40

Airway Management Navigation for Army Reserve Combat Medics

1LT Bradley Miller, BSN, RN, CFRN, EMT-P, ANC, USAR; Rachel Smith-Steinert, DNP, CRNA; Matt Yockey, MSN, CRNA; CPT Chad Kinder, MSN, RN, CNOR, CNE, CRNFA, ANC, USAR

University of Cincinnati Nurse Anesthesia Program

Introduction: Army Reserve Combat Medics possess a wide variety of knowledge, skill, experience, and training and are expected to perform in austere conditions with limited resources. Over 90% of battlefield deaths occur in the prehospital setting, 24% of which are potentially survivable. This airway education intervention demonstrates the impact that nurse anesthetists and student anesthetists can have on the performance of this population during airway management navigation.

Methods: IRB approval was obtained to host 10 Army Reserve Combat Medics to participate in an education intervention developed by a senior nurse anesthesia student to investigate the effectiveness of improving airway management performance in this population of providers. A presurvey/postsurvey, preknowledge/postknowledge assessment, and preperformance/postperformance evaluation tool were used to measure the effectiveness of an airway education intervention consisting of a lecture presentation, high fidelity simulation experience, and rotation through hands-on stations to learn airway management concepts from anesthesia trained personnel.

Analysis of the Evidence: A statistically significant increase in average comfort level with skills ($t=-.63856$, $p=0.0005$) and average comfort level with knowing the next steps after the previous had failed ($t=-6.3070$, $p=0.008$) was found after the workshop. A statistically significant increase in average comfort level with predicting difficulty with airway interventions based on patient's features was found after the workshop ($t=-4.56212$, $p=0.019$). A significantly less amount of time was spent on futile tasks during simulation, and establishment of ventilation was completed in a significantly smaller amount of time. Navigation through the management of the patient was more coherent, safe, and effective after the airway workshop and new knowledge was gained.

Recommendation for Practice: Nurse anesthetists and student anesthetists are subject matter experts in the field of basic and advanced airway management, and utilizing them to supplement the training of Army Reserve Combat Medics is a platform from which the most basic airway knowledge of the anesthetist can easily and effectively be shared with and highly valued by Army Combat Medics. Confidence level plays a critical role in decision-making capacity, especially under times of duress, in the prevention of preventable deaths on the battlefield, and nurse anesthetists and student anesthetists can easily impart this to this population of military providers.

A41

An Evaluation of Goal Directed Therapy Algorithm Implementation in Free Tissue Transfer Patients

Shatericka Campbell, BSN, RN; Kalie Grambeau, BSN, RN; Amanda Reuter, BSN, RN; Martha Sturm, BSN, RN; Michele M. Ballister, DNP, CRNA, APRN, CHSE

Medical University of South Carolina

Introduction: In 2016, a goal directed therapy algorithm was implemented at a major academic medical center in patients with head and neck cancers undergoing free tissue transfers that yielded positive outcomes in both the success of the tissue transfer and the overall length of stay in the ICU and hospital. The purpose of this study was to evaluate the continued use of the algorithm and its effectiveness in the postresearch period.

Methods: After IRB approval, a retrospective systematic chart review was performed at the same major academic medical center as the original study with data collected from July 2016 to December 2016. Electronic medical records were filtered by ICD 9 codes in the head and neck department returning 34 charts that met inclusion criteria. Fidelity to the original study was established via patient demographics, type of surgery, and intraoperative use of fluids, vasopressors, or inotropes. The data collected were compared with the published results of the original study for clinical significance.

Analysis of the Evidence: Thirty-four patient charts were reviewed for comparison of patient outcomes. The raw data from the 2016 study were not available; only the published data could be used for comparison. The results from the initial study and the chart review showed negative correlation of patient outcomes when the goal directed therapy algorithm is utilized. The treatment group in the reference study demonstrated a 32% utilization of vasopressors and a mean ICU length of stay (LOS) of 1.8 days. The current data collection period reveals 100% of patients received vasopressors with a mean ICU LOS of 2.8 days. Patient outcomes did not exhibit the same reduction in ICU LOS in the postresearch period as during the 2016 study period.

Recommendation for Practice: This study compared the outcomes of patients having free tissue transfers in separate time intervals managed with a goal directed therapy algorithm. During the original research phase, there were reductions in ICU and overall hospital LOS. This study revealed equivalent patient outcomes were not produced outside of the initial data collection period. Statistically significant differences could not be determined because raw data from the initial study was unavailable. Further research is needed to determine the cause of these variances and methods to replicate the original study data.

A42

An Evidenced-Based Review of the Importance of an Enhanced Recovery After Surgery (ERAS) Protocol for Elective Cesarean Deliveries

Zafar Anwar, BSN, RN, CCRN; Lyda Shambo, DNP, CRNA

Columbia University School of Nursing

Introduction: The introduction of enhanced recovery after surgery (ERAS) protocols a decade ago were directed at optimizing multiple facets of perioperative patient care and facilitate earlier discharge after surgery. Cesarean deliveries in the United States account for one-third of deliveries that have been associated with significant morbidity and complications. ERAS protocols for elective cesarean deliveries have been developed and implemented in different countries with positive outcomes.

Methods: A search was conducted in EBSCOhost, PubMed, and Ovid MEDLINE for literature from 2013 to the present. Scholarly publications were reviewed, which were in English and available in full text. Six studies were included that were relevant to the topic. Two meta-analyses were reviewed, one that establishes the effectiveness of ERAS protocols in current practice and the other examines the current trends of elective C-section ERAS protocols. A survey, retrospective study, and prospective study explored the current ERAS protocols for elective C-sections in the United Kingdom and France with outcomes and recommendations for further research. A case control study observed an increase in maternal satisfaction and maternal-neonate bonding with the implementation of an ERAS protocol.

Analysis of the Evidence: Most studies' recommendations regarding an ERAS protocol for elective cesarean deliveries in the literature include implementing early oral intake, early mobilization and early removal of urinary catheter. Other studies propose usage of nonparticulate carbohydrate drinks, appropriate analgesia, and early skin-to-skin contact. A multidisciplinary team is recommended to further this effort in the perioperative period. These are consistent with ERAS protocols in other surgical subspecialties that have shown to decrease length of stay, overall complications, costs, and early resumption of gastrointestinal function.

Recommendation for Practice: Preliminary evidence suggests an interest in the development and implementation of an ERAS protocol for elective cesarean delivery. Extensive research and subsequent ERAS protocols have been implemented in other surgical subspecialties. Evidence suggests that enactment of such protocols result in reduced morbidity, decreased length of stay, and resumption of baseline function of patients. Further research is warranted to better evaluate the efficacy of an ERAS protocol for elective cesarean deliveries in the United States.

A43

Anticoagulation Use in Postoperative Atrial Fibrillation: A Quality Improvement Project

Carmen Chan, RN; COL Derrick C. Glymph, DNAP, CRNA, ARNP, ANC, USAR; Ivan Arenas, MD

Florida International University

Introduction: Postoperative atrial fibrillation (POAF) is a common complication after cardiac surgery and is associated with a variety of adverse events. Studies have shown that 40% to 50% of patients undergoing cardiac surgery will develop POAF. POAF is linked to postoperative complications that include stroke, congestive heart failure, increased inotropic support, acute kidney injury, and death.

Methods: This quality improvement project focused on studies relevant to the PICO question: In adult patients with new onset of postoperative atrial fibrillation (P), how does the use of early oral anticoagulation (I) compared with not utilizing anticoagulation increase the incidence of hemorrhagic events (O)? The PICO question was used to initiate the search for evidence. The study selection was guided by the PICO question with an inclusion and exclusion criteria. A total of 6 studies were chosen from CINAHL, MEDLINE, and EMBASE. In addition, a current retrospective chart review will contribute to the evidence-based data collected.

Analysis of the Evidence: All 6 selected studies did not show an increase in hemorrhagic events after starting oral anticoagulation for new onset of POAF after cardiac surgery. Based on level IV to VI evidence, POAF after cardiac surgery was found to be associated with major adverse clinical events that included late cardiovascular mortality, late atrial fibrillation, myocardial infarction, and stroke.

Recommendation for Practice: Further research with different study prospective would provide more information on the risks and benefits of utilizing anticoagulation for patients with new onset of POAF. The data may help guide clinical practice and expectations for patients taking oral anticoagulation for future surgical procedures.

A44

Anxiety Management for Needle Localization

Maj Jorge Arizpe, BSN, RN, USAF, NC; Capt Keren Stimeling, BSN, RN, USAF, NC; Lt Col Lonnie Hodges, DNP, CRNA, USAF, NC

Daniel K. Inouye Graduate School of Nursing, Uniformed Services University of the Health Sciences

Introduction: Unaddressed anxiety of individuals undergoing needle localized breast biopsy (NLBBx) may lead to delays in follow-up care and changes in anesthetic plans, increasing healthcare costs, and adversely impacting the patient's short-term and long-term well-being.

Methods: In patients undergoing needle localization in interventional radiology (IR), will giving an anxiolytic before the procedure increase patient satisfaction compared with no anxiolysis? Literature database search methods included CINAHL, EMBASE, and PubMed. A total of 108 nonduplicate citations were screened for inclusion. Inclusion criteria referenced anxiety and pain before, during, and after procedure; 10-year limit for publication; and language in English. A total of 94 articles were excluded, leaving 14 articles retrieved for full review. Of those 14 articles, 10 were excluded due to not meeting inclusion criteria of study design levels I-III and language in English. A total of 4 articles remained for full review and inclusion for evidential support. Two previous studies were included as foundational precedence to support this process improvement project.

Analysis of the Evidence: Patient satisfaction was the primary focus for this project. Question numbers 3 and 4 of the physician data query (PDQ) provided the information we were looking to assess: question 3—feeling of medication benefit—increased from 60% to 100% postimplementation; question 4—there was a decreased response to discomfort—reduced from 80% to 62.5%, and—no discomfort increased—10% up to 37.5%.

Recommendation for Practice: Unrelieved patient anxiety may result in decreased postoperative satisfaction and potentially increases the financial burden on the healthcare system, requiring costlier interventions and prolonging treatment. By providing anxiolysis, we can improve the patient experience and potentially decrease patient anxiety. By addressing anxiety, we can provide the best anesthetic intervention, achieve better patient outcomes, diminish postoperative recovery time, and decrease overall cost to the healthcare system.

A45

ASICS: Anesthesia Simulation in Cardiac Surgery

Jeanna Staun, MSN, RN; Jennifer Lanzillotta, MSN, CRNA; Lauren Freed, MSN, CRNA; Matt Yockey, MSN, CRNA; Matt Rota, PhD

University of Cincinnati

Introduction: The purpose of this project is to improve nurse anesthesia students' performance and increase self-efficacy during their cardiac anesthesia clinical rotation by utilizing simulation training.

Methods: The PICOT question utilized for this project was the following: In nurse anesthesia students, how does completing an open-heart surgery simulation affect students' performance and perceived self-efficacy by the time they complete their cardiac curriculum? A literature search was then conducted, which produced articles that addressed simulation in both nurse anesthesia and anesthesiology professions. Additionally, articles that detailed only cardiac surgery simulation and not the anesthetic aspect of the simulation were excluded. This produced 17 relevant articles, including 2 randomized controlled trials. After consulting the literature and working closely with individuals with significant clinical expertise in the open-heart surgery setting, a simulation was developed that included 3 sequential stations.

Analysis of the Evidence: Simulation-based training provides an opportunity for teaching and practicing clinical skills, allowing students to learn from their successes as well as their mistakes (Bandali, 2008; Lewis, 2010; McGaghie, 2010). In a landmark systematic review and meta-analysis, a study found that simulation training in anesthesia is effective and associated with positive outcomes (Lorello, Cook, Johnson, and Brydges, 2014). With increasing emphasis on patient safety in the healthcare arena, current literature supports simulation as an effective tool that not only improves student skills but has the potential to improve patient outcomes as well (Murray, 2011).

Recommendation for Practice: Simulation is a worthwhile tool that can provide exposure to the open-heart surgery environment and prepare student nurse anesthetists for their cardiac rotation. Implementing this tool during a student nurse anesthetist's cardiac curriculum can allow for more productive learning time and serve as a kinesthetic learning supplement. By providing the opportunity to allow for repetition, simulation can promote accelerated skill acquisition within the open-heart surgery milieu. Improved skill development has the potential to enhance patient safety, as well as groom students to become more prepared certified registered nurse anesthetists.

A46

Assessing a Novel Method to Reduce Anesthesia Machine Contamination: A Prospective, Observational Trial

Thomas Corey Davis, PhD, CRNA; Beverly George-Gay, MSN, RN; Emily M. Hill, PhD; Brad Verhulst, PhD; Chuck J. Biddle, PhD, CRNA

Virginia Commonwealth University

Introduction: Anesthesia machines are known potent reservoirs of bacterial pathogens contributing to the burden of healthcare associated infections. The design of anesthesia machines makes disinfection particularly difficult. This study examines the use of a barrier device in the form of a thin transparent plastic shield to wrap the anesthesia machine to decrease cross-contamination between the anesthesia machine and the patient and transmission of pathogens between cases.

Methods: An anesthesia machine wrap was used to cover anesthesia machines. After determining use of the device would not impede use and an exempt review from the Virginia Commonwealth University IRB, a prospective, experimental study design was utilized. Eleven general anesthesia cases utilized the wrap as the experimental group, while 11 similar control cases did not use the barrier. Routine anesthesia machine cleaning protocols were followed for all cases. Culture samples were collected on 7 “hot spot” areas of the anesthesia machine determined a priori by a panel of experts. Cultures were obtained from all machines prior to initial use for the day and at the end of each case before subsequent cleaning was initiated. Statistical analysis was performed to determine if the anesthesia machine wrap was effective in reducing the bacterial load on the anesthesia machine over the course of the surgical case.

Analysis of the Evidence: Wilcoxon signed rank tests were used to assess the ability of the anesthesia machine wrap to reduce the density of microorganism growth. Anesthesia machines covered with the protective barrier had a statistically significant reduction in global density of bacterial colony formation across all hot spots as compared with the unwrapped machines, with the exception of the adjustable pressure limiting valve. As several of the operating rooms were used repeatedly, it was possible to trace the density and diversity of bacterial contamination over time. The study revealed a stable or decreasing volume of bacteria on the covered machines and an increase in both density and bacterial species on the uncovered machines, despite identical disinfection protocols between cases.

Recommendation for Practice: This study was the first to examine the use of a barrier that wrapped the entire machine, reducing cross-contamination between machine and patient, decreasing transmission between cases. The barrier device as designed is cumbersome to place, although easily removed in the event of emergent need to interact with the machine in a manner in which the device could impede the practitioner. As such, the device may not have a place in routine anesthesia delivery. The device may have a significant impact in cases in which advanced protection of the patient or workstation is critical (eg, hepatitis, HIV, or antibiotic resistant strains of bacteria). The device is a low-cost solution that is effective in the prevention of cross-contamination between the anesthesia machine and the patient.

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A47

Can Sugammadex Reverse Rocuronium-Induced Anaphylaxis?

Meredith Saccone, BSN, RN

Columbia University School of Nursing

Introduction: Sugammadex is a modified γ -cyclodextrin that encapsulates aminosteroid NDMBs, propagating robust reversal of paralysis. Rocuronium is an established cause of hypersensitivity reactions and accounts for approximately 60% of intraoperative cases of anaphylaxis. In several case reports, sugammadex restored hemodynamic stability in rocuronium-induced anaphylaxis that was refractory to standard therapy alone.

Methods: Case studies and reviews indicate that rocuronium-induced anaphylaxis may be reversed by sugammadex. Conclusive clinical randomized controlled trials (RCTs) are lacking due to ethical considerations. Preclinical trials and cutaneous models provide limited but relevant insight into a potential role of sugammadex in the treatment of rocuronium-induced hypersensitivity reactions. Authors hypothesize that encapsulation of rocuronium's allergenic quaternary ammonium ion prevents IgE-antibody binding and subsequent immunological cascade. Evidence also suggests that sugammadex directly attenuates mast cell degranulation and non-IgE-mediated anaphylactoid reactions.

Analysis of the Evidence: A search was conducted using CLIO, PubMed, Google Scholar, and Web of Science for scholarly literature published between 2013 and the present using the search terms: sugammadex, intraoperative anaphylaxis, rocuronium-induced anaphylaxis reversal, and rocuronium hypersensitivity. Twenty articles comprised of 7 case reports, 2 case-control studies, 5 literature reviews, 3 editorials, and RCTs were chosen for review. Two articles published in 2012 were included due to their immediate relevance to current literature informing the topic. One case study published in French was translated into English using Google Translate.

Recommendation for Practice: Sugammadex does appear to alter immune responses to rocuronium; however, the mechanism remains elusive. Sugammadex may impede anaphylactoid responses to rocuronium via the recently identified mast cell-specific MRGPRX2 receptor. Observed hemodynamic improvement may also be attributable to restoration of muscle tone and thus venous return and cardiac output; removal of rocuronium from circulation, which prevents further mediator release and allows epinephrine to work more effectively; or coincidental decrudescence. Data are insufficient to support sugammadex as first-line therapy; established protocols remain the gold standard for anaphylaxis treatment. It is reasonable to consider adjunct sugammadex if standard therapy is ineffective, and suspicion exists that rocuronium is the causative agent. Anecdotal data suggest sugammadex is most effective at high doses (~16 mg/kg) early in the course of anaphylaxis.

A48

Clinical Effectiveness of Transverse Abdominis Plane (TAP) Block in Postcesarean Pain Management Compared With Spinal and Epidural Alone: A Quality Improvement Project

Anika Dianez, RN; COL Derrick C. Glymph, DNAP, CRNA, ARNP, ANC, USAR; Vicente Behrens, MD
Florida International University

Introduction: Ineffective postcesarean pain management can lead to delayed recovery, ineffective maternal bonding, increased use of opioids, and postpartum depression. TAP blocks have been commonly used during enhanced recovery after surgery (ERAS) protocols and for cesarean delivery in 2008. Its benefits include long-term analgesic effects and facilitation of early ambulation with minimal side effects.

Methods: Data collection was focused on the identification of available randomized controlled trials in agreement with Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines and relevant to the PICO question: In parturients age 18 to 35 undergoing cesarean section (P), who receive transverse abdominis plane (TAP) blocks and regional (I) compared with just regional blockade with spinal or epidural (C) report decreased pain, opioid requirement and nausea and vomiting (O)? A total of 12 level I randomized controlled trials were chosen from the PubMed, Cochrane, and CINAHL databases. Inclusion criteria were human test subjects, female gender, ages 18 to 35, parturients undergoing cesarean section.

Analysis of the Evidence: There was a statically significant reduction of postoperative consumption of intravenous and oral opioid analgesics. Rest and ambulation pain scores were reduced after the administration of TAP blocks during the first 24-hour period. Also, opioid related side effects, like nausea and vomiting, had a reduced incidence in the intervention group subjects. When evaluated, patients who received TAP blocks reported an increased satisfaction with their labor and recovery experience than those with spinal and epidural alone. Nevertheless, further research is needed to evaluate the incidence of chronic pain and other regional anesthesia related complications.

Recommendation for Practice: Future research would benefit from a different study perspective. For example, 1 important variable is the influence of the patient's preferences about the background training and professional behavior from the practitioner. Psychoeducational interventions are a cost-effective technique to educate our patients so they can make an informed decision. Additionally, these may include the development of assessment tools during the early discharge period that help identify unexpected side effects outside the hospital setting. Specific population groups that would benefit from individualized studies include those with substance abuse, systemic comorbidities, mental conditions, obesity, and minors.

A49

Critical-Thinking Development in Nurse Anesthesia Learners: Addressing Barriers to Problem-Based Learning

Kristin J. Henderson, DNAP, CRNA; Elisha R. Coppens, DNAP, CRNA; Paul N. Austin, PhD, CRNA

Texas Wesleyan University

Introduction: Active learning methods such as problem-based learning (PBL) not only focus on learners' ability to understand concepts using their skills but also encourages students to learn by applying their personal experience. However, its implementation can be impeded by faculty, student, and resource barriers. We sought to identify methods to address these barriers.

Methods: The PICO question was: What are the barriers to successful implementation (outcome) of problem-based learning (PBL) (intervention) in nurse anesthesia education (population)? Traditional lecture-based approach was the implied comparison. The search for evidence using PubMed, the Cochrane Library, Education Resources Information Center, Google Scholar, and the Cumulative Index of Nursing and Allied Health Literature resulted in 47 potential evidence sources. Twenty descriptive studies (8 case reports, 3 mixed methods surveys, 9 surveys), 2 systematic reviews and 1 systematic review meta-analysis met the inclusion criteria. Study settings included medical schools, nursing educations, and other graduate medical education specialties.

Analysis of the Evidence: The evidence identified 3 categories of barriers to PBL implementation in graduate health profession education: faculty, student, and resources. The faculty barriers included a lack of buy-in to the value of PBL, lack of training, the need to commit additional time, and resistance to change. Student barriers were fear and discomfort due to inexperience with PBL and increased time toward learning activities. Resource barriers noted were the need for more instructors to facilitate small groups, support personnel needed to coordinate activities, and private rooms for PBL groups to meet.

Recommendation for Practice: Interventions supported by the evidence addressing faculty barriers included education and training about PBL, discussion of concerns, and allow for additional faculty time. Interventions for student concerns included providing PBL examples and basic cases, discussing concerns, providing positive reinforcement and encouraging students' input. Resource interventions included training adjunct instructors and support personnel and staggering PBL sessions. These findings can be used to help implement PBL in nurse anesthesia curriculum and plan future PBL-related research.

A50

Cultural Competence in Nurse Anesthesia

Amanda Brown, BSN, RN; Beth Ann Clayton, DNP, CRNA; Gordon Gillespie, PhD, DNP, RN
University of Cincinnati

Introduction: Culturally competent care is a mechanism to reduce health disparities experienced by diverse patients. Nurse anesthetists lack diversity as a profession, indicating a critical need for cultural competence. This evidence-based project determines the cultural competence gained from a nurse anesthesia program and possible revisions to improve the cultural competence of nurse anesthetist graduates.

Methods: The research question used as the basis for this project was: Does specific curriculum language improve cultural competence compared with current curriculum language improve the cultural competence of nurse anesthesia students prior to graduation? MeSH term and keyword searches using anesthesia, nursing, cultural competence, education, and curriculum were performed on PubMed, CINAHL, and Cochrane databases. Results were initially limited to publications after 2012, published in English; however, the date limitation was removed to increase the number of results. After removing duplicates and extraneous results, 1 meta-analysis and more than 30 qualitative studies and expert opinion articles were reviewed to determine the best mechanism to develop cultural competence for nurse anesthetists.

Analysis of the Evidence: A paucity of information about cultural competence and diversity within nurse anesthesia was identified; expanding the search to include the overall field of nursing provided an abundance of results. Various themes were identified from the analysis of literature: nurse educators feel unprepared to teach cultural competence curriculum, a lack of consensus on the most effective mechanism to teach cultural competence, no evaluation tool to assess cultural competence, and students enjoyed the experiences gained from cultural competence education activities. Effective teaching modalities include activities such as reflective journaling and open discussions.

Recommendation for Practice: Students from the University of Cincinnati Nurse Anesthesia Program were surveyed, first-year students as a control and third-year students as the intervention, to examine the effect of exposure to the nurse anesthesia program on their cultural competence. Though some survey questions had significant differences between the control and intervention groups, the control group tended to show more cultural competence than the intervention, indicating failure of the program to improve the cultural competence of students. Establishing diversity language within curriculum objectives places a long-term focus upon cultural competence for nurse anesthesia programs.

A51

Do Anesthesia Providers Who Experience Production Pressure Have a Higher Incidence of Medical Errors as Compared With Those Who Do Not Experience Production Pressure

Jodi-Ann Elliston, BSN, RN; Jorge Valdes, DNP, CRNA, ARNP; Johanna Newman, DNAP, CRNA

Florida International University

Introduction: Emphasis placed on efficiency encourages staff to work faster while minimizing cost. Anesthesia providers are expected to provide fast and efficient care often compromising safety. Production pressure can be a barrier to patient safety contributing to medical errors. Reduction of production pressure will decrease medical error, improve patient safety, and improve anesthesia provider well-being.

Methods: The purpose of this evidence-based project is to answer the following clinical question: Do Anesthesia providers who experience production pressure have a higher incidence of medical errors as compared with those who do not experience production pressure. Inclusion criteria addressed production pressures, workload, fatigue, and stress in anesthesia providers and their relationship with medical errors. Study characteristics included author, publication year, design, sample size, measurements, data analysis, findings, and level of quality. Twelve articles were included for analysis, 6 were cross-sectional survey descriptive studies, 3 were literature reviews, and 3 were qualitative study articles.

Analysis of the Evidence: Production pressure is a significant contributor to medical errors, fatigue, and burnout of anesthesia providers. Medical error is a systematic problem rather than the result of individual misconduct. Production pressure has not been extensively assessed as an important cause of systematic error. Of the 12 studies included, half were surveys. In 1 study, 80.9% of respondents agreed that production pressures had a negative impact on patient safety. The results were significant and generalizable. Maladaptive behaviors are used to cope with production pressures, allowing providers to go faster or perhaps cheaper with an increased risk of catastrophic events.

Recommendation for Practice: Production pressures in anesthesia can compromise patient safety. Negative effects associated with production pressure include adverse patient events, fatigue/burnout, increased workload, and depression of providers. Further research is needed on the role of production pressure, medical errors, and potential tools to mitigate these errors. The correlation between cost saving of speeding up production times is unknown. Interventions, tools, and resources are needed to identify the most effective actions to decrease production pressure. Further studies should be conducted evaluating how perceived production pressure can be reduced by implementing different strategies.

A52

Does a Formalized Preceptor-Training Program Reduce Barriers and Improve Learning for SRNAs and CRNAs in the Clinical Setting

Gregory Baez, DNP, CRNA, ARNP; Ann Miller, DNP, CRNA, ARNP

Florida International University

Introduction: The proper training and development of certified registered nurse anesthetists (CRNAs) to the role of preceptor facilitates the psychosocial and developmental needs of student registered nurse anesthetists (SRNAs) and CRNAs. Preceptors are the main facilitators of clinical teaching, critical thinking, educational proficiency, and professionalism. The proper development of preceptors not only influences the healthcare delivery in the present but also for future iterations.

Methods: The purpose of this evidence-based project was to answer the following clinical question: For CRNA and SRNA students, does a CRNA preceptor program versus no preceptor training program reduce barriers in learning, increase preceptor satisfaction, and improved preceptor effectiveness. Inclusion criteria addressed preceptor training and nursing student outcomes in nurse anesthesia. Study characteristics included author, publication year, conceptual framework, design, sample size, major variables, measurements, data analysis, findings, and level of quality based on Johns Hopkins Evidence-Based Practice Research Evidence Appraisal Tool. Eight articles were included for analysis: 3 randomized controlled trials, 2 cross-sectional survey descriptive studies, and 3 descriptive quantitative studies.

Analysis of the Evidence: A quasi-experimental design evaluated a preceptorship program in decreasing nurses' turnover rate, cost, quality, and satisfaction of preceptor's teaching. Turnover after the preceptorship program was 46.5% less, with a savings of \$186,102 in 3 months. An experimental design looked at a formalized preceptor training program for RNs and found that the implementation of a preceptor training program improved RNs' knowledge of teaching and teaching strategies. A descriptive correlation design determined interrelationships between variables pertaining to preceptors' perceptions of benefits and reward. The study concluded preceptors will be committed to the preceptor role.

Recommendation for Practice: The empirical evidence shows a formalized preceptor program establishes the role and responsibilities of preceptors in instructing new nurses and addresses the concerns of turnover, cost, quality of care, communication, and independent decision-making. The preceptor's role is critical in explaining, encouraging and translating concepts into practice and decreasing the theory-practice gap. A formalized preceptor training program will provide positive outcomes for all stakeholders to enhance student learning and decrease barriers of learning. Preceptor development has a positive impact on the preceptee development allowing for the development of the preceptee into the new role of CRNA.

A53

Does Under Drape Suctioning, Drape Tenting, and Minimal Oxygen Delivery During Monitored Anesthesia Care Cases Using Open Oxygen Delivery Device (eg, Nasal Cannula, Face Mask) Decrease the Risk of Operating Room Fire?

Izaskun Green, BSN, RN

Florida International University

Introduction: Surgical fires caused by a collection of oxygen beneath surgical drapes is a well-characterized, readily preventable catastrophe that arises when the fire triad is present in the operating room. Concerns regarding prolonged length of hospital stay, acquired infection, and financial impact due to severe burns has prompted a move to adopt interventions to reduce the risk of surgical fires.

Methods: The purpose of this evidence-based project was to answer the following clinical question: In surgeries around the face, head, or neck, do interventions provided by the anesthesia provider compared with standard practice affect the reduction of surgical fires in the operating room? Inclusion criteria addressed drape suctioning, drape tenting, and minimal oxygen delivery to reduce the risk of surgical fires. Study characteristics included publication year, conceptual framework, design, sample size, data analysis, findings, and level of quality based on Johns Hopkins Evidence-Based Practice Research Evidence Appraisal Tool. Seven studies were included for analysis; 3 randomized controlled trials, 1 experimental, 2 research journal articles, and 1 retrospective cohort study.

Analysis of the Evidence: A randomized controlled trial described the effects of nasal cannula oxygen administration at facial and adjacent landmarks. Oxygen concentration at facial landmarks were greater when oxygen was given at a rate of 6 L/min than at 2 L/min or 4 L/min. To reduce combustion risk, ignition sources should be kept at least 10 cm from the oxygen outlet when nasal cannula is used at a flow rate greater than 4 L/min. An experimental design looked at the effects of intraoral suction with strategic drape tenting to reduce oxygen enriched surgical environments. Their results suggested that oxygen levels around a patient's face during facial surgery was 40% reduced through the use of both techniques.

Recommendation for Practice: The empirical evidence shows most reported surgical fires implicate the pooling of oxygen beneath surgical drapes or within the operative site. Recommended measures to mitigate oxygen pooling include the use of vacuum suction and oxygen flow rate less than 4 L/min to decrease ambient oxygen concentration. Interventions aim to reduce the available oxidizer in the surgical field that can be readily performed by the anesthetist provider. This reduces the risk of an operating room fire in meeting Centers for Medicare & Medicaid Services guidelines for safe, quality, cost-effective care.

A54

Effective Analgesia for Elective Cesarean Delivery with Neuraxial Anesthesia

Alina Adams, BSN, RN

Florida Gulf Coast University

Introduction: In 2015, approximately 1.33 million of the 3.98 million births recorded in America were via cesarean delivery. The percentage of births by cesarean delivery in the United States has increased from 20.7% to 32.0% from 1996 to 2015. Safest anesthesia for elective cesarean delivery is neuraxial blockade; current recommendations include intrathecal opioids and advances in technology that provide opportunity for integration of transversus abdominis plane (TAP) block.

Methods: The following PICO question served as a guide: What is the best approach to manage postoperative pain for elective cesarean section? Electronic databases were used including PubMed, Cochrane, and Trip Database. Search terms included cesarean analgesia, intrathecal opioids, transversus abdominis plane blocks cesarean, enhanced recovery cesarean section, pain management cesarean, and combined spinal epidural cesarean. Approximately 3,500 search results were obtained that were narrowed down to 98 articles after screening of titles and abstracts. Of those, 11 citations were chosen with the inclusion criteria of human subjects, research within the last 10 years, and acute pain relief. Research surrounding emergent cesarean sections was excluded. Articles chosen include systematic reviews, randomized controlled trials, retrospective studies, and meta-analyses.

Analysis of the Evidence: TAP blocks significantly decrease pain at rest compared with placebo or no TAP blocks, morphine consumption significantly decreased with TAP blocks. Another benefit from integration of TAP blocks included decreased oral narcotic use leading to fewer maternal side effects. Intrathecal morphine in combination with TAP blocks provided better pain control, but as the dose increased so did frequency of side effects including moderate to severe nausea and pruritis requiring treatment. First request for supplemental morphine was significantly longer in patients who received TAP block in addition to epidural morphine with combined spinal-epidural anesthesia. There was a significantly shorter time required for getting up, walking, and gastrointestinal reestablishment in patients with TAP block.

Recommendation for Practice: Evidence supports that morphine remains an excellent method for analgesia whether it is given in the intrathecal or epidural space. Technology for ultrasound-guided TAP blocks is available, and research supports implementation into practice to decrease narcotic consumption. The combination of low-dose (50-100 mcg) intrathecal opioids with TAP blocks for postsurgical pain was shown to decrease oral and IV opioids that decreases side effects such as nausea, vomiting, and pruritis. Integration of the TAP block should be considered as an aspect of multimodal pain control as well as enhanced recovery for cesarean delivery.

A55

Effectiveness of Pectoral Nerve Block I/II in Patients Undergoing Breast Cancer Surgery

Lester Pineda, BSN, RN, CCRN

Florida International University

Introduction: In 2017, the CDC reported an estimated 252,000 cases of breast cancer. The use of volatile anesthetics and opioids increases the risks of breast cancer recurrence and metastasis in women undergoing breast cancer surgery. Regional anesthetic techniques decrease the use of opioids in the perioperative setting. Ultrasound technology has led to the advent of PECS I/II block for breast surgeries.

Methods: The purpose of this systematic review was to answer the following clinical question: In patients presenting for breast cancer surgery, does a pectoral nerve block I/II compared with paravertebral nerve block, general anesthesia, or narcotic techniques decrease postoperative pain, nausea, vomiting, and opioid utilization. Inclusion criteria consisted of women undergoing unilateral radical or modified radical mastectomy with axillary node dissection or lumpectomy using a general anesthetic technique in addition to a PECS I/II block, thoracic paravertebral block (PVB), or narcotic technique. MEDLINE, PubMed, CINAHL, and Cochrane Database were used to retrieve the empirical evidence. Ten articles were included for analysis: 7 randomized controlled trials, 2 retrospective studies, and 1 case study.

Analysis of the Evidence: A randomized controlled trial comparing the analgesic efficacy of a PECS I/II to that of a general anesthetic in female patients undergoing a unilateral modified radical mastectomy showed a decrease of 50% in intraoperative fentanyl consumption in the PECS I/II group. In a double blind randomized controlled trial, a PECS I/II block decreased morphine consumption by 5 mg in the postoperative period in breast cancer surgery patients. A randomized controlled trial measured the numerical rating scale (NRS) of patients receiving a PECS I/II block or a thoracic PVB. The PECS I/II group had significant lower postoperative NRS scores in the first 12 hours when compared with the thoracic PVB group.

Recommendation for Practice: The empirical evidence supports the use of a PECS I/II block for women undergoing breast cancer surgery over a PVB and a general anesthetic. The PECS I/II block is a less invasive regional anesthetic technique that effectively reduces opioid consumption in the perioperative setting while providing adequate analgesia. When compared with thoracic PVBs, PECS I/II block is a safer anesthesia option as it carries less risk of complications, decreases nausea, vomiting, breast cancer recurrence, metastasis, and overall cost of breast cancer treatment. The advantages of a PECS block should be exploited in order to deliver better care for patients undergoing surgical treatment for breast cancer.

A56

Effectiveness of Stellate Ganglion Blockade on Refractory Ventricular Arrhythmias: A Systematic Review

Elizabeth Clair Mayo, BS, ADN, RN; Narbelito V. Lloren, BSN, RN

Texas Christian University

Introduction: Ventricular arrhythmias are life threatening and difficult to treat. Sympathetic stimulation releases norepinephrine, increasing activity in the heart. When standard treatments fail, other interventions can reduce sympathetic activity by way of the stellate ganglion. This review examines the effectiveness of ultrasound-guided stellate ganglion blockade for treatment of ventricular arrhythmias.

Methods: The search strategy aimed to discover both published as well as unpublished studies in English. The databases searched included Embase, PubMed, and Web of Science. Trial registries included ClinicalTrials.gov and Cochrane Central Register of Controlled Trials. The search for unpublished studies included ProQuest Dissertations and Theses and MEDNAR. As of April 2018, our search strategy resulted in 3,132 nonduplicate articles. Based on abstract and title, 34 articles were screened independently, after assessment of full text, by primary and secondary reviewers. A total of 15 articles were found to be relevant based on inclusion criteria. Due to the topic, there were not any randomized controlled trials performed in humans.

Analysis of the Evidence: The results revealed ultrasound-guided stellate ganglion block can provide temporary relief of ventricular arrhythmias, allowing for patient stabilization and a plan for a long-term treatment. The arrhythmias free period varied from case to case. A successful block was identified in many reports by ipsilateral Horner syndrome and observation of diffusion. No complications were reported. Study limitations were: all studies were retrospective case reports and case series resulting in a small sample size, lack of consistency in treatment before the block, differences in the amount and type of local anesthetic used, and some of the outcomes intended to be measured were unavailable.

Recommendation for Practice: Refractory ventricular arrhythmias are life threatening, difficult to treat, and are associated with a high mortality rate. The results of our systematic review support using an ultrasound-guided stellate ganglion block as an adjunctive treatment for refractory ventricular arrhythmias. Education on its use as an adjunctive therapy for refractory ventricular arrhythmias can potentially provide a life-saving bridge to treatment for a condition that would otherwise have a poor prognosis. Further research is needed to fully demonstrate the safety and efficacy of stellate ganglion block in treating refractory ventricular arrhythmias.

A57

Effects of Mindfulness Training on Perceived Stress and Emotional Wellness in Nurse Anesthesia Students

Brian Deatley, BSN, RN

University of Cincinnati

Introduction: Diversion of narcotics, alcohol abuse, and social isolation are just a few maladaptive coping strategies that are evident in nurse anesthesia students throughout the country and will ultimately lead to academic/clinical failure, legal consequences, burnout, depression, and potential suicidal ideation. The purpose of this study is to educate students on adaptive coping mechanisms, such as mindfulness.

Methods: PICOT: How will implementing an abbreviated mindfulness-based stress reduction (MBSR) course affect the perceived stress and emotional wellness of a pilot group of nurse anesthesia students during their program? Databases included PubMed, SCOPUS, and CINAHL, yielding a total of 228 articles using the keywords: stress, psychological; stress reduction; mindfulness; meditation; nurse; students; and nurse anesthesia. Articles that lacked generalizability and relevance were excluded. Thirty-five articles were analyzed including randomized controlled trials, controlled trials, systematic reviews, literature reviews, qualitative studies, and meta-analyses.

Analysis of the Evidence: Studies have shown mindfulness to be associated with decreased levels of stress and anxiety; improved emotional, mental and physiological regulation; and promotion of brain plasticity. Nurse anesthesia education is highly stressful. While stress cannot be eradicated from the practice of anesthesia, it can be managed, especially when recognized early. Common stressors include entering a new field of practice, dealing with critically ill patients, becoming a graduate student, losing financial stability and a decreased level of autonomy. High stress levels can have negative effects on the health and well-being of students. Drug abuse, narcotic diversion, depression, and suicidal ideation are probable problems in this profession.

Recommendation for Practice: It is evident that there is a need for implementing mindfulness to improve the emotional effects of stress, as well as decrease the level of stress and anxiety in nurse anesthesia programs. There is a substantial amount of data concluding that MBSR can lower stress, anxiety, and improve depression. While there is no data on the need for improved emotional wellness for these students, there is evidence supporting that mindfulness can improve the aspects of emotional regulation, which is significantly affected by stress and anxiety.

A58

Efficacy of Beta Blocker in Preventing POAF in Cardiac Surgery

Vivien Li, BSN, RN; COL Derrick C. Glymph, DNP, CRNA, ARNP, ANC, USAR

Florida International University

Introduction: Postoperative atrial fibrillation (POAF) is most common arrhythmia after cardiac thoracic surgery, even higher after valve-replacement surgery. POAF increases expenses in healthcare, hospital readmission rate, and greatly increases mortality rate. The purpose of this evidence-based practice research is to evaluate the best empirical evidence on the effectiveness in reducing POAF by the preoperative administration of beta blocker compared with non-beta blocker administration.

Methods: The study is utilizing systematic review from recent 10 year of literature to examine whether adult patients who are not on beta blockers after cardiac thoracic surgery compared with prophylactic administration of beta blockers have a higher incidence of developing POAF. Study characteristics includes author, year, design method, sample and setting, variables, study method, and significant findings. Among the 13 selected studies, it included 2 retrospective cohort studies, 5 meta-analysis studies and 6 randomized controlled trials .

Analysis of the Evidence: In a randomized controlled trial, the beta blocker was administered from the beginning of the operation until postoperative day 2. The incidence of atrial fibrillation was significantly lower in the beta blocker group compared with the control group. However, 1 meta-analysis included 506,110 patients 18 years and older undergoing nonemergent CABG surgery who had not experienced a myocardial infarction in the prior 21 days or any other high-risk presenting symptom. There is no significant difference between patients who did and did not receive preoperative beta blockers in rates of operative mortality, stroke, prolonged ventilation, renal failure, and deep sternal wound infection.

Recommendation for Practice: Whether to administer beta blockers should be based on individual scenarios. For patients who have high risk of developing atrial fibrillation, such as recent myocardial infarction less than a month or history of atrial or ventricular arrhythmias, beta blockers are highly recommended to continue until the day of surgery. On the contrary, for patients who don't have a history of myocardial infarction or any cardiac distress are not necessarily given beta blocker preoperatively.

A59

Electronic Risk Stratification to Prevent Postoperative Nausea and Vomiting

LT Rusty Bledsoe, BSN, RN; LT Michelle Hamrick, BSN, RN; LCDR Chad Moore, DNP, CRNA; CDR Raymond Bonds, DNP, CRNA; CDR Kenneth Wofford, PhD, CRNA

Uniformed Services University

Introduction: Postoperative nausea and vomiting (PONV) causes patient distress and strains resources. In research and clinical practice, the Apfel simplified score preoperatively estimates risk for PONV from 10% to 80% and improves prophylaxis. This systematic review evaluates the effect of PONV risk scoring on incidence of PONV in the postanesthesia care unit to inform the development of a real-time tool embedded in the electronic medical record.

Methods: In patients having surgery, when an electronic Apfel simplified score is used to assess risk for PONV compared with using no scoring system, will rates of PONV be reduced or management of PONV improved during the perioperative period? PubMed and Cumulative Index of Nursing and Allied Health Literature (CINAHL) databases were searched for: Apfel score, postoperative nausea and vomiting, electronic medical record, computerized decision support tool, electronic clinical support tool, “provider compliance, provider adherence, and guideline adherence. Limits included: 2006 to 2016, English language, and adult populations. After full-text review, 7 met criteria and were included for analysis.

Analysis of the Evidence: The Johns Hopkins Nursing Evidence Appraisal Tool was used to evaluate quality. One systematic review and 6 Level IV retrospective cohort, prospective observational, or prospective cohort studies were included—4 high and 3 good quality. All studies used Apfel criteria. When measured, electronic decision support increased PONV prophylaxis in 6 of 6 studies and decreased PONV in 4 of 5 of these studies.

Recommendation for Practice: Standardized risk assessment and evidence-based prophylaxis for PONV is recommended by adapting the Apfel simplified score to the electronic medical record. Standardized and consistently applied risk assessment and prophylaxis will result in reduced PONV rates, with concurrent improvements in the patient experience and reductions in the cost of care. This project has provided a template for other military treatment facilities seeking to improve the experience of patients undergoing outpatient surgery and contain per capita cost.

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A60

Enhanced Recovery After Surgery (ERAS): Its Role in Postoperative Outcomes for Patients Undergoing Radical Cystectomy

Lauren Krauss, BSN

Florida International University

Introduction: Radical cystectomy (RC) is the standard treatment for patients diagnosed with invasive bladder cancer, yet it carries a high risk for morbidity and mortality. The urological community is beginning to adopt enhanced recovery after surgery (ERAS) protocols for RC, but there is still skepticism about their utility in this population. The purpose of this research is to evaluate the outcomes of implementing ERAS protocols for RC.

Methods: An electronic database search was performed to find evidence that answered the PICO question: Do enhanced recovery after surgery programs shorten postoperative length of stay compared with standard care (SC) in patients undergoing urinary diversion procedures? Databases searched included the Cochrane Database of Systematic Reviews, MEDLINE, and CINAHL. Key terms included ERAS, enhanced recovery after surgery, fast track, urinary diversion, radical cystectomy, and urology. The main outcome of interest in this review was length of stay (LOS), and secondary measures included complication and readmission rates. The final review resulted in 15 studies consisting of 2 randomized controlled trials and 13 quasi-experimental studies.

Analysis of the Evidence: Eleven studies found a statistically significant reduction in LOS between their pre-ERAS and ERAS cohorts. The studies reporting significant reductions in LOS, averaged decreases between 0.5 and 14 days, with the majority reporting 1 to 4 day decreases in postoperative days. Four studies reported no significant reduction in LOS after an ERAS protocol was implemented, including a large randomized controlled trial. The results on complication and readmission rates was robust, with no study finding a significant increase in either outcome with the implementation of an ERAS protocol.

Recommendation for Practice: There is accruing evidence supporting the use of ERAS pathways in radical cystectomy patients. Moreover, today's healthcare systems are pressured by escalating costs in a progressively complex healthcare system. Enhanced recovery protocols, or evidence-based care pathways, aim to minimize surgical stress, decrease clinical performance variances, and streamline postoperative recovery. Implementation of ERAS pathways for radical cystectomy offers an opportunity for providers to improve patient outcomes while concurrently limiting costs.

A61

Enhanced Recovery After Surgery for Pediatric Colorectal Patients

Amber Craver, MSN, CRNA; Brian Hall, MS, CRNA; Sarah Rutledge, MSN, CRNA

Nationwide Children's Hospital

Introduction: Enhanced recovery after surgery protocols (ERAS) have been shown to decrease opioid consumption and hospital stay in adults. We see benefit in translating these practices to pediatrics. Children undergoing colorectal surgery have complex medical histories resulting in longer hospital stays. Using a multimodal anesthetic, we propose to reduce stay and improve pain control.

Methods: In pediatric patients undergoing colorectal surgery, we assessed how a multimodal drug and regional anesthetic may compare with conventional anesthetic delivery methods on postoperative opioid consumption and length of hospitalization. A literature review was done using PubMed and Google Scholar to obtain evidence-based practice for our protocol. Migjuan et al evaluated pharmacologic and nonpharmacologic components of a multimodal anesthetic based on evidence from key reviews of ERAS protocols. Zhu et al examined meta-analyses, and randomized controlled trials that evaluated preoperative or intraoperative use of nonopioid medications in a pediatric surgical population.

Analysis of the Evidence: Regional and neuraxial techniques decreased postoperative opioid use, accelerated return of bowel function and length of stay following colorectal surgery. Intravenous acetaminophen reduced opioid consumption by 30%. Lidocaine infusions were associated with lower incidence of ileus and reduced opioid consumption following colorectal surgery. Ketamine reduced postoperative opioid requirements and decreased stay following colonic resection. Gabapentin reduced opioid consumption and lessened pain when included in a multimodal anesthetic. Dexmedetomidine decreased postoperative opioid consumption, pain intensity, and opioid-related side effects.

Recommendation for Practice: Our recommendation is that patients drink electrolyte based drinks until 2 hours prior to surgery. The patient will also receive gabapentin and acetaminophen preoperatively. Intraoperatively, patients will receive a mid-thoracic epidural, bilateral TAP blocks, or a lidocaine infusion. A ketamine and dexmedetomidine bolus and infusion will be administered as adjuvants. Dexamethasone and ketorolac will also be given as appropriate. Fluid administration will be limited, with albumin and blood products as needed. Postoperatively, acetaminophen and ibuprofen will be alternated every 6 hours to reduce need for opioids for breakthrough pain.

A62

**Evaluating Outcomes of Adult Patients Experiencing Spinal Surgery in a Community Hospital:
Addressing the Need for a Standardized Perioperative Multimodal Analgesic Approach**

Bruce Weiner, DNP, MSNA, CRNA; John Maye, PhD, CRNA

University of South Florida

Introduction: Evidence-based strategies such as enhanced recovery after surgery (ERAS) programs, implemented throughout the perioperative period, have significantly improved patient outcomes and decreased hospital length of stays. Spine surgery creates a challenge due to surgical complexity, patients' history of chronic pain, and postoperative patient expectations. Research has suggested that implementing the components of an ERAS protocol can improve outcomes in spine surgery patients.

Methods: The primary objective of this project was to develop a quality improvement initiative that evaluated outcomes of patients who underwent 2 to 5 level posterior lumbar spine fusion in order to develop a standardized perioperative multimodal analgesic approach with emphasis on preemptive pain control strategies. A search of literature was conducted using PubMed and search terms: ERAS and spine, multimodal pain management and spine, non-opioid analgesia, and preemptive analgesia and spine. The initial search returned 630 results; 31 were relevant to the topic of ERAS and preemptive multimodal analgesia in spine and total joint arthroplasty. Of those 31 studies, 5 addressed the use of multimodal analgesia in spine surgery. Using the Johns Hopkins Nursing Evidence-Based Appraisal, the evidence was found to be strong, compelling with consistent results, and applicable to practice.

Analysis of the Evidence: Recent research has suggested that implementing the components of an ERAS protocol can improve outcomes in spine surgery patients. In a 2013 investigation, the use of an extensive preemptive multimodal analgesic approach demonstrated a significantly lower level of opioid consumption on postoperative day 1 and day 2 when compared with the control group. In a 2016 investigation, adults patients undergoing multilevel posterior spine fusion (N=80) receiving preemptive and multimodal analgesia had significantly lower visual analog pain scores than the control group that received no preemptive medications. A 2015 investigation found that poorly controlled pain after spine surgery led to a decrease in mobilization and an increase in complications and hospital length of stay.

Recommendation for Practice: Following IRB approval, a retrospective chart review was conducted on 48 patients at a Florida-based hospital who experienced a 2 to 5 level posterior spinal fusion between January 1, 2016 and December 31, 2016. The results and analysis of data confirmed the challenges in managing postoperative pain. Numeric pain scores steadily increased over the first 72 hours following postanesthesia care unit (PACU) discharge. Opioid requirements in the first 24 hours (M=168.99 +/- 193.01) increased significantly from PACU discharge. The extreme variability in standard deviations in opioid consumption provides opportunity to implement a standardized perioperative multimodal analgesic approach with emphasis on preemptive strategies that potentially reduce opioid consumption and hospital length of stay.

A63

Examination of Medication Errors in Pediatric Operating Rooms

Leah Bergman, MS, CRNA; Heather Frankenfield, MS, CRNA; Amanda Dickert, MS, CRNA; Buffy Krauser Lupear, DNP, CRNA, APRN

Vanderbilt University Medical Center

Introduction: According to the Institute for Safe Medication Practices, CRNAs prepare and administer medications that are considered to be "high-alert", as part of their daily clinical practice; therefore, eliminating any opportunity for adverse medication events is a priority for every CRNA. The purpose of this narrative is to identify potential gaps in safe medication practices and whether the gap is due to lack of awareness, education, or clinical practice.

Methods: A literature review was conducted using the web of science; search terms were anesthesia and medication error, filters 2016-2017, and highly cited. A data collection tool, used for internal quality improvement (QI) initiative purposes only, was also created to audit the medication practices of the CRNAs. In January 2018, random audits were conducted of the medication practices of the CRNAs practicing in the pediatric operating room setting. The audits focused on safe medication practices, more specifically, proper medication labeling and preparation. In February 2018, a department-wide medication safety grand rounds education took place, outlining expectations and medication safety standards established by the Institute of Safe Medication Practices, USP 797, and the Centers for Disease Control. Following the medication safety education, compliance audits of the CRNA were resumed.

Analysis of the Evidence: The internal (QI) data was reviewed and analyzed. Since the departmental education on safe medication practices, and through continued use of the audit tool, an increase in compliance of safe medication practice in the areas of appropriate syringe labeling and preparation has been noted.

Recommendation for Practice: Education and awareness is critical to ensure safe medication practice. Useful methods to accomplish this are through auditing compliance and providing in-the-moment feedback to the CRNA. Through education and medication audits, we have identified opportunities for improvement and devised recommendations for medication practice change. The recommendations for medication practice change include, but are not limited to, not reconstituting medications using commercially prepared prefilled normal saline syringes, preparing medications for each "to-follow" case immediately prior to the case with administration within 1 hour of preparation, and properly labeling syringes and IV fluids with date, time, and initials of the person who prepared them.

A64

Gastric Content Measurement Utilizing Point-of-Care Ultrasound to Decrease Risk of Perioperative Aspiration

Elizabeth Diaz Agüero, BSN, RN; Ann B. Miller, DNP, CRNA, ARNP; Shayne D. Hauglum, PhD, CRNA, ARNP
Florida International University

Introduction: Gastric aspiration has a high incidence in the surgical population of up to 19%, related to patient and surgical factors. Pulmonary aspiration is linked to 9% of all anesthesia-related deaths. The mortality rate ranges from 30% to 70% once aspiration has occurred. Aspiration prevention for the surgical patient follows the standard ASA fasting guidelines and administration of pharmacological agents.

Methods: The purpose of this evidence-based systematic review was to answer the following clinical question: In all surgical patients, does the utilization of point-of-care ultrasound in the preoperative assessment of gastric contents compared with ASA fasting guidelines decrease the risk of aspiration, reduce morbidity, mortality and surgical delays in the intraoperative period? The databases searched were EMBASE, MEDLINE ProQuest, and National Library of Medicine's PubMed. The search was limited to articles from 2007 to present, human subjects, English language, and peer-reviewed articles. The exclusion criteria included literature reviews, anecdotal, and personal or opinion articles. Titles and abstracts were screened. Fourteen research studies were selected for critical appraisal.

Analysis of the Evidence: Observational studies described the qualitative characteristics of the antrum for surgical patients. The antrum containing clear fluids presents as a round shape, thin walled, and is hypoechoic. The antrum after the ingestion of milk was round and distended with increased echogenicity. Solid content gave the antrum the appearance of frosted glass, which impaired the visualization of deeper structures. The research consisted of observational studies that found a high correlation between cross-sectional antral area and gastric volume with a $p < 0.0001$. Multiple studies validate the use of point-of-care ultrasound on morbidly obese, pediatric, and pregnant women.

Recommendation for Practice: Point-of-care gastric ultrasound is a noninvasive reliable tool that can provide an accurate preoperative assessment of the quality and quantity of stomach contents for the surgical patient. Gastric ultrasound can be utilized in patients at risk for aspiration. Multiple studies covering healthy volunteers, patients ASA I through IV, obstetric, pediatric, and morbidly obese patients concluded that point-of-care ultrasound accurately assessed gastric volume to reduce aspiration, morbidity, and mortality. Gastric assessment as standard of care of the antral area took less than 2 minutes and meets the Centers for Medicare & Medicaid Services guidelines for safe, quality, cost-effective care.

A65

IMPACT: Inpatient Management With Preoperative Assessment Collaboration Tool

Jordan Ruf, BSN, RN; Jennifer Lanzillotta, MSN, CRNA; Beth Ann Clayton, DNP, CRNA; Erin Grawe, MD
University of Cincinnati

Introduction: Poor patient optimization preoperatively causes significant day of surgery cancellations. These cancellations result in financial consequences and decreased patient and provider satisfaction. Development of a decision-support screening tool allowed anesthesia providers to perform evidenced-based preoperative assessments for improved resource utilization, care coordination, and cost containment.

Methods: PICOT: For inpatients undergoing noncardiac surgery, does utilizing a decision-support screening tool during the preoperative assessment, compared with current clinical practice improve the preoperative assessment process? A literature search using peer-reviewed articles from PubMed, MEDLINE, CINAHL, Scopus, and EBSCOHost yielded 5 systematic reviews, 1 randomized controlled trial, 3 clinical practice guidelines, and multiple retrospective and prospective studies. A decision-support screening tool was derived from identified best practice recommendations and validated risk indices. The tool was coupled with a new workflow process and provider education. Evaluation compared preday and postday of surgery cancellation rates and included a preimplementation and postimplementation provider survey.

Analysis of the Evidence: Presurvey results indicated 29% of anesthesia providers agreed patient optimization was effective, and 0% agreed sufficient time was available preprocedure. Postsurvey results increased to 100% and 60% respectively. Assessing the new workflow process, 70% of providers had enough resources, and 85% felt the process was facile. Improvement areas include: increased time preprocedure to optimize, improved system for patient follow-up if needed, and additional providers to perform evaluations. In January 2018, 17 scheduled surgeries were canceled (11.1%). One month after implementation, the cancellation rate dropped to 5.4%, with only 9 cases canceled, producing the institution's lowest rate.

Recommendation for Practice: This intervention demonstrates the value of using a decision-support screening tool for the inpatient preoperative assessment. Implementing a standardized tool and process will improve adherence to best practice guidelines and allow for patient care optimization strategies preprocedure. This will, in turn, prevent unnecessary delays and cancellations, lead to improved patient and provider satisfaction, and decrease healthcare costs. Overall patient outcomes will improve by enabling a system for patient care optimization and decreasing preventable perioperative complications, benefiting the provider, the facility at large, and the at-risk inpatient population of the academic medical center.

A66

Implementation of a Mindfulness-Based Resilience Training for Anesthesia Providers

Jacqueline Mainwaring, DNP, MS, CRNA

Wilmington University

Introduction: Due to increasing practice pressure, staff shortages, caring for critically ill patients, an extreme sense of responsibility, and an increased workload with decreasing resources, CRNAs are at high risk for burnout. Burnout is a syndrome of depersonalization, emotional exhaustion, and reduced meaning or accomplishment. Mindfulness and resilience training can mitigate the effects of burnout.

Methods: PICOT question: How would a mindfulness-based resilience practice program impact burnout in anesthesia providers as assessed by comparing validated questionnaire results measuring mindfulness and resilience before training and 6-weeks postintervention? A comprehensive literature review was performed utilizing full-text articles from MEDLINE, CINAHL Complete, and OVID Nursing. Studies were screened relating to healthcare, mindfulness-based resilience interventions, anesthesia providers, perioperative providers, and high-quality, evidence-based research. Bibliographies were searched for relevant studies leaving a total of 28 articles included for use in this project, including 3 systematic reviews.

Analysis of the Evidence: In a systematic review of 46 studies on clinician well-being, burnout, and patient safety, researchers concluded burnout and lack of provider well-being are both significantly associated with poorer patient safety. Compared with clinicians at low-risk for burnout, self-reported errors were more common among those with poor well-being, anxiety, burnout, poor quality of life, and depression. A critical appraisal of the literature supports implementing a mindfulness-based resilience training program to mitigate the effects of burnout in anesthesia providers. Arming CRNAs with tools to combat burnout can positively impact patient safety and provider wellness.

Recommendation for Practice: Research suggests positive emotions correlate with resilience, mindfulness, work outcomes, physical health, and life satisfaction. Participants were asked to complete a prepractice survey, attend a lecture, complete a 2-week mindfulness-based resilience training exercise, and fill out a postexercise survey. Participants maintained a gratitude journal and wrote down 3 good things daily for 2 weeks. Research shows both these practices improve mindfulness and resilience that lasts 6 months postexercise. Despite quantitative data showing no significant change in mindfulness or resilience scores; 89.3% of participants reported a positive change in their outlook and attitude.

A67

Implementation of a Standardized Intraoperative Handoff Tool for Anesthesia Providers

CPT Shayna DeBarros, BSN, ANC, USA; CPT A. Noel Wilhoit, BSN, CCRN, ANC, USA

Uniform Services University of the Health Sciences

Introduction: Gaps in communication during transfers of care increase the risk of adverse outcomes as identified by the Institute of Medicine. Implementing an anesthesia-specific handoff tool can increase the quality of communication and potentially decrease adverse patient outcomes. The purpose of this project is to implement and evaluate the use of a standardized handoff tool between anesthesia providers with the goal of improving communication during intraoperative transitions in care.

Methods: PICO: Does utilizing a standardized anesthesia handoff tool during intraoperative transfer of care between anesthesia providers, compared with not utilizing a tool, impact the quality of communication, defined as the transfer of essential components of patient information, between anesthesia providers? As of January 2017, a literature review yielded 1,252 articles based on keyword search criteria. After further review of the abstracts and inclusion/exclusion criteria, 27 articles remained relevant to the PICO. After a full-text screening, 23 articles were excluded due to the lack of an anesthesia-specific standardized handoff tool within the study. The remaining 4 articles met evidence level 3 or higher.

Analysis of the Evidence: The aim of this project was to assess how an anesthesia-specific handoff tool impacts the quality of communication during intraoperative handoffs. Prior to implementing the tool, we observed intraoperative handoffs to evaluate current handoff practices and gauge provider attitude in using a standardized communication tool. Next, we provided department-wide education and training on the handoff protocol, and then conducted direct and indirect observations over a 4-week period. To evaluate for a change in the quality in communication, we measured 2 outcomes: the use of the handoff tool and its completeness. In comparing preimplementation and postimplementation results, there was an overall improvement in the quality of communication with the use of the anesthesia handoff tool.

Recommendation for Practice: We recommend an initial informal survey of anesthesia providers in the anesthesia department to assess for their willingness to use an anesthesia specific handoff tool. Next, we recommend the provision of education and training on the use of a tool while emphasizing its significance of its use that can lead to increased communication and improved outcomes for the patient. Following training, we recommend a trial period of use of the tool to enable providers to report back on its ease of use and applicability to local practices. When a final tool is chosen for implementation by the department, we recommend incorporation of the tool's use into local policy for future sustainment.

A68

Implementation of a Structured Peer Mentoring Program for Nurse Anesthesia Students

Emily Duncan, BSN, RN; Jennifer Lanzillotta, MSN, CRNA; Beth Ann Clayton, DNP, MS, CRNA; Lawrence O'Neal, PhD

University of Cincinnati

Introduction: Nurse anesthesia programs are competitive with demanding curricula; they are regarded as stressful for both social and academic reasons. A needs analysis identified the necessity to implement a structured peer mentoring program for nurse anesthesia students at a large university. The purpose of implementation is to decrease stress and improve clinical and didactic performance of first-year anesthesia students.

Methods: The following question was posed: "In nurse anesthesia students, how does the implementation of a structured peer mentoring program, versus an informal mentor pairing, affect clinical performance, didactic performance, and stress, within the first 18 months of CRNA school?" The MeSH terms nursing, anesthesia, mentors, students, and retention were used in the PubMed database search. After exclusion criteria, full-text evaluation, and assessment of level of evidence, 16 articles were reviewed. Two articles were meta-analyses of multiple controlled studies, 2 were quasi-experimental studies, 8 were nonexperimental (correlational descriptive or qualitative research), 3 were case reports/program evaluation data, and 1 qualified as opinion of respected authority.

Analysis of the Evidence: As a whole, nurse anesthesia programs lack stress management resources for students. Stress can affect the well being of students and interfere with clinical and didactic performance. As nurse anesthesia programs move from master's level to doctorate level, both program length and student expectations will increase. Structured peer mentoring programs have shown to decrease stress, provide social support, increase self-efficacy, and increase motivation among students. Peer mentors, as opposed to faculty mentors, have a unique advantage to help anesthesia students succeed in school. Clearly delineated expectations and compatibility among mentors and mentees are necessary for program success.

Recommendation for Practice: Mentor and mentee pairings should take into account hobbies/interests and prior relationships. This helps students bond and build trust, allows the mentee to feel comfortable contacting the mentor, and makes the mentor more invested in the success of the mentee. Create a handbook that clearly delineates expectations. Include a program overview, objectives for each semester, specific checklists for mentors and mentees to complete together, and due dates. Encourage frequent/regular communication beyond what is required. This will allow students to help shape the program into what is most beneficial for them, whether it be didactic questions, specific case tips, CRNA preferences, etc.

A69

Implementation of Postcesarean Delivery Analgesic Guidelines

Sarah Farmer, BSN, RN; Beth Clayton, DNP, CRNA; Donna Green, PhD, RN; Melissa Stec, DNP, CNM
University of Cincinnati

Introduction: Cesarean delivery is a frequently occurring operation with high incidence of inadequate acute postoperative analgesia. Poorly controlled acute postcesarean delivery pain has numerous consequences, including a strong prediction for chronic pain development. Documented interventions have been consistently ineffective. There is a significant need for implementation of evidence-based analgesic guidelines.

Methods: The purpose of this quality improvement project is to determine how providing an educational intervention affects registered nurse (RN) knowledge and perceptions of postcesarean analgesic guidelines. A literature search was performed using PubMed, MEDLINE, and CINAHL databases from 2006 to 2016. A total of 481 results were returned and 42 abstracts were reviewed. A total of 21 studies meeting the inclusion and exclusion criteria were utilized. Nine of the articles were systematic reviews of healthcare guideline implementation. Oral and supplemental education were identified as strategies correlated with a high degree of efficacy in increasing staff knowledge and achieving patient outcome measures.

Analysis of the Evidence: Literature demonstrates that an educational component is necessary for successful guideline implementation. A video-recorded presentation summarizing the science and clinical implications surrounding the Analgesia and Anesthesia for the Obstetric Patient component of the *AANA Practice Guidelines* was constructed. This presentation was provided to 5 CRNAs and 85 RNs on a family birthing unit. A 15-item questionnaire assessing knowledge and perceptions of postcesarean analgesia was administered to RNs prior to and following the educational intervention. Preliminary results demonstrate a statistically significant increase in RN knowledge and willingness to comply with guideline recommendations.

Recommendation for Practice: This quality improvement project demonstrates the success of employing a video-recorded educational intervention. This intervention could be utilized by obstetric anesthesia providers to improve staff knowledge and willingness to comply with postoperative analgesic guidelines. Inadequate acute postcesarean analgesia, leading to chronic pain development, is a prevalent obstetric anesthesia concern. Due to the large volume of cesarean deliveries performed, any incidence of chronic pain has significant public health consequences. Facilities should consider this timely, minimal resource strategy when suboptimal postcesarean delivery analgesia is observed.

A70

Implementing a Simulated Experience in Airway Crisis Management for Enhancing Education of Critical Care Nurses

Julie Pozz, BSN, RN; Mary Bakis, DNP, CRNA

University of Cincinnati

Introduction: Failure of airway management remains a significant source of morbidity and mortality, particularly among critical care patients where the incidence of difficult intubation is twice as likely. Providers must be able to identify and prepare for the possibility of airway failure. This crisis management education intervention demonstrates how nurse anesthetists and student anesthetists can positively impact critical care nurses' knowledge of airway crisis.

Methods: Education interventions were developed by a senior nurse anesthesia student to establish the effectiveness of training on improving the knowledge base and skills confidence of critical care nurses in airway crisis management. A total of 18 participants in 4 (2-hour) sessions received training including didactic, simulation, and hands-on education. A pretest/posttest knowledge assessment as well as the Student Satisfaction and Self-Confidence in Learning postsurvey were used as methods of evaluation. The education session was approved through the Ohio Board of Nursing at UC Health for continuing education credits for participants.

Analysis of the Evidence: Posttest knowledge assessment revealed a statistically significant increase ($t=6.35413$, $p < 0.001$). Student Satisfaction and Self-Confidence in Learning postsurvey showed improved confidence in skill development and knowledge and satisfaction with the way the materials were presented. Participants reported improved awareness of critical airway management including alternative actions in can't intubate, can't oxygenate (CICO) situations as well as identification and preparedness for airway emergencies.

Recommendation for Practice: The experience and expertise of nurse anesthetists and student anesthetists in airway management is undoubtedly valuable and opportunities to education other healthcare team members heightens awareness of the significance of airway crisis and importance of effective management. Improved confidence and knowledge via education and simulation training prepares providers in clinical decision making and responsiveness, particularly when in stressful emergency situations.

A71

Improving Success Rate of the Adductor Canal Block (ACB) by Standardizing Technique: An Evidence-Based Practice Project

LT Jared L. Hartman, BSN, RN, NC, USN; LT Sean A. Hutchison, BSN, RN, NC, USN; LCDR Stephanie E. Wallace, BSN, RN, NC, USN

Uniformed Services University

Introduction: The success of peripheral nerve blockade is an important determinant of patient satisfaction and length of stay after surgery. Recent evidence suggests that success rates for adductor canal block (ACB) can be as high as 94%. However, the success rate for ACB at the facility is 77%.

Methods: The purpose of this project is to find the best technique for ACB and standardize ACB the facility. This is a preimplementation and postimplementation performance improvement project to standardize adductor canal blocks. PubMed and Embase databases were searched for articles relevant to the background question posed.

Analysis of the Evidence: Success rates of ACB before and after standardization were similar. Prior to implementation, the success rate was approximately 77%. Following standardization, the success rate was 76%. The volume of local anesthetic was reduced to 20 mL with no reduction in efficacy.

Recommendation for Practice: Standardization of ACB did not improve the block success rate. However, we were able to reduce block volume by 10 mL, minimizing the potential for local anesthetic toxicity.

A72

In Obstetric Patients Presenting for Cesarean Delivery Under Spinal Anesthesia, How Does Administration of Prophylactic Ondansetron Compare With the Prophylactic Administration of Phenylephrine in Reducing the Incidence of Spinal-Induced Hypotension?

Larisse Greenwell, BSN, RN, CCRN; CDR Valerie J. Diaz, DNP, CRNA, ARNP, NC, USN

Florida International University

Introduction: Preventing hypotension in parturients can improve maternal and fetal outcomes, decreasing the risk of nausea and vomiting, aspiration, and altered mental status in the mother. Potential harm to the baby can occur as a result of uteroplacental hypoperfusion leading to fetal acidosis. Recent studies have been directing the use of ondansetron to reduce the incidence of hypotension and bradycardia.

Methods: The purpose of this evidence-based project was to answer the following clinical question: In obstetric patients presenting for cesarean section under spinal anesthesia, how does administration of prophylactic ondansetron compare with the prophylactic administration of phenylephrine in reducing the incidence of spinal-induced hypotension. Inclusion criteria focused on nonlaboring parturients undergoing C-section and the use of spinal anesthesia. Study characteristics included author, publication year, objective, conceptual framework, design, sample size, data analysis, results, outcomes, and level of quality based on Johns Hopkins Evidence-Based Practice Research Evidence Appraisal Tool. Seven randomized controlled trials were included for analysis.

Analysis of the Evidence: A double-blind randomized, placebo-controlled study concluded that 4 mg given before spinal anesthesia can attenuate decreases in blood pressure and vasopressor use following spinal anesthesia in parturients undergoing elective caesarean section. A randomized controlled trial comparing ondansetron and a placebo found that ondansetron significantly reduced hypotension and heart rate fluctuations in nonlaboring mothers undergoing a cesarean delivery under spinal anesthesia. A randomized controlled trial found that 4 mg of ondansetron preloading was the optimal dose to prevent maternal hypotension, nausea, and other adverse effects during cesarean delivery.

Recommendation for Practice: The studies developed on the subject have demonstrated variable findings regarding the prophylactic use of ondansetron and phenylephrine to prevent maternal hypotension postspinal anesthesia. The studies that included ondansetron established that prophylactic use supports the hypothesis that intravenous administration attenuates hypotension postspinal anesthetic use in parturients. Future studies regarding the efficacy of ondansetron and phenylephrine should consider evaluating the potential effects of fetal exposure to these drugs prior to delivery, establishing which pharmacological option presents a larger margin of fetal safety.

A73

In Parturients With a Substance Abuse History or Current Problem With Substance Abuse, Will the Use of Nonopioid Pain Adjuncts Decrease the Need for Postpartum Narcotics and Result in a Better Maternal Outcome?

Jorge A. Valdes, DNP, CRNA, ARNP; Jeffrey Griggs, BSN, RN

Florida International University

Introduction: Opioid misuse is on the rise, and these drugs are widely used in the obstetric setting. Parturients presenting with an opioid or substance addiction result in poor outcomes throughout the peripartum period. Identifying these patients and providing nonopioid adjuncts to analgesia will create better maternal outcomes and decrease peripartum complications.

Methods: The purpose of this evidence-based project was to answer the following clinical question: In parturients with a substance abuse history or current problem with substance abuse, will the use of nonopioid pain adjuncts decrease the need for postpartum narcotics and result in a better maternal outcome. Inclusion criteria addressed parturients with a substance abuse problem. Study characteristics included dates and authors, design, participants, data analysis, measurements, limitations, variables, and level of quality based on Johns Hopkins Evidence-Based Practice Research Evidence Appraisal Tool. A total of 13 articles were included consisting of randomized controlled trials, systematic reviews, and case studies.

Analysis of the Evidence: The literature review yielded the use of intravenous acetaminophen as an adjunct for postpartum narcotics. Additionally, transversus abdominal plane (TAP) blocks administered postcesarean delivery improved pain score and decreased the use of narcotics. The use of regional anesthesia blunted the need for postoperative narcotics for breakthrough pain. Other pharmacological management methods were utilized and shown that the addition of buprenorphine to pharmacological management proved to offer the best possible outcome.

Recommendation for Practice: Combining modalities such as regional anesthesia and medication will facilitate less opioid use and higher incidences of positive outcomes in the postoperative and postpartum periods. Further research should be conducted exploring the use of different nonopioid methods to decrease the use of narcotics throughout the perioperative period. Different modalities can be further identified and proven to assist in better outcomes for these patients while decreasing their need for postoperative narcotics. Finally, other nonpharmacological methods can be developed and researched to help decrease opioid use while providing the appropriate amount of analgesia and assist in the best possible outcome.

A74

Incidence of Postdischarge Nausea and Vomiting in the Outpatient Surgical Population

Lisa Saunders, RN; Adam Jacob, MD; Robyn Finney, DNAP, CRNA, APRN

Mayo Clinic

Introduction: There has been relatively little research examining the incidence of nausea and vomiting after an individual is discharged following an outpatient surgical procedure. Postdischarge nausea and vomiting (PDNV) is often an overlooked aspect of ambulatory anesthesia. Since this complication occurs at home, PDNV is suspected to be an underreported condition.

Methods: This is a prospective online survey of patients of all ages undergoing an outpatient surgical procedure in Gonda 15 at Mayo Clinic. The purpose of this design is to capture accurate, timely reports of postdischarge nausea and/or vomiting. Consideration for inclusion into this study will be given to patients who undergo an outpatient surgical procedure and are discharged home from Gonda 15. Individuals who are willing to participate will receive a survey from the Mayo Research Center 3 days following their dismissal from the outpatient surgery center.

Analysis of the Evidence: Based on the electronic survey results of 360 patients, the incidence of nausea from 0 to 72 hours after discharge was 34.7%, with a $\pm 5\%$ precision of estimate based on a 95% confidence interval. Of the individuals reporting nausea, 28.8% of them ranked their nausea to be a 5 or higher on a Likert scale from 0 to 10, with 10 being very severe nausea. The incidence of vomiting was 8.3% and the incidence of retching or dry heaves was 7.2%.

Recommendation for Practice: Dissemination of these results to anesthesia and other healthcare providers will provide evidence to support the need for change and for further investigation into the antiemetic and anesthetic practices within this department. Education should include the current Society for Ambulatory Surgery (SAMBA) consensus guidelines for preventing postoperative nausea and vomiting.

Source of Funding: The Survey Research Center at Mayo Clinic administered online surveys at a cost of \$1,805. The Anesthesia Research Committee Small Grant Program at Mayo Clinic funded this project in its entirety.

A75

Incivility in the Workplace: An Evidence-Based Practice Project

Maj Lindsay Howard, MSN, RN, USAF, NC; LT Colleen Spiri, RN, NC, USN; Capt Richard Brocksmith, BSN, RN, USAF, NC

Uniformed Services University of the Health Sciences

Introduction: Workplace incivility presents significant risk and serious consequences to healthcare organizations and patients to include compromised communication, teamwork, patient safety, employee health, and productivity. Evidence-based literature is silent on workplace incivility in the context of the military healthcare system (MHS), which led the authors to explore the presence of workplace incivility in an MHS facility.

Methods: The setting was the perioperative department at a single military treatment facility (MTF) (57-bed facility with 3,100 annual/surgeries). Participants were 53 perioperative RNs (certified registered nurse anesthetists, operating room, ambulatory surgery, and postanesthesia care nurses). Steps were: 1. Project background informational briefings were offered to RNs. 2. Nursing Incivility Scale (NIS), delivered via online platform, assessed 5 sources of incivility. Participation was anonymous and voluntary. 3. Box-and-whisker plots were used to analyze and illustrate results. 4. Targeted evidence-based educational interventions were identified and presented to perioperative leadership. 5. As chosen by unit leadership, results were disseminated to all perioperative RNs with education links via emailed PowerPoint. 6. A 2-question evaluation of the results and interventions utilizing a 5-point Likert scale was included. Evaluation results were tabulated.

Analysis of the Evidence: Thirty-two of 53 perioperative nurses completed the NIS for a response rate of 60%. Results were analyzed by computing composite scores for each incivility source to yield median, upper quartile, and lower quartile scores. NIS results demonstrated moderate incivility from the “all personnel”, “physicians”, and “other nurses” sources, indicating respondents could benefit from targeted workplace incivility interventions. Six of 53 perioperative nurses completed the follow-up questionnaire (11% response rate). Six of 53 perioperative nurses completed the follow-up questionnaire with incivility resources rated “somewhat” to “very” useful (5-point Likert scale).

Recommendation for Practice: A baseline workplace incivility assessment identified sources of uncivil behaviors that guided intervention strategies. Due to MTF constraints, implementation of targeted evidence-based interventions were not feasible. Instead, general resources aimed at prevention and mitigation of workplace incivility were offered to preoperative nurses. A reassessment and implementation of targeted interventions is warranted to fully discern the impact of this project on incivility in the workplace at this single MTF. Future direction: 1. Expand assessment to include all perioperative staff. 2. Create multidisciplinary task force. 3. Use Plan-Do-Study-Act model to improve interventions. 4. Expand assessment/interventions MTF-wide to promote an organizational culture of civility.

A76

Incorporating Preprocedural Hand-Held Ultrasound to Improve the Efficacy of Neuraxial Anesthesia in Obese Parturients

Gregory Barlion, BSN, RN, CCRN-CSC; Beth Ann Clayton, DNP, MS, CRNA; Lesley Gilbertson, MD; Lori Ostmann, MS, CRNA

University of Cincinnati

Introduction: Neuraxial anesthesia (NA) for obese parturients is challenging due to positioning constraints, difficulties locating anatomical landmarks, and inaccuracies of landmark palpation. The purpose of this evidence-based research is to evaluate the current evidence regarding preprocedural hand-held ultrasound (HUD) for NA and assess the incorporation of HUD in anesthesia trainee clinical education.

Methods: A literature search was conducted using PubMed, CINAHL, and Scopus databases using the following keywords: anesthesia, epidural analgesia, epidural anesthesia, labor pain, obesity, obstetric labor complications, obstetrical analgesia, obstetrical anesthesia, palpation, spinal anesthesia, and ultrasonography. Search results were limited to peer-reviewed and full-text articles. A total of 41 articles were selected for analysis, including 3 systematic review/meta-analyses, 18 randomized controlled trials, 2 case-control, and 18 cohort studies.

Analysis of the Evidence: Results from the systematic review/meta-analyses found the use of ultrasound for NA: increases first attempt success rate; accurately determines intervertebral level and predicts depth to epidural space; and decreases number of needle insertion attempts, needle puncture levels, needle passes and redirections, neuraxial complications, and failed procedures. The Accuro (Rivanna Medical) is a wireless HUD for NA with pattern recognition software capable of automated and accurate detection of spine midline, intervertebral spaces, and depth to epidural space. Accuro utilization led to successful epidural placement on first Touhy needle pass in 87% of cases, 78% requiring no needle redirects.

Recommendation for Practice: All anesthesia trainees (student nurse anesthetists and anesthesia residents) attended an educational in-service for the Accuro HUD prior to their obstetric rotation, followed by supervised clinical utilization. All trainees completed a postrotation survey describing their Accuro experience. Trainees reported the Accuro was very beneficial, improved procedural success, and increased their ability to locate spine midline and intervertebral spaces. The Accuro HUD facilitates the objective identification of spinal landmarks and bridges the gap between complex ultrasound technologies and provider inexperience, which has the potential to improve the efficacy of NA in obese parturients.

A77

Intraoperative Methadone for Postoperative Pain Management

Kristen Deveras, BSN; Ann Miller, DNP, CRNA, ARNP

Florida International University

Introduction: Inadequate pain management plays a major role in surgical care inefficiencies leading to decrease in quality of patient care and substantial increase in healthcare costs. Anesthesia providers, suited to link fragments between phases of surgical care, can utilize methadone to limit overuse of opioids and thus decrease side effects, improve patient outcomes, and decrease length of stay.

Methods: The purpose of this evidence-based project was to answer the following clinical question: In surgical patients, does 20 mg of intravenous methadone on induction compared with fentanyl boluses in the intraoperative period result in decreased pain, hospital stay, healthcare costs, and increase pain satisfaction in the postoperative period. Inclusion criteria addressed surgical patients who received intravenous methadone and measured outcomes related to postoperative pain management. Study characteristics included author, publication year, design, sample size, major variables, measurements, data analysis, findings, and level of quality based on the strength of evidence rating pyramid. Eleven articles were included for analysis: 10 randomized controlled trials and a retrospective chart review.

Analysis of the Evidence: Intraoperative methadone was introduced in 1982 in a randomized controlled trial; 20 mg of methadone on induction resulted in one-third of the sample being pain free and with decreased need for opioids postoperatively. A randomized controlled trial compared methadone (0.2 mg/kg) before incision with sufentanil infusion for spine surgical patients; the methadone group had reduced need for postoperative opioids by 50%. Another randomized clinical trial evaluated intraoperative methadone (0.3 mg/kg) and fentanyl (12 mcg/kg) for cardiac surgical patients; the methadone group resulted in reduced need for morphine, improved pain scores, and enhanced perceived pain management postoperatively.

Recommendation for Practice: The empirical evidence supported methadone, a mu opioid agonist and NMDA receptor antagonist, as an effective perioperative analgesic. Methadone, 20 mg IV, administered on the induction of anesthesia results in effective pain control in the postoperative period and enhanced recovery, increasing the quality of care for surgical patients and decreasing the financial burden exerted on the healthcare system. Intraoperative methadone further addresses current challenges in pain management associated with rising surgical volumes with an aging population, increased presence of comorbidities, increase in ASA physical status 3 and 4 patients, and increased incidence of patients with chronic pain.

A78

Intravenous Ketamine as a Postoperative Opioid-Sparing Modality for Adults Undergoing Total Knee Arthroplasty

Lorelein Valladares, BSN, RN; Vince Gonzalez, DNP, CRNA, ARNP; Jampierre Mato, DNP, CRNA, ARNP
Florida International University

Introduction: Total knee arthroplasty is one of the most commonly performed orthopedic surgeries. Achieving adequate pain relief is challenging. Ketamine can be used as a postoperative opioid-sparing modality for patients undergoing total knee arthroplasty. Ketamine also improves postoperative outcomes, as evidenced by improved knee mobility and reduced incidence of long-term neuropathic pain.

Methods: A literature search was conducted to identify the following clinical question: In adult patients undergoing total knee arthroplasty, how does the perioperative use of intravenous ketamine compared with standard opioid analgesia affect postoperative opioid consumption? The original search revealed 69 articles. Excluded articles were those on animals, pediatrics, nonintravenous ketamine, and surgery other than total knee arthroplasty. Inclusion criteria included: adults, total knee arthroplasty, and perioperative intravenous ketamine. Within this systematic review there are 4 randomized controlled double blind studies and 1 follow-up observational study.

Analysis of the Evidence: Perioperative ketamine is an effective opioid-sparing modality in patients undergoing total knee arthroplasty. Studies found efficacy when ketamine was given as an intravenous bolus and/or continuous infusion extending into the postoperative period. Those who received intraoperative ketamine had less postoperative pain, consumed less morphine, and had improved knee mobility. One study described diplopia and dizziness in patients that received ketamine. A follow-up study found that ketamine reduced neuropathic pain 6 months and 1 year after total knee arthroplasty.

Recommendation for Practice: Although a final dosing recommendation cannot be made at this time, intravenous ketamine is an effective opioid-sparing adjunct when administered intraoperatively as a continuous infusion, with or without initial bolus. Studies showed success with initial boluses ranging from 200 mcg/kg to 10 mg and infusions ranging from 3 mcg/kg/min to 120 mcg/kg/min. Additional benefit is gained when the infusion is continued 24 to 48 hours postoperatively at half the intraoperative rate. Future studies should examine the ideal ketamine dose that optimizes pain relief, but minimizes side effects.

A79

Intravenous Ondansetron Attenuates Spinal-Induced Hypotension in Healthy Parturients Undergoing Elective Cesarean Delivery

Sarah Juedes, BSN, RN; Amy Harbeck, CRNA, MS; Kristie Wade, CRNA, DNAP; Heather Dohr, CRNA, MS
Center for Nurse Anesthesiology at Albany Medical College

Introduction: Elective cesarean delivery is usually performed with spinal anesthesia. Fifty percent to 80% of patients become hypotensive due to sympathectomy and the Bezold-Jarisch reflex (BJR). The BJR is a cardioinhibitory reflex triggered by serotonin at 5HT₃ receptors on vagal afferent fibers in the myocardium. Targeting this reflex with a 5HT₃ antagonist before spinal anesthesia may prevent hypotension and bradycardia.

Methods: Does pretreatment with ondansetron, 4 mg IV, decrease hypotension and bradycardia after spinal anesthesia in healthy parturients undergoing elective cesarean section? A comprehensive search of the PubMed, CINAHL, and Cochrane library databases was conducted in June 2017. MeSH terms included: cesarean, spinal, ondansetron, and hypotension. The search was limited to studies published after 2012, English language, and human subjects. Four randomized controlled trials were included for review.

Analysis of the Evidence: Four randomized controlled trials were included for this review: Wang et al (2014), Sahoo et al (2012), El Khouly and Meligy (2016), and Rashad and Farmawy (2013). All 4 studies concluded that pretreatment with ondansetron, 4 mg IV, decreased the incidence of maternal hypotension, as well as both the frequency and dosage of vasopressor required after spinal anesthesia with 10 mg, 0.5% bupivacaine. None of the studies demonstrated an effect of ondansetron on the incidence of bradycardia. Sahoo et al (2012) and Rashad and Farmawy (2013) reported the lowest incidence of hypotension among the studies, which may have been due to their protocol of 20 mL/kg IV fluid bolus.

Recommendation for Practice: These studies provide evidence that pretreatment with ondansetron, 4 mg IV, decreases the incidence of hypotension, but not bradycardia, following spinal anesthesia in healthy parturients undergoing elective cesarean delivery. This improves safety for both mothers and their fetuses and decreases the requirement for vasopressors. Ondansetron should be considered as premedication for spinal anesthesia in elective cases as long as there are no contraindications. Future studies should examine the additive effect of IV fluid bolus volume with ondansetron.

A80

Intravenous Versus Oral Acetaminophen: Is One Route Superior Perioperatively?

Eric Grider, BSN, RN

Drexel University

Introduction: Acetaminophen (APAP) has an established safety profile and minimal impact on platelet function and is often utilized in intravenous (IV) and oral form during the perioperative period. The known pharmacokinetic advantages of IV APAP when compared with the less expensive oral formulation have not consistently translated into a clinical benefit. A review of the literature was conducted to determine if there is any clear clinical benefit of IV APAP in comparison with oral APAP.

Methods: The following PICO question was utilized to guide the review: In adult surgical patients (P), is perioperatively administered intravenous acetaminophen (I) more efficient than perioperatively administered oral acetaminophen (C) in controlling postoperative pain (O)? A literature search utilizing the keywords acetaminophen, perioperative, efficacy, intravenous, and oral was conducted off the CINAHL, Cochrane, PubMed, and PsysINFO databases was conducted. Three studies containing a total of 621 subjects were ultimately chosen based on both relevance to the PICO question and level of evidence. These studies included 1 systematic review of randomized controlled trials, 1 randomized double blind clinical trial, and 1 retrospective cohort study.

Analysis of the Evidence: The 3 studies failed to show strong statistically significant evidence that would suggest that IV APAP is clinically superior to oral APAP in the perioperative setting.

Recommendation for Practice: Based on the current evidence available, it is therefore recommended that the more expensive formulation of IV APAP be reserved only for patients that are unable to tolerate oral medication during the perioperative period due to the lack of clear clinical benefit when compared with oral APAP.

A81

Ketamine as an Adjunct to Chronic Pain Management

Melissa Fields, MSN, CRNA

Columbia University

Introduction: The purpose of this review is to examine 5 studies and find commonality among them to give the practitioner a better understanding of how administration of ketamine can be an adjunct in the patient with chronic pain. Chronic pain diagnoses have wildly increased in the past decade. Likely by inhibition of N-methyl-D-aspartate (NMDA) receptor and anti-inflammatory effects, ketamine is highly successful in treating intractable pain.

Methods: A literature review was conducted with information from 2013 to 2018. Databases searched were PubMed, NCBI, and Google Scholar. Keywords included in the search were ketamine, chronic pain, intractable pain, cancer pain, and complex regional pain syndrome. Inclusion criteria consisted of studies less than 5 years old, published and written in English. Studies excluded were nonhuman trials. From the search, a total of 5 articles were included in this literature review.

Analysis of the Evidence: The literature review has shown that ketamine use is highly successful in treating intractable pain. In addition, the literature supports that ketamine is a useful treatment option in patients who have failed treatment with opioids. Ketamine for intractable pain has been used with caution. Though there is much research and many supporters of ketamine use, practitioners are unfamiliar with the treatment regime and seem to avoid the use of ketamine in its entirety. Implementation of ketamine usage has shown to decrease chronic pain and in some instances rid pain completely with limited side effects compared with its opioid counterparts.

Recommendation for Practice: Ketamine use for intractable pain has been used with caution. Though there is much research and many supporters of ketamine use, practitioners are unfamiliar with the treatment regime and seem to avoid the use of ketamine in its entirety. Implementation of ketamine usage has shown to decrease chronic pain and in some instances rid pain completely with limited side effects compared with its opioid counterparts. Literature supports effectiveness in both oral and intravenous ketamine administration in a wide range of chronic pain, such as: neuropathic and nociceptive. This literature review also established the recommended ketamine dose for both adult and pediatric patients who were deemed suffering with chronic pain.

A82

Ketorolac Administration and Bleeding in the Neurosurgical Patient

Vanessa Tran, BScN, RN

Albany Medical College - Center for Nurse Anesthesiology

Introduction: Ketorolac blocks the COX-1 pathway causing clinicians to limit its use in patients undergoing neurosurgical procedures. Clear evidence on how it affects bleeding would allow for a safer analgesic profile. As we search for solutions to the opioid crisis, the use of ketorolac can control pain, while avoiding negative side effects of opioids, including addiction.

Methods: Is perioperative bleeding increased in pediatric and adult patients who undergo neurosurgical surgery and receive ketorolac? A comprehensive electronic search of the PubMed database was completed. MeSH terms included: ketorolac, Toradol, bleeding, and neurosurgery. Studies were published after 2012 and limited to English language. Neurosurgical patients who received ketorolac were compared with a control. Three studies were included in the final analysis.

Analysis of the Evidence: Three articles were included in the review: Richardson et al, 2016; Magni et al, 2013; and Siribunrungwong et al, 2015. No association was found between ketorolac and elevated risk of bleeding when compared with the control groups. Richardson et al (2016) found that the procedure type and presence of pharmaceutical confounders (e.g. blood thinning medications) were associated with increased bleeding. Results from Magni et al (2013) showed that older age was significantly associated with intracranial hemorrhage (or bleeding).

Recommendation for Practice: Ketorolac reduces pain and can help mitigate the opioid crisis. These studies offer evidence that neurosurgical patients who receive ketorolac in the perioperative period are not at increased risk of bleeding; therefore, ketorolac administration may be considered. However, until further research with larger sample sizes and specific inclusion criteria are completed, there are no definitive indications for safe ketorolac administration.

A83

Levosimendan for Renoprotection and Prevention of Acute Kidney Injury in Cardiac Surgery

Cassandra Jones, BSN, RN, CCRN; Lyda Shambo, DNP, CRNA

Columbia University School of Nursing

Introduction: Levosimendan (LS) is an inodilator in US Food and Drug Administration trials in the United States. Inotropic study outcomes show LS preserves renal function in cardiac surgery patients. New research shows renal protection from vasodilatory mechanism of action (MOA). LS use prevents acute kidney injury (AKI) and maintains renal perfusion in cardiac patients.

Methods: PubMed, Cochrane Library and Ovid MEDLINE were searched. Relevant studies were published in English from 2013 to present with adult patients and included 3 meta-analyses, 5 randomized controlled trials, an observational and an animal study, and 1 position paper. Studies evaluated the renal effect of LS in comparison with control and/or placebo in cardiac surgery patients with varied cardiac function. Studies indicate that LS has been shown to decrease AKI postoperatively and preserve renal function.

Analysis of the Evidence: Data collection was done with document reviews from literature published in peer-reviewed journals. Keywords included levosimendan, renal, kidney, acute, and organ. The result was 11 relevant articles including 3 meta-analyses, 5 randomized controlled trials, an observational and an animal study, and 1 position paper. Perioperative LS improves renal function in cardiac surgery patients versus control. LS decreases AKI and RRT in adult cardiac surgery patients. LS increases RBF, UO, GFR; improves BUN, Cr, cystatin C, RBF velocity, and renal artery diameter; and decreases renal vascular resistance.

Recommendation for Practice: LS in cardiac surgery is renoprotective in patients with normal/decreased cardiac function. LS increases RBF/GFR and produces renal arterial and venous vasodilation. LS MOA is independent of catecholamines, has no increase in myocardial O₂ demand, has fewer adverse effects, and improves RBF before cardiac index. Larger studies with standardized dosing are needed to guide use in cardiac surgery patients.

A84

Magnesium Sulfate Usage for Postoperative Pain Control After Surgery

Julie C. Mozo, BSN, RN; Samantha E. McNeill, BSN, RN

University of North Florida

Introduction: Narcotics for surgical pain are associated with many side effects. Magnesium sulfate antagonizes NMDA receptors and antagonizes N-type calcium channels. It is unclear if IV preoperative magnesium reduces postoperative pain. The purpose of this evidence-based practice project is to present the evidence on the effectiveness of IV magnesium sulfate on postoperative pain in surgical patients.

Methods: Keywords from the following PICOT question were used to search the CINAHL, PubMed, and Cochrane literature databases: Do surgical patients (P) who are given IV magnesium sulfate preoperatively (I) compared with similar patients who are not given magnesium sulfate (C) have less pain (O) postoperatively (T)? Two systematic reviews of randomized clinical trials (RCTs) and 3 RCTs were critically appraised.

Analysis of the Evidence: The results of these studies consistently found that a 30 to 50 mg/kg bolus of magnesium sulfate at the induction of anesthesia decreased postoperative pain and narcotic requirements after surgery. From this evidence it is recommended that intraoperative IV magnesium sulfate be given to reduce postoperative pain and reduce narcotic administration.

Recommendation for Practice: A 15-minute power point presentation was given to CRNAs at Mayo Clinic Jacksonville followed up with biweekly emails containing facts about magnesium with encouragement for its use. To determine a change in frequency of use, pharmacy records of all surgeries except transplant and cardiac surgeries were reviewed. Results found that the use of magnesium sulfate increased from 16 vials during the 6 months before the presentation to 10 vials 1 month following the presentation. However, use of magnesium dropped to 3 vials 2 months after the presentation. This work showed that an oral presentation on the effectiveness of IV magnesium for postoperative pain with follow-up informational emails resulted in a practice change for the anesthesia providers at Mayo Clinic Jacksonville.

A85

Medication Reconciliation in the PACU: Accurate Medication Handoff between PACU RNs and Anesthesia Providers

Lauren Easterbrook, BSN, RN; Erin Martin, DNP, CRNA, APRN; Jean Guyer, DNP, CRNA, APRN; Tim Curry, MD, PhD; Tammy Bergan, MAN, MSM, RN; Maura McCabe, MSN, RN, CPAN; Mary Marienau, PhD, CRNA, APRN

Mayo Clinic

Introduction: The Mayo Clinic (MC), The Joint Commission (JC), and Anesthesia Patient Safety Foundation (APSF) have identified communication as a patient safety concern. The project aim was to decrease the number of medication discrepancies that occur during the handoff of care in the PACU through a structured medication reconciliation. A hospital-wide presentation educated staff on medication handoff errors.

Methods: How does the use of a standardized process for medication reconciliation (MR) during the handoff in the PACU impact the number of medication discrepancies that occur during a patient's perioperative experience? Literature searches showed that there is research addressing handoff composed primarily of observational studies with high levels of MR inaccuracy. The JC identifies inadequate handoff as a high contributor to sentinel events and has made it a National Patient Safety Standard. The APSF has published its recent journal specifically on handoff communication, labeling it an APSF safety initiative. Data were also collected from direct observations in the PACU. Medication error data and the discrepancy resolution process were collected from the pharmacy department.

Analysis of the Evidence: Observations showed that the PACU where handoff takes place can be noisy, distracting, and stressful, which may lead to nursing staff being misinformed of the medications administered by anesthesia staff. Over half of the sentinel events reported in the United States can be traced to a breakdown in communication. This project is congruent with this institutional initiative. Research shows that standardization of handoff is important to prevent inaccuracies. More in-depth and advanced medication reconciliation methods are required to prevent discrepancies and drug diversion. This intervention clarifies medication inaccuracies especially those concerning narcotic discrepancies.

Recommendation for Practice: An educational presentation was created based on observations, literature, and institutional data. Topics included medication errors, narcotic discrepancies, high risk medications, and best practice for MR. The intervention was presented to PACU and anesthesia staff at meetings and recorded online. A structured computer process for MR was implemented. There was an 80% increase in use of the computer, and 2 medication charting discrepancies were adjusted at the bedside. Staff reported increased communication and little impact on workflow. We have now started a team that will standardize handoff during the transition to a new computer system utilizing MR improvements in the new process.

A86

Methadone: A Perioperative Analgesic for Use in the Opioid-Dependent Patient

Jason Fernandes, BSN, RN; Jorge Valdes, DNP, CRNA

Florida International University

Introduction: Effective perioperative analgesia in opioid-dependent patients often requires large doses of narcotics. Administration of conventional narcotics may not be ideal for administration to opioid-dependent patients. The efficacy of methadone was compared with conventional narcotics for the reduction of surgical pain during the perioperative period in opioid-dependent patients.

Methods: The purpose of this evidence-based project was to answer the following clinical question: In the opioid-dependent patient population, how does perioperative methadone administration compare with conventional narcotics for the reduction of surgical pain in the perioperative and postoperative period? The Florida International University online library was used to obtain literature from databases such as Cumulative Index to Nursing and Allied Health Literature (CINAHL) Complete, Embase, and MEDLINE via PubMed. Several studies emphasized literature reviews, while others employed randomized controlled trials, prospective and retrospective techniques, case-control and case-report methods, and chart reviews.

Analysis of the Evidence: Methadone is an effective perioperative analgesic and decreases postoperative narcotic requirements when compared with conventional narcotics. Postoperative pain scores and satisfaction with pain management were better with the perioperative administration of methadone versus conventional narcotics. Methadone can be as effective or better than conventional narcotics when administered during the perioperative period. The anesthetist should understand that postsurgical analgesic requirements in opioid-dependent patients may need to be increased by a minimum of 30% compared with opioid-naive patients. After surgery, short-acting narcotics should be limited to the control of pain with activity.

Recommendation for Practice: Methadone is an effective, inexpensive, and efficacious means for providing prolonged analgesia and should be considered for use by anesthetists that understand its pharmacokinetics and pharmacodynamics. Recommendations for perioperative administration in the opioid-dependent patient vary depending on the type of surgery, expected length of stay, patient population, and history. Opioid-dependent patients on medication-assisted treatment (MAT) should take their prescribed opioid-replacement the day of the surgery. Postoperative narcotics should be prescribed on discharge and in consideration of the patient's condition, surgery, and in correspondence with the MAT program personnel and pharmacy.

A87

Neurotoxic Potential of General Anesthetic and Sedation Drugs in Pediatrics

Lloyd Barnwell, DNAP, CRNA; Beth Ann Clayton, DNP, MS, CRNA; Lesley Gilbertson, MD; Lori Ostmann, MS, CRNA

Virginia Commonwealth University

Introduction: The purpose of the review was to analyze, interpret, and synthesize the December 14, 2016 US Food and Drug Administration's (FDA) safety announcement with relevant literature from 2017 and 2018. The authors considered that in light of new evidence, modifications to the announcement's recommendations for anesthesiologists may be merited.

Methods: In pediatric patients presenting for anesthesia and surgery, is the December 14, 2016 US Food and Drug Administration's safety announcement the most up-to-date reference guide for anesthesiologists to review compared with relevant literature published since the announcement for minimizing the potential neurotoxic effect associated with anesthesia? Analysis and interpretation of the FDA's safety announcement and of relevant literature published since the announcement was completed. Recommendations from the announcement were compared with studies published following the announcement. Clinical recommendations based on current best evidence were identified and summarized.

Analysis of the Evidence: The FDA warns that anesthetics may adversely affect brain development in children less than 3 years of age when administered repeatedly or for longer than 3 hours. The FDA required that warning labels be added to gamma-aminobutyric acid (GABA) agonists and N-methyl-D-aspartate (NMDA) antagonists. The FDA has not required a warning label be added to α_2 -agonists (eg, dexmedetomidine). At least 1 nonclinical (animal) study published since the announcement has reported an 84% reduction in neuroapoptosis when dexmedetomidine is coadministered with sevoflurane. At least 1 nonclinical study published since the announcement has demonstrated that isoflurane anesthesia causes a 4-fold increase in neuroapoptosis when anesthesia is administered for only 3 hours.

Recommendation for Practice: Nonclinical (animal) data support cause for concern about the use of general anesthetic drugs in young children and pregnant women; clinical evidence is mixed and inconclusive. Recommendations guide practice in regard to: patient and caregiver education, patient age, single versus repeated anesthetics, and anesthetic duration. Recommendations are based largely on nonclinical data. Evidence in humans supporting or refuting the neurotoxic potential of anesthetic medications is largely retrospective, limited, and inconsistent. No recommendation regarding a specific drug or regimen is identified as superior. Recommendations are largely based on nonclinical data. Limited and inconclusive evidence published since the FDA's safety announcement does not support modifying current recommendations.

A88

Nonpharmacological Techniques in the Treatment and Prevention of Nausea and Vomiting for the Parturient Undergoing Cesarean Delivery With Neuraxial Anesthesia

Paul Echeverri, BSN, RN

Florida International University

Introduction: In the obstetric population, nausea and vomiting can be as high as 80% after neuraxial anesthesia for cesarean delivery. Placental transfer of drugs intraoperatively and secretion in breast milk postoperatively has untoward side effects. An adoption of nonpharmacological techniques will optimize maternal and fetal outcomes in the treatment of nausea and vomiting.

Methods: The purpose of this evidence-based project was to answer the following clinical question: In obstetric patients presenting for cesarean delivery under neuraxial anesthesia, do nonpharmacological treatments compared with antiemetic medications decrease the prevention and treatment of nausea and vomiting? Inclusion criteria included ginger, TENS, acupressure, acupuncture, electroacupuncture, and peppermint aromatherapy for the prevention or treatment of nausea, vomiting after cesarean section with neuraxial anesthesia in the laboring parturient. Exclusion criteria addressed noncesarean deliveries and cesarean sections under general anesthesia. The search strategy utilized the Cochrane Library, PubMed, and CINAHL. Nine randomized controlled trials were included for critical analysis.

Analysis of the Evidence: An experimental design observing acupressure reported the occurrence of vomiting during cesarean section (C/S) between the acupressure group (0/76 of participants) compared with the control group (11/76 of participants) was statistically significant ($p=0.002$). An experimental design observing ginger reported the mean severity of vomiting during C/S in the ginger group compared with the control group was statistically significant in half an hour and 1 hour after surgery ($p<0.05$). An experimental design observing electro-acupuncture reported that nausea and vomiting occurred less often in the active treatment groups during C/S and for 6 hours postoperatively: Control was 34%/28%, acupuncture was 9%/7%, and Zofran was 8%/6%.

Recommendation for Practice: The empirical evidence shows that the use of nonpharmacological techniques optimally decrease nausea and vomiting for the cesarean parturient. Implementation to reduce nausea and vomiting in the parturient can consist of P6 stimulation by electro-acupuncture at 50 Hz, acupressure bands 30 minutes prior to surgery, ginger capsule (250 mg), root powder with 30 mL of water 1 hour prior to surgery, and inhalation of peppermint spirits. An evidence-based practice recommendation of nonpharmacological adjuncts will complement anesthesia management of nausea and vomiting in the obstetric patient in meeting Centers for Medicare & Medicaid Services guidelines for safe, quality, cost-effective care.

A89

Norepinephrine for the Prevention and Treatment of Spinal Hypotension in the Obstetric Population

Jennifer M. Fenley, BSN, RN; Ann B. Miller, DNP, CRNA, ARNP

Florida International University

Introduction: Spinal hypotension is the most common complication following spinal anesthesia for cesarean delivery with an occurrence of approximately 80%, with a 9% to 30% increase over the last decade. This evidence-based practice project is to evaluate empirical evidence on the effects of norepinephrine on spinal hypotension with regard to maternal, fetal safety and efficacy, and placental vascular resistance.

Methods: The purpose of this evidence-based project was to answer the following clinical question: In patients presenting for a cesarean delivery under spinal anesthesia, does norepinephrine boluses, 4 to 12 mcg compared with coload of intravenous fluid, phenylephrine and ephedrine IV boluses, or infusions maintain blood pressure within 20%, decrease spinal hypotension, decrease placental vascular resistance, and decrease fetal acidosis? Inclusion criteria consisted of articles published in English within 10 years from MEDLINE, EMBASE, and CINAHL. Participants consisted of elective cesarean section with spinal anesthesia, ASA class I-II, and minimal gestation age of 36 weeks. Articles assessed spinal hypotension, fetal acidosis, and maternal blood pressure through vasopressor administration.

Analysis of the Evidence: A randomized double-blinded study of 104 patients undergoing cesarean delivery with spinal anesthesia concluded that a norepinephrine infusion was more effective in maintaining blood pressure within 20%, increased heart rate, and cardiac output than the phenylephrine infusion group. A prospective double-blind study of 40 parturients determined the effective norepinephrine dose, 6 mcg, in the prevention of postspinal hypotension in 90% of women undergoing elective cesarean delivery with spinal anesthesia. A double-blinded study compared patient blood pressure when receiving a single bolus of norepinephrine doses ranging from 4 to 12 mcg with phenylephrine ranging from 60 to 200 mcg for treatment of spinal hypotension.

Recommendation for Practice: In the obstetric population, empirical evidence supports the administration of norepinephrine, 6 to 8 mcg, to be more efficacious in treating spinal hypotension compared with coload with intravascular fluid, phenylephrine, ephedrine infusion, or boluses. Norepinephrine increases maternal blood pressure, uteroplacental blood flow, improves fetal oxygenation, decreases fetal acidosis, and is an alpha-adrenergic and beta-adrenergic agonist allowing for quick onset, maintenance of cardiac output, and blood pressure. Norepinephrine boluses for elective cesarean delivery will enhance current practice in meeting the Centers for Medicare & Medicaid Services payment guidelines for quality and safe practice.

A90

Opiate Sparing Technique Utilizing Magnesium and Lidocaine in the Perioperative Period

Kathryn Beyer, BSN, RN, CCRN

Florida International University - Nicole Wertheim College of Nursing and Health Sciences

Introduction: Pain management treatment goals in the perioperative setting are to administer opioids to successfully manage pain without undesired side effects. Untreated pain causes negative side effects such as nausea, vomiting, decreased bowel motility, and increased length of stay. Lidocaine and magnesium decrease opioid administration, improve patient outcomes, and increase patient satisfaction.

Methods: This evidence-based project answered the clinical question: In the adult surgical patient, does the administration of intravenous lidocaine and/or magnesium compared with opioid administration in the perioperative period decrease patient pain levels, decrease opioid administration, and increase patient satisfaction? Search terms included analgesic, pain, pain measurement, perioperative, lidocaine, and magnesium. Inclusion criteria included human, adult studies, in the past 8 years, double-blind, prospective, single-blind, and retrospective studies. Exclusion criteria applied to children, nerve blocks for pain management, and studies over 8 years old. A total of 15 articles were critically appraised.

Analysis of the Evidence: A meta-analysis shows perioperative magnesium reduced IV morphine consumption by 24.4% at 24 hours. Pain scores at rest and on movement were reduced by 4.2% and 9.2% respectively. A double-blind randomized controlled trial showed a magnesium bolus of 20 mg/kg followed by 2 mg/kg/h improves pain control, acting as an opioid-sparing adjuvant. A randomized double-blind, comparative trial showed opioid consumption significantly lower when administered lidocaine, 2 mg/kg, or magnesium, 20 mg/kg, after induction followed by infusions of 2 mg/kg/h and 20 mg/kg/h. A prospective, randomized, double-blind study found patients given 1.5 mg/kg lidocaine and 2 mg/kg/h infusion had decreased pain, decreased fentanyl consumption, and nausea scores.

Recommendation for Practice: The goal of introducing magnesium and lidocaine to an anesthetic pain regimen is to decrease pain, anesthetic administration, postoperative nausea, vomiting, length of stay, and immune changes while improving analgesia, bowel function, and quality of life in the perioperative period. Magnesium dosages between 20 to 50 mg/kg at induction or emergence with 20 mg/kg/h and lidocaine 1.5 to 2 mg/kg bolus with 2 mg/kg/h has shown to decrease opioid usage intraoperatively. Multimodal opioid sparing anesthetic management is the new practice technique in meeting Centers for Medicare & Medicaid Services payment guidelines for safe, cost-effective, quality of care.

A91

Pathogenesis and Pharmacologic Treatment Strategies for Vasoplegic Shock in Cardiac Surgery

Joseph R. Paravati, BSN, RN

Florida Gulf Coast University

Introduction: Vasoplegic shock (VS) is a shock state characterized by severe hypotension, with normal or elevated CO, diminished cardiac filling pressures, and decreased SVR. VS is also characterized by an absent response to fluid resuscitation and catecholamines. VS is commonly encountered in the setting of cardiac surgery. Patients receiving ACE inhibitors are particularly susceptible to VS while under general anesthesia for noncardiac procedures.

Methods: In patients undergoing cardiac surgery with sustained, catecholamine resistant hypotension (P), what pharmacologic agents are available in the treatment of VS (I)? Compare traditional treatments, established rescue therapies, and emerging treatments (C), resulting in a sustained increase in blood pressure, tissue perfusion, or decreased morbidity and mortality (O). A literature search was conducted using PubMed and Google Scholar to explore the risk factors, etiology, and traditional treatment strategies for VS. Furthermore, emerging and nontraditional pharmacotherapies were reviewed. Three randomized controlled trials, 5 retrospective studies, and 1 case study were included in the literature review.

Analysis of the Evidence: Risk factors for VS are multifactorial and include modifiable and nonmodifiable factors. Risk factors include early hypotension cardiopulmonary bypass, heart failure, length of cardiopulmonary bypass, hematocrit, perioperative ARB, and ACEI. When traditional therapies (ie, fluid resuscitation and catecholamines) for shock syndromes fail, vasopressin, methylene blue, and hydroxocobalamin are useful to restore vascular tone in patients with VS.

Recommendation for Practice: Methylene blue, vasopressin, and hydroxocobalamin are promising therapies for VS. Given the high mortality rate associated with VS, the benefits of these therapies outweigh the risks. Additional trials comparing therapies are needed to establish guidelines on the treatment of VS particularly regarding which therapy is most efficacious and when to initiate treatment.

Perioperative Blood Loss Measurement: A Review of the Literature

Christina Vera, DNP, CRNA

Vanderbilt University

Introduction: Blood loss is an anticipated risk for any invasive procedure, and surgery is cited as the most frequent cause of large volume blood loss. Severe surgical bleeding requires the administration of large quantities of intravenous fluid and blood transfusions for the prevention of symptomatic anemia. If left untreated, local hemorrhage may lead to hypovolemic shock and can result in death. Accurate blood loss measurement is vital for effective fluid management.

Methods: A literature search was conducted to produce a definition for the concept of blood loss during the operative period. Databases employed for the search included PubMed, MEDLINE, and the Cumulative Index to Nursing and Allied Health Literature. The terms surgical blood loss, intraoperative blood loss, postoperative blood loss, and perioperative blood loss were searched in combination with measurement or measuring. Only full-text English language articles were considered for review and no time limit was applied. Dictionaries and textbooks were also searched. The following inclusion criteria were used: the source's ability to offer an explicit or implicit definition of the concept, content describing the concept's uses, or presence of a blood loss measurement instrument.

Analysis of the Evidence: Visually estimated blood loss (VEBL), gravimetry (weighed blood loss or WBL), and colorimetry were examined in the review. VEBL is most widely used to determine blood loss during surgery but has proven to be an inaccurate measure for perioperative blood loss estimation. WBL is the oldest measure and involves subtracting the dry weight of blood-soaked items from the weight of the items after saturation with blood. WBL has shown mixed data for accuracy of estimation and tends to systematically overestimate blood loss. Studies examining the WBL method fail to provide information on the precision of the weighing scales used. A novel colorimetric method using photographs of blood-soaked sponges to estimate Hb mass through iPad software exhibits sound psychometrics and shows promise for blood loss quantification.

Recommendation for Practice: VEBL and gravimetry have proven to be inaccurate measures for blood loss. It is recommended these widely accepted methods be replaced with a measure possessing strong psychometric properties. Further research is warranted on a new colorimetric device, particularly with blood loss on textiles other than surgical sponges. In the absence of accurate and precise measures of perioperative blood loss, it is suggested the novel colorimetric method be adopted into practice. The device's ability to discriminate between blood and other fluids present in the surgical field and in suction canisters provides a unique advantage. The technology's low rate of bias and error and its ability to generate blood loss estimates in real time potentially provides a more effective means for measuring blood loss.

A93

Perioperative Glucose Monitoring for Improving Diabetic Surgical Patient Outcomes

Kyle Maxwell, BSN, RN; Jessica Yarger, BSN, RN

University of North Florida

Introduction: The physiological stress of surgery contributes to changes in blood glucose and insulin resistance. Diabetic patients experience these changes to a greater extent due to reduced pancreatic function, required fasting, and antidiabetic drugs. The purpose of this evidence-based practice project is to describe the evidence on the effectiveness of perioperative glucose management to improve outcomes.

Methods: Keywords from the following PICOT question were used to search the literature databases Cochrane Library, PubMed, CINAHL, and ProQuest: Do diabetic patients undergoing noncardiac surgery (P) who are monitored and managed perioperatively for blood glucose (I) compared with similar patients who are not monitored and managed perioperatively (C) have better outcomes (O) postoperatively (T)? A systematic review of 8 randomized clinical trials (RCTs), 1 RCT, and 2 retrospective cohort studies were critically appraised.

Analysis of the Evidence: The results of the 4 studies found that perioperative blood glucose management reduced the incidence of hyperglycemia perioperatively. Results showed perioperative hyperglycemia increased the incidence of surgical site infections, hospital length of stay, in-hospital mortality, myocardial infarctions, and acute renal failure.

Recommendation for Practice: A presentation was given to anesthesia providers concerning the evidence on the effectiveness of monitoring and managing perioperative blood glucose. The anesthesia providers were informed of the location of the OR's glucometer and insulin and were provided with a copy of the institution's policy on blood glucose management. The policy was displayed with the recommended monitoring intervals and treatment. To monitor a change in practice of perioperative glucose management, the frequency of glucometer use and insulin removed from Omnicell pharmacy was determined preintervention and postintervention.

A94

Phenylephrine Infusions in Obstetrical Patients With Spinal Anesthesia for Cesarean Delivery

Dorie C. Ellis, BSN, RN; Ashley Passwater, BSN, RN; Samantha Underhill, BSN, CCRN; Katherine Fowler, DNP, CRNA; Analise Murphy, DNP, CRNA

University of North Florida

Introduction: Hypotension is associated with neuraxial anesthesia for cesarean deliveries, and it is unclear if the use of prophylactic phenylephrine infusions is safe and effective at reducing its incidence. The purpose of this evidence-based project is to describe the evidence on the effectiveness of phenylephrine infusions in preventing hypotension after spinal anesthesia for a cesarean delivery.

Methods: Keywords derived from the following PICOT question were used in the literature database search: Do obstetric patients with spinal anesthesia undergoing cesarean delivery (P) who have prophylactic phenylephrine infusions (I) compared with similar patients who do not receive phenylephrine infusions (C) have less hypotension (O) perioperatively (T)? Six randomized controlled trials were critically appraised.

Analysis of the Evidence: The results of these 6 randomized controlled trials consistently found that prophylactic phenylephrine infusion used concurrent with spinal anesthesia in the parturient undergoing cesarean delivery was more effective in preventing maternal hypotension perioperatively compared with other methods used.

Recommendation for Practice: A presentation was made to anesthesia providers at UF Health Jacksonville on the evidence of the effectiveness of prophylactic phenylephrine infusion to reduce hypotension in the parturient population undergoing cesarean delivery with spinal anesthesia. It was recommended that phenylephrine infusions be implemented on all cesarean deliveries where neuraxial anesthesia is used and no contraindications are present. This was supported with follow-up discussions and flyers distributed in the operating room. The frequency of use of phenylephrine infusions was monitored for 3 months prior to and following the implementation.

A95

Preoperative Administration of Aprepitant to Prevent PONV in High-Risk Patients

Brianna L. Ingemi, BSN, RN, CCRN; Victoria L. Shrader, BSN, RN, CCRN-CMC; Donna L. Amato, BSN, RN
University of North Florida

Introduction: Postoperative nausea and vomiting (PONV) is associated with discharge delays, unexpected admissions, patient dissatisfaction, and increased costs. Aprepitant antagonizes the neurokinin-1 receptor pathway and may be effective as an antiemetic drug. The purpose of this evidenced-based practice project is to describe the evidence on the effectiveness of aprepitant at reducing PONV.

Methods: The literature databases CINAHL, PubMed, the Cochrane Database of Systematic Reviews, Web of Science Database, and MEDLINE were searched using keywords from the following PICOT question: Do surgical patients undergoing gynecological procedures (P) who receive oral aprepitant preoperatively (I) compared with similar patients who do not receive aprepitant (C) have a lower incidence of nausea and vomiting (O) postoperatively (T)? Specific terms, phrases, synonyms, and the brand name, Emend, were searched. This search yielded 2 meta-analyses and 4 randomized controlled trials answering the PICOT question that were critically appraised.

Analysis of the Evidence: The evidence from these studies consistently found that the preoperative administration of 40 mg of oral aprepitant decreased the incidence of PONV for up to 48 hours in high-risk PONV surgical patients.

Recommendation for Practice: Anesthesia providers, preoperative, and PACU nurses at Halifax Medical Center were educated on the effectiveness of preoperative oral aprepitant in patients at high risk for developing PONV. A flyer, which contained the benefits and dose of aprepitant, was attached to patient charts and displayed in the preoperative area. To determine a change in clinical practice, pharmacy charges of aprepitant were monitored in the Omnicells located in the preoperative, operating room, and PACU areas for 2 months prior to the educational session. Monitoring of aprepitant use will be done for 2 months following the educational session to determine whether there was a change in practice.

A96

Prophylaxis and Treatment of Angioedema with Fresh Frozen Plasma

Meredith Mosier, BSN, RN

Texas Christian University

Introduction: Rapid intervention by a skilled team is required when angioedema occurs in the operative setting. Patients at risk for bradykinin-mediated angioedema are susceptible to airway compromise during or immediately following surgery. If a patient undergoing surgery is known or suspected to be at risk for bradykinin-mediated angioedema, prophylactic measures can be taken. Pharmacologic prophylactic options include fresh frozen plasma (FFP), C1 esterase inhibitor (C1-INH), and androgen therapy.

Methods: PICO question: In patients with known history or suspected susceptibility to hereditary angioedema (HAE), does the administration of FFP compared with no infusion of FFP have an effect on the occurrence or severity of angioedema postoperatively? Two structured searches were conducted. Embase database was searched using the search terms: fresh frozen plasma, angioneurotic edema, and anesthesia were combined with the Boolean operator AND. Twenty-three articles were retrieved. The second search was conducted of the CINAHL, Health Source: Nursing/Academic Edition, and MEDLINE databases within EBSCOhost search engine. Search terms angioedema, fresh frozen plasma, and surgery were combined with the Boolean operator AND. This search retrieved 16 results. Six articles were selected. The articles are classified according to the JBI Levels of Evidence.

Analysis of the Evidence: The research studies reviewed are inconclusive related to the value of FFP in HAE prophylaxis because investigators in all cases used multiple prophylactic agents. No clinical trials investigating the effect of FFP on HAE were identified. When signs and symptoms of HAE occur, the situation is acute and requires immediate, multimodal prophylactic measures to treat the condition. Hereditary angioedema can be life threatening, so when signs and symptoms appear, multiple therapeutic techniques should be employed. Patients in the cases studied received other prophylactic measures besides FFP infusions including attenuated androgens, histamine antagonists, or corticosteroids.

Recommendation for Practice: The PICO question presented above cannot be definitively answered. All the studies analyzed included prophylactic measures such as administration of danazol preoperatively, administration of antifibrinolytics, or administration of antihistamines in addition to FFP. The effect of administration of FFP without additional prophylactic measures on occurrence or severity of angioedema cannot be determined from the evidence cited in the reviewed articles. Exogenous C1-INH is a valuable component in treatment and prophylaxis against HAE exacerbations. FFP can be used as part of a multimodal treatment plan for prophylaxis against angioedema if exogenous C1-INH is not available.

A97

Providing Comfort After Cesarean Delivery

Morgan Phillips, BSN, CCRN

University of Miami

Introduction: Ultimately, this literature review is intended to examine whether patients who have a cesarean delivery experience greater comfort when only given an intrathecal morphine dose in excess of 0.1 mg relative to alternative treatments.

Methods: Reports from randomized controlled trials, nonrandomized controlled trials, systematic chart reviews, and systematic meta-analyses were used to address the issue of whether patients who have cesarean delivery experience greater comfort when given an intrathecal morphine dose in excess of 0.1 mg. The literature of this review was obtained using Google Scholar, PubMed, MEDLINE, CINAHL, and Cochrane Database of Systematic reviews. The search contained the following keywords and phrases: intrathecal morphine doses, postcesarean analgesia, intrathecal opioids, cesarean section with neuraxial anesthesia, how intrathecal morphine works, and adverse effects of intrathecal morphine. Using the evidence pyramid, the articles were categorized accordingly.

Analysis of the Evidence: There are 5 mainstays as to why using lower doses of intrathecal morphine resulted in better patient comfort relative to higher doses of intrathecal morphine. First, 0.1 mg of morphine provides longer postoperative analgesia when compared with other opioids alone. Second, using 0.1 mg or less of intrathecal morphine decreases the incidence of pruritus. Third, using 0.1 mg or less of intrathecal morphine decreases the incidence of nausea. Fourth, 0.1 mg of morphine provides higher patient satisfactory score when compared with oral opioids. Finally, using low doses of intrathecal morphine with other nonopioid medications reduces adverse effects and provides adequate analgesia relative to solely administering a dose of intrathecal morphine in excess of 0.1 mg.

Recommendation for Practice: Currently, there is no cure-all method or drug that provides both adequate analgesia and no adverse effects during post cesarean delivery. Research shows there is little benefit to intrathecal morphine doses exceeding 0.1 mg, and as an alternative method, providers should consider using lower doses of intrathecal morphine in conjunction with nonopioid medications. This multimodal approach decreases the number of adverse events reported while achieving adequate analgesia. In general, the use of doses higher than 0.1 mg of intrathecal morphine are associated with greater incidence of adverse reactions, limiting any benefit in pain reduction.

A98

Rapid Recovery Cardiac Surgery Fluid Replacement Protocol

Matthew Onofrio, BSN, RN, CCRN; Erica Wittwer, MD; Hartzell Schaff, MD

Mayo Clinic

Introduction: At Mayo Clinic, the preexisting cardiac surgery fluid replacement protocol was based solely on isolated central venous pressure (CVP) numbers. Cardiac surgeons and ICU practitioners were expressing concern that patients were receiving too much fluid in the postoperative period. The literature review and expert consult survey revealed evidence that supported development of new protocol that used more indicators to guide fluid therapy.

Methods: The PICOT question developed to guide this project was: "In rapid-recovery cardiac surgical patients at Mayo Clinic, what effect does the implementation of an evidence-based, goal-directed fluid replacement protocol, as compared with current practice, have on ICU length of stay, hospital length of stay, ICU discharge delta weight, and total amount of fluid and products administered in the 48 hours postoperatively?" Studies included in the literature review met the following criteria: published in English, publication dates from 2010 to 2015, peer reviewed, and focused on cardiac surgery. PubMed, Embase, Google Scholar, National Guideline Clearinghouse, and the Cochrane Library databases were searched for the following keywords: cardiac surgery, fluid therapy, water-electrolyte balance, central venous pressure, pulmonary artery catheter, and vasoconstrictor.

Analysis of the Evidence: The literature review results were high quality in nature consisting predominantly of meta-analysis, systematic reviews, and randomized controlled trials in multicentered institutions. The main gap in evidence was that all of the information did not always apply to the specific target population of cardiac surgery. Since there were no guidelines specifically for this patient population, the principles in the literature had to be applied in conjunction with expert consult. A provider survey yielded 123 respondents including cardiac surgeons, anesthesiologists, nurses practitioners, physician assistants, and nurses. The provider survey was dovetailed with the literature to develop a new fluid protocol.

Recommendation for Practice: The CVP-based fluid protocol used for rapid recovery cardiac surgery patients demonstrated a divide between recommendations from evidence-based literature and current practice. An interdisciplinary team worked to solve this issue by replacing the outdated protocol with a new evidence-based protocol. In order to assess the outcome, 20 mechanical aortic valve replacement patients were randomly selected preprotocol/postprotocol implementation. The postimplementation group received an average of 425 mL less fluid than patients who received fluids according to the previous protocol. The new protocol was integrated into the cardiovascular surgery rapid recovery order sets at Mayo Clinic campuses in Rochester, Minnesota; Scottsdale, Arizona; and Jacksonville, Florida.

Source of Funding: No funding was required for this project. Support was provided by Mayo Clinic's Department of Cardiology, Department of Anesthesiology, Critical Care Service (CCS), Order Set & Protocol Advisory Group (OSPAG), and Center for Clinical and Translational Services (CCaTS).

A99

Reducing Perioperative Medication Errors Among Anesthesia Providers

Carlos Moreno, BSN, RN, CCRN

University of Miami

Introduction: In 2000, the Institute of Medicine found medication errors injured 1.5 million people and killed 7,000 annually. They declared a need to improve patient safety by learning from errors and raising standards. In the operating room, medication errors occur due to a fast-paced environment. Evidence-based recommendations to reduce the risk of error in anesthesia are necessary.

Methods: The purpose of this review was to answer the following question: In surgical patients, which recommendations will significantly help reduce the incidence of medication error in anesthesia during the perioperative period? The literature search used the CINAHL, EMBASE, and MEDLINE databases for the gathering of peer-reviewed studies. Inclusion criteria included peer-reviewed studies in English, published from 2010 to present, medication errors, drug error, perioperative setting, patient safety, and recommendations. The appraisal of evidence was performed with the Johns Hopkins Appraisal Tool. Three Level II studies, 12 Level III studies, 2 Level IV studies, and 6 Level V studies were included in the appraisal.

Analysis of the Evidence: Peer-reviewed studies indicated the most common type of medication error was wrong dosage. Analgesic, antibiotics, and vasopressors attributed to the most common medication error administered by anesthesia providers. The articles also stated that several contributing factors led to perioperative medication errors such as human, environmental, and patient characteristics. Evidence further stated distractions, lack of standardization, lack of technology, lack of pharmacy involvement, inadequate patient information, and work culture attributed to medication errors. In consideration of these findings, improvement is needed to reduce errors in the perioperative setting.

Recommendation for Practice: In conclusion of this review, synthesis of evidence recommends thorough patient history standardization, technology implementation, pharmacy involvement, distraction avoidance, and culture be addressed in the perioperative setting to minimize anesthesia-related medication errors. Medication reconciliation and established weight-based dose limits are components in the patient's record. Having high-alert medications prepared in the pharmacy with scanning labels addresses standardization, pharmacy involvement, and technology implementation. Minimizing distractions such as music during time out and promoting a nonpunitive culture is essential in reducing medication errors.

A100

Relationship Between Emotional Intelligence and Occupational Stress Levels Among Certified Registered Nurse Anesthetists

Andrea Bittinger, DNP, CRNA; Karen Dunn, PhD, RN; Estelle Codier, PhD, RN; Anne Hranchook, DNP, CRNA

Oakland University

Introduction: CRNAs are exposed to many stressors and therefore experience high levels of occupational stress and job burnout, which can have harmful effects on practitioners and patients. Having higher levels of emotional intelligence (EI) may be a key coping mechanism in CRNAs to decrease occupational stress. The purpose of this study was to determine if a significant relationship exists between levels of EI and stress levels among CRNAs.

Methods: A CINAHL search was used. Within the nursing literature, nurses who reported higher levels of EI had significantly more positive health outcomes including quality of care, enhanced patient safety, less work-related stress, and less job burnout than nurses who reported lower levels of EI. This study attempted to assess the levels of EI among CRNAs, assess the levels of stress in CRNAs, and determine if significant relationships exist between levels of EI, levels of stress, and demographic variables among CRNAs. A convenience sample of current CRNA members who had an active email address with a list-service was used. Consent was implied by participating in the survey. The study was granted IRB exempt status. A questionnaire survey developed by the principal investigator was used in this study to collect the data of EI, stress levels, and demographics.

Analysis of the Evidence: Most participants were (1) female (68.1%), (2) between the ages of 51 to 55 years of age (16.4%), (3) practicing as a CRNA for over 25 years (28.1%), and (4) working in trauma centers (Level I, II, and III) (71.2%). A statistically significant inverse correlation was found between the total scores of the Emotional Intelligence Scale and the total scores of the Workplace Stress Survey ($r = -.20, p < 0.01$) indicating CRNAs who scored higher levels of EI reported lower levels of workplace stress. Total workplace stress mean score among this sample of CRNAs was 42.48 indicating participants could handle the stress on the job moderately well. Post hoc independent sample testing revealed that female CRNAs scored significantly higher EI levels ($M = 127.55$) than male CRNAs ($M = 122.14$).

Recommendation for Practice: This study provided additional evidence to support that higher levels of EI among healthcare providers may be an effective coping mechanism to decrease the negative effects of stress and indirectly improve the quality and safety of patient care. Less workplace stress may impact job satisfaction and longevity, which can lead to a decrease in staff attrition. Further research is needed to investigate the impact of EI programs and workplace stress awareness programs on job performance and patient satisfaction scores. Assessing levels of EI may be an ideal strategy in the selection of the most qualified nurse anesthesia program candidates to decrease attrition rates.

A101

Retrospective Investigation on Sugammadex and Traditional Reversal on Postoperative Nausea and Vomiting in High-Risk Patients

Ryan Rozycki, BSN, RN; Jacob Kirtley, BSN, RN

Webster University

Introduction: PONV is a frequent postsurgical complication, and patients have rated incidences of PONV as worse than postsurgical pain. Traditional neuromuscular blockade reversal practice includes the use of neostigmine, an associated contributor to PONV. Sugammadex may offer reduction in PONV by eliminating the muscarinic side effects associated with neostigmine. These findings may offer a better guidance of management for those at higher risk of PONV to achieve better outcomes.

Methods: Electronic medical records of 220 patients who had received general anesthesia while undergoing laparoscopic procedures were reviewed. Only high-risk patients (female, nonsmokers, and use of intraoperative opioids) were considered in the study. Patients were categorized into 2 groups on the basis of the type of reversal agent to neuromuscular blockade that was used: a traditional reversal agent (neostigmine; group N; n = 110) and sugammadex; group S; n = 110). Data were then collected if the patient experienced PONV. The primary outcome of this study was PONV from the time leaving the operating room to being discharged from the postanesthesia care unit.

Analysis of the Evidence: The data collected from subjects were analyzed using a chi-square test. This test of independence assesses whether an association exists between the 2 variables by comparing the observed pattern of responses to the pattern that would be expected if the variables were truly independent of each other. Determination of statistical significance was determined by a 95% confidence interval. A $P < 0.05$ was considered statistically significant. Group N resulted in 37 (33.636%) experiencing PONV. Group S resulted in 29 (26.363%) experiencing PONV. There is no significant difference between each group (Pearson chi-square, $P > 0.05$).

Recommendation for Practice: The mechanisms of PONV are multifactorial, including patient history and demography, type of surgery, and anesthetic technique. Although the mechanisms behind PONV are multifactorial, the incidence is distinctly affected by the choice of anesthetic drugs. We recommend a study investigating high-risk patients receiving total intravenous anesthesia undergoing laparoscopy with more control on the dose and type of antiemetics and neuromuscular blockade reversal agents. Until further research has been performed on PONV, 1 way to surmount this particular issue would be to create a protocol that standardizes the anesthetic management of the high-risk patient to help improve the overall patient outcomes.

A102

S.E.E.A.M. – Strategies for Effective Emergency Airway Management

Brian Estevez, BSN, RN; Jennifer Lanzillotta, MSN, CRNA; Beth Clayton, DNP, CRNA; Mary Bakis, DNP, CRNA; Meghan Johnson, MSN, CRNA

University of Cincinnati, Nurse Anesthesia Program

Introduction: Predicting when an airway crisis will transpire is extremely challenging. Patients rarely present with obvious risk factors and most difficult airways are not identified until instrumentation has already been initiated. The aim of the S.E.E.A.M. project was to enhance multidisciplinary preparedness through staff education and standardization of emergency airway equipment.

Methods: PICOT - Does airway cart standardization and education improve clinician preparedness of emergency airway events? The literature review included peer-reviewed articles published between 2011 and 2016 in CINAHL, PubMed, Scopus, and EBSCOHOST databases. Abstracts were assessed and 131 articles were identified. Twenty-eight full-text articles were printed, read, and evaluated. Eight articles were eliminated because these did not satisfy the inclusion criteria, leaving 20 articles for the final analysis. The S.E.E.A.M. project was implemented at Highland District Hospital, a 25-bed, critical access hospital in Hillsboro, Ohio. Informed consent was waived per the IRB. OR staff voluntarily completed a pretest survey. An education module examined current airway literature, difficult airway guidelines, specific hospital policies, and the equipment stored in airway carts. A posttest survey was then administered.

Analysis of the Evidence: Presurvey data indicated that more than 50% of the participants were not aware of all the equipment located within the emergency airway cart. Following the education module, participants were familiar with the location of emergency airway equipment in their unit and in the facility and felt the cart was more organized. Additionally, all participants felt more prepared to assist clinicians with the placement of emergency airway devices. Not all participants completed both surveys, presurvey (n=10) and postsurvey (n=7). Qualitative feedback was positive, although some stated hands-on participation would have improved the experience. Further investigation is necessary to evaluate the S.E.E.A.M. project and its impact on emergency airway outcomes.

Recommendation for Practice: Securing an airway in an emergency requires skill, available equipment, and team collaboration. It is imperative that staff members know the location of emergency airway carts within their institution and feel prepared to assist clinicians during an airway crisis. Emergency airway carts should be standardized to meet the specific needs of the institution, clinicians, and patients served. Proactive approaches such as S.E.E.A.M. can increase access to airway equipment, expedite intervention times, and optimize patient safety standards.

A103

Safety of Neuraxial Anesthesia for Labor and Delivery in Parturients with Arnold Chiari Type I Malformation

Danielle Fassieux, BSN, RN; Lyda Shambo, DNP, CRNA

Columbia University School of Nursing

Introduction: Consideration must be given to the anesthetic management of parturients with Chiari malformations. Patients with Arnold Chiari malformation type I (ACM-I) are assumed to have inherent high intracranial pressure (ICP) and the risk of herniation after dural puncture has been cited as a contraindication to neuraxial anesthesia. This assertion has no evidentiary support in asymptomatic patients. Current literature is devoid of management recommendations.

Methods: The Google Scholar, Ovid, PubMed, and CINAHL databases were searched for literature from 2013 to the present. Keywords included Chiari malformation, anesthesia, and parturient. Only English language articles with full text available online were selected from peer-reviewed journals. Of the 16 articles that met the above criteria, 4 were excluded for lack of relevance or were deemed ineligible for not focusing exclusively on the anesthetic management of parturients with ACM-I. The final search results yielded 5 case reports, 5 literature reviews, and 2 retrospective case series.

Analysis of the Evidence: Each study referenced a sentinel work that examined parturients with ACM-I in a 50-year case series to conclude that neuraxial anesthesia is safe and effective. Ten studies cited evidence showing that neuraxial anesthesia is safe in asymptomatic ACM-I patients. Maternal postpartum symptoms were only noted after utilizing a continuous spinal or inadvertent dural puncture. General anesthesia was used in case reports in which patients had significant tonsillar herniation. Irrespective of ACM-I, difficult or failed intubation for induction of general anesthesia is the leading cause of anesthesia-related maternal complications in all parturients.

Recommendation for Practice: If symptoms are present upon neurological evaluation, current research recommends recent MRI imaging should be obtained to evaluate the level of herniation. If increased ICP, syringomyelia, and/or tonsillar herniation greater than 1 cm are present, general anesthesia should be used. In the absence of these signs, research indicates that neuraxial anesthesia is safe and should be employed when possible to decrease the risks of airway management. Practice recommendations state epidural placement should be done by the most experienced provider using slow titration of epidural medication.

A104

Student Registered Nurse Anesthetist (SRNA) Education on Noise Pollution in the Operating Room and Reduction Strategies and Tools

Tyler Davis-Sandfoss, BSN, RN; Rachel Smith-Steinert, DNP, CRNA; Courtney Hamilton, DNP, RN

University of Cincinnati

Introduction: Noise pollution in the operating room (OR) poses a threat to both patients and providers. Sound levels often exceed recommended standards. The purpose of this project was to examine current evidence and implement education regarding noise in the OR. Attention was placed on the effects of increased noise level and the delivery of an anesthetic, with focus on resultant sequelae.

Methods: PICOT: Considering the student registered nurse anesthetist (SRNA), does the use of an educational module addressing noise pollution in the operating room and associated complications, compared with the current curriculum schema with no formal education of noise pollution, influence provider concentration and willingness to adjust clinical practice within 6 months of completing the module? A literature review produced 117 articles, of which 35 were included for analysis. Systematic reviews, randomized and nonrandomized controlled trials, cohort studies, case studies, qualitative studies, and expert opinion were all included. An education module was delivered to SRNAs. A pretest and posttest methodology was utilized to assess the efficacy of the education module for SRNAs.

Analysis of the Evidence: Noise pollution is a complex, multifactorial problem. The psychological, physical, and emotional effects of noise pollution identified were the inability to critically think, impaired team communication, chronic hearing loss, and increased incidence of medical error. Results generated from the education module illustrate a knowledge deficient of SRNAs pertaining to noise reduction, cognitive demand, and attention allocation. Posttest scores (M=90%) for SRNAs who completed the education module were significantly greater than pretest scores (M=60%), $t(39) = 10.1$, $p = 1.88 \times 10^{-12}$.

Recommendation for Practice: Emphasis should be placed on sustaining and integrating the noise reduction education into curriculum schema of nurse anesthesia programs. To be comprehensive, it would be beneficial for the educational content to be delivered to include all anesthesia providers and the interdisciplinary care team in the operating room. Although several national initiatives are in place to reduce noise, it is imperative that this knowledge be shared and interventions implemented to protect both provider and patient. Furthermore, there should be collaboration among a variety of surgical specificities to continue research pertaining to the production of noise in the operating room.

A105

The Effectiveness of a Standardized Anesthesia Intraoperative Handoff Report on Improving Communication

Amanda Gonzalez, BSN, RN

University of North Florida

Introduction: Inaccurate or incomplete handoffs can result in delays, suboptimal care, greater costs, and patient harm. It is unclear if the use of an intraoperative handoff checklist between anesthesia providers is effective in improving communication. The purpose of this evidence-based practice project is to present the evidence on the effectiveness of an intraoperative anesthesia handoff checklist on handoff communication.

Methods: Keywords from the following PICOT question were used to search the Cochrane, PubMed, CINAHL, and OVID literature databases: Do surgical patients receiving anesthesia (P) whose charting uses a standard intraoperative handoff report (I) compared with similar patients whose charting did not have this type of report (C) have a greater level of communication (O) intraoperatively (T)? Four quasi-experimental studies were critically appraised.

Analysis of the Evidence: The results of these studies consistently found that the use of checklists improved the accuracy and completeness of intraoperative anesthesia handoff reports, found improved retention of critical patient information after handoff, and found that improved handoffs occurred even 6 months after implementing a checklist with accompanying training. From this evidence it is recommended that intraoperative anesthesia handoff report checklists be used to improve the quality of handoff report and the retention of information.

Recommendation for Practice: Two informational lunch sessions were given to certified registered nurse anesthetists (CRNAs), student registered nurse anesthetists (SRNAs), and anesthesiologists at Halifax Health Medical Center of Daytona Beach, Florida. No preintervention information was collected because there was no intraoperative handoff policy in place. To determine a change, completeness of the handoff reports using the checklist was monitored during each case over 5 weeks following the lunch sessions. Complete report using the checklist was given during 80.2% of handoffs. This work showed that implementing intraoperative anesthesia handoff checklists and giving informational sessions on the effectiveness of such checklists resulted in a practice change for the anesthesia providers at Halifax Health.

A106

The Effectiveness of Combined Single-Shot Femoral/Sciatic Peripheral Nerve Block Versus a Single-Shot Femoral Nerve Block for Postoperative Pain Management in Patients Receiving Total Knee Arthroplasty

John Bell, BSN, RN; Vicente Gonzalez, DNP, CRNA; Rick Hasty, MD

Florida International University

Introduction: Total knee arthroplasty (TKA) is one of the most common elective surgical procedures, which causes severe postoperative pain in 60% of patients. Inadequate postoperative pain management could lead to severe complications. Peripheral nerve blocks have proven to be a reliable source of analgesia for patients undergoing a TKA, which enhances recovery and the patient's overall experience.

Methods: The purpose of this evidence-based project was to answer the following clinical question: Among patients undergoing total knee arthroplasty, does administering a combined femoral and sciatic peripheral nerve block result in reduced postoperative pain within the initial 24-hour postoperative period, as compared with a single-shot femoral peripheral nerve block? Existing systematic reviews and evidence-based guidelines on the topic were reviewed through the databases of Cumulative Index to Nursing and Allied Health Literature (CINAHL), MEDLINE, and PubMed. The search was limited to publications within the past 8 years and analyzed based on their title and abstract. The result was 543 articles, 12 met the inclusion criteria that consisted of systematic reviews, meta-analyses, and randomized controlled trials.

Analysis of the Evidence: This systematic review evaluated the effectiveness of a combined single-shot femoral/sciatic peripheral nerve block (CFSNB) versus a single-shot femoral nerve block (FNB) for postoperative pain management in patients receiving TKA. Eleven out of the 12 studies demonstrated that the CFSNB substantially reduced postoperative pain scores and opioid consumption within the first 24 hours in patients receiving TKA. The CFSNB decreased opioid consumption by 10.6 mg and showed a decrease in pain levels up to 8 to 24 hours during rest and movement.

Recommendation for Practice: Patients undergoing TKA, excluding those with contraindications to regional anesthesia, should receive a preoperative CFSNB to improve postoperative pain management, mobility, and reduce length of stay. Enhanced recovery after surgery (ERAS) protocols are multimodal perioperative care pathways designed to achieve early recovery after surgical procedures. The implementation of ERAS protocols with CFSNB in TKA as the standard of treatment will achieve early recovery by reducing intraoperative hemodynamic instability, postoperative pain and opioid use, and improve mobility and rehabilitation.

A107

The Effectiveness of Continuous Intraoperative Lidocaine Infusions at Reducing Postoperative Pain

Kristi Doke, BSN, RN; Jessica Lowther, BSN, RN; John McDonough, CRNA, EdD; Debran Harmon-O'Connor, DNP, CRNA; Enrico Camporesi, MD

University of North Florida, Doctorate of Nursing Practice in Nursing Anesthesia Practice

Introduction: Abdominal surgery is associated with complications especially with opioid drugs. Intraoperative intravenous (IV) lidocaine with anti-inflammatory, analgesic, and antihypertensive properties may be an effective alternative to opioids. The purpose of this evidence-based practice project was to describe the evidence on the effectiveness of intraoperative IV lidocaine at reducing postoperative pain.

Methods: Keywords from the following PICOT question were used to search the literature databases CINAHL, PubMed, Cochrane, and the National Library of Medicine: Do adult patients undergoing abdominal surgery (P) who are administered a continuous lidocaine infusion intraoperatively, (I) compared with similar patients that do not receive a continuous lidocaine infusion intraoperatively, (C) have less pain and better outcomes (O) postoperatively (T)? The results of this search yielded 1 systematic review, 1 meta-analysis, and 2 randomized controlled trials that answered the PICOT question.

Analysis of the Evidence: Results from these studies consistently found that patients who received intraoperative IV lidocaine infusion had less postoperative pain, fewer narcotic requirements, faster return of gastrointestinal function, decreased incidence of ileus formation, and reduced hospital length of stay. It is recommended from this evidence that intraoperative lidocaine infusion be given to reduce postoperative pain.

Recommendation for Practice: A 20-minute PowerPoint presentation was given to anesthesia providers at Tampa General Hospital that educated providers on the effectiveness of IV lidocaine at reducing postoperative pain. Educational flyers were placed in each operating room with key points regarding the effectiveness of IV lidocaine infusion. To determine if a change in practice occurred, the frequency of lidocaine use was determined by monitoring pharmacy records for abdominal surgery patients for 2 months prior to implementation (January-February 2018) and 2 months following implementation (March-April 2018).

A108

The Effectiveness of Dexmedetomidine for Emergence Agitation in Pediatric Patients

Olivia Maggitti, BSN, RN; Angela Hankins, BSN, RN

University of North Florida, Doctorate of Nursing Practice in Nurse Anesthesia Program

Introduction: Emergence agitation (EA) occurs in up to 80% of pediatric surgical patients on emergence from general anesthesia. Fentanyl, midazolam, and propofol are used to prevent or treat EA, all have adverse side effects. It is unclear if intravenous (IV) dexmedetomidine, a highly selective alpha-2 adrenergic agonist, decreases the incidence and severity of EA in pediatric surgical patients. This work will describe the evidence on dexmedetomidine in reducing the incidence and severity of EA.

Methods: Keywords from the following PICOT question were used to search the Cochrane Library of Systematic Reviews, CINAHL, PubMed, and MEDLINE databases: Do pediatric patients undergoing general anesthesia (P) who are given intraoperative IV dexmedetomidine (I) compared with similar patients who are not given IV dexmedetomidine (C) have a lower incidence of emergence agitation (O) postoperatively (T)? One meta-analysis of randomized controlled trials (RCTs) and 3 RCTs were critically appraised.

Analysis of the Evidence: The results of 1 meta-analysis of RCTs and 3 RCTs consistently found that intraoperative IV dexmedetomidine decreased the incidence of EA in pediatric surgical patients. Three RCTs found that IV dexmedetomidine in the dose range of 0.3 to 0.5 mcg/kg administered within 5 minutes prior to the end of surgery significantly decreased the incidence of EA.

Recommendation for Practice: A 10-minute PowerPoint presentation was given to CRNAs at Halifax Health Medical Center during a monthly anesthesia meeting. A lunch-and-learn session was set up in the anesthesia break room following the anesthesia meeting for CRNAs to ask questions. Flyers explaining the evidence of the effectiveness of dexmedetomidine and the effective dose were displayed in frequently accessed areas. Operating room (OR) pharmacy records on pediatric surgery days were monitored to determine the change in frequency of use of dexmedetomidine.

A109

The Effectiveness of Preoperative Warming to Prevent Intraoperative Hypothermia

Jessica E. Smith, BSN; Alexis N. Johnson, BSN; Gerard Hogan, DNSc, CRNA, ARNP, PMHNP-BC; Nicholas Kalynych, DNP, MSHS, CRNA, ARNP

University of North Florida, Doctorate of Nursing Practice in Nurse Anesthesia Program

Introduction: Perioperative hypothermia occurs with more than half of surgical patients, impeding physiological function. It is unclear if active preoperative warming increases body temperature intraoperatively to improve patient outcomes. The purpose of this evidence-based practice project was to present evidence on effectiveness of preoperative forced-air warming to prevent intraoperative hypothermia.

Methods: Keywords from the following PICOT question were used to search the literature databases CINAHL, PubMed, Cochrane Library, and MEDLINE. Do surgical patients (P) who receive preoperative warming (I) compared with similar patients who do not receive preoperative warming (C) have a lower incidence of hypothermia (O) intraoperatively (T)? Three randomized clinical trials, 1 systematic review of randomized clinical trials, and a cohort study that answered the PICOT question were critically appraised.

Analysis of the Evidence: Results found preoperative forced-air warming for 10, 20, or 30 minutes improved intraoperative hypothermia. In a systematic review by Roberson et al (2013), a statistically significant difference was found in the incidence of intraoperative hypothermia between prewarmed and not prewarmed patients. A randomized controlled trial by Horn et al (2012) found that preoperative forced-air warming prevented intraoperative hypothermia more than warm blankets. From this evidence it is recommended that preoperative forced-air warming be initiated to reduce intraoperative hypothermia.

Recommendation for Practice: It is recommended from this evidence that patients receiving general anesthesia for surgical procedures less than 120 minutes receive preoperative forced-air warming to reduce intraoperative hypothermia. Intraoperative temperatures at Mayo Clinic Jacksonville showed many patients with hypothermia were not prewarmed. Education on the evidence of effectiveness of preoperative warming was presented to the perioperative staff. The frequency of use of preoperative BairHuggers was monitored for 1 month prior to the education session and 1 month after to determine if there was an increase in the number of prewarmed patients.

A110

The Effects of Dexmedetomidine on Postoperative Opioid Use in Obese Patients Undergoing Bariatric Surgery

Khetsung Sherpa, BSN; Amy Harbeck, MS; Kristie Wade, DNAP; Peter Moll, MD

Center for Nurse Anesthesiology

Introduction: Obese patients pose a significant challenge to anesthesia providers, as these patients are at a higher risk for postoperative hypoxemia and hypoventilation. Furthermore, narcotics reduce upper airway tone and exacerbate sleep apnea. This literature review examined if the use of intraoperative dexmedetomidine reduced postoperative opioid consumption in obese patients undergoing bariatric surgery.

Methods: Does intraoperative dexmedetomidine decrease postoperative opioid requirements in obese patients undergoing bariatric surgery? PubMed and CINAHL databases were used for this literature review. MeSH terms included OSA, obstructive sleep apnea, bariatric surgery, and dexmedetomidine. Only English language, human subject studies, and those published within the past 10 years were selected for inclusion. An initial search yielded 7 studies. A total of 3 studies were included in this literature review.

Analysis of the Evidence: Three articles were included in this literature review (Bakhamees et al, 2007; Dholakia et al, 2007; Tufanogullari et al, 2008). Studies showed that intraoperative dexmedetomidine significantly decreased total intraoperative fentanyl and total postoperative morphine requirements. These findings were limited by small sample sizes and a lack of power. Further studies with larger sample sizes and additional dose ranging studies are required to support the use of dexmedetomidine in obese patients.

Recommendation for Practice: Obese patients are at an increased risk for narcotic induced postoperative respiratory depression. Dexmedetomidine has been demonstrated to decrease postoperative opioid use in obese patients undergoing bariatric surgery. Dexmedetomidine offers a safe adjunct to opioid analgesics and may be beneficial in the management of obese patients undergoing bariatric surgery.

A111

The Graduate Record Examination as a Predictor of Success in Nurse Anesthesia Educational Programs

Tu Nguyen, BSN, RN; Jodi Della Rocca, PhD, CRNA; Denise Martin-Sheridan, PhD, CRNA

Center for Nurse Anesthesiology at Albany Medical College

Introduction: The Graduate Record Exam (GRE) is not a universal requirement for nurse anesthesia educational programs (NAEPs). Its use in NAEP completion or achievement of first-time pass rates on the National Certification Examination (NCE) may be valuable. This review of the literature investigates the individual subcategories of the GRE for predictive validity and successful program completion.

Methods: Literature presented in this review was obtained from a comprehensive electronic search in PubMed, ProQuest, and the Cumulative Index to Nursing and Allied Health Literature (CINAHL) database through the Schaffer Library at Albany Medical College and Google Scholar. Search strategies included the key terms graduate record examination, GRE, CRNA, nurse anesthesia, NCE, and program success. All articles were written in English. Three peer-reviewed articles and 1 published dissertation were included in the review. The peer-reviewed articles consisted of a prospective, longitudinal, descriptive study; a retrospective cohort study; and a quantitative correlational study. The dissertation was a quantitative, predictive correlational study.

Analysis of the Evidence: This literature review investigated if GRE scores were predictive of successful completion of an NAEP or successful first-time pass rate on the NCE. Hulse et al concluded that quantitative and verbal GRE scores were not predictive of success in an NAEP, while Wilson et al established a correlation between the analytical and total GRE score with success in an NAEP. Burns identified a correlation between the total GRE score and positive academic progression in an NAEP. Della Rocca demonstrated quantitative GRE scores were predictive of first-time pass rate on the NCE at 1 NAEP.

Recommendation for Practice: Identifying predictive assessments of success in an NAEP is problematic. Conflicting evidence exists regarding the use of GRE scores for successful completion of an NAEP. Studies were limited by convenience sampling, subject homogeneity, and small sample sizes. Hulse et al and Wilson et al were further limited to military NAEPs. Due to the paucity of research and conflicting results, further research is required to determine if the GRE is a valuable tool in predicting successful completion of an NAEP.

A112

The Patients Are Alive With the Sound of Music: Effects of Intraoperative Music on Postoperative Outcomes

Kent Haina Jr, BS, RN, CCRN; Lyda Shambo, DNP, CRNA

Columbia University School of Nursing

Introduction: Support for music as a cheap, effective treatment for anxiety and pain is well documented. Intraoperative music and postoperative outcomes have been investigated, but practice recommendations are absent due to a lack of synthesized data about efficacy and best practice. This review examines current literature to explore music as an intraoperative adjunct to improve postoperative outcomes in adults.

Methods: PubMed, Ovid, and CLIO were searched for scholarly publications, in English from 2013 to present, and for titles containing music and anesthesia and music and intraoperative. Exclusion criteria included no headphones used, music not used intraoperatively, no postoperative outcomes measured, no relevance to the topic, and pediatric cases. Six studies were included in the final analysis; 4 randomized controlled trials, 1 quasi-experiment, and 1 qualitative study. None were double-blinded. All quantitative studies were deemed unbiased and power analysis found them to be adequately powered. Type of music use varied, and some studies allowed patients to select their music.

Analysis of the Evidence: Research demonstrates that intraoperative music significantly decreases postoperative anxiety across anesthesia techniques, with 5 studies reporting this. Three studies measured postoperative satisfaction with mixed results. One article measured recovery time and found no difference in outcomes between groups. No side effects were reported from the interventions, and they are recognized as low cost and safe. A qualitative study determined that patients prefer choosing their own music. One study explored general anesthesia and postoperative pain, with results suggesting that music played under general anesthesia may lead to improved postoperative pain, calmer recovery, and higher patient satisfaction.

Recommendation for Practice: Current evidence confirms previous studies that support music's role in decreasing anxiety. Given these results, music may be used intraoperatively to decrease postoperative anxiety with an intervention that is easy to employ, low cost, and has no side effects. General anesthesia, higher acuity patients, recovery time, and music type are not fully studied. Limited general anesthesia results suggest that music may be helpful in improving postoperative pain and recovery. Further research is needed to determine how music might best be used intraoperatively to improve postoperative outcomes.

A113

The Pharmacodynamic Effects of the Single Nucleotide Polymorphism A118G on the μ -1 Opioid Receptor and Its Relationship with Perioperative Morphine Consumption in Adults Undergoing Abdominal Surgery

Natalie Grable, BSN, RN; Giovanna M. Mahar, DNAP, CRNA; Dana R. Crawford, PhD

Center for Nurse Anesthesiology at Albany Medical College

Introduction: Structural variations in the μ -opioid receptor (OPRM1) alter the pharmacodynamics of pain perception and processing. Understanding how genetics influence nociception will contribute to a safer approach to pain management. This literature review evaluates the difference in perioperative morphine consumption in surgical patients who exhibit the OPRM1 A118G genetic variation and in those who do not.

Methods: In adult patients undergoing abdominal surgery who exhibit the OPRM1 A118G allele (AG or GG), is there a significant difference in perioperative morphine consumption compared with those who exhibit the OPRM1 wild type (AA) allele? PubMed and CINAHL databases were used for this literature review. Key terms used for the search included OPRM1, A118G, morphine, abdominal, and surgery. A total of 18 articles were recovered. All research had to be completed within the past 10 years and limited to the English language. Research had to have subjects greater than 18 years of age undergoing surgical abdominal procedures. Research focusing on any opioid other than morphine was excluded. A total of 3 studies met inclusion criteria and were included in this literature review.

Analysis of the Evidence: Three articles were included in this literature review (Tan et al, 2009; Sia et al, 2013; De Gregori et al, 2016). A significant association between the OPRM1 A118G allele and total morphine consumed was identified (Tan et al, 2009; Sia et al, 2013). De Gregori et al (2016) showed a direct relationship between the number of G alleles and increasing morphine consumption, but results did not achieve statistical significance. These studies offer evidence that patients who exhibit the OPRM1 A118G allele (AG or GG) may require more perioperative morphine than patients who exhibit the OPRM1 wild type allele (AA).

Recommendation for Practice: The ability to predict the effects of specific opioid doses in surgical patients could mitigate the untoward side effects associated with opioid overdose while optimizing perioperative analgesia. Adequate pain management is multifactorial and involves more than simply determining one's A118 genotype. Similar studies investigating OPRM1 receptor variations and other drugs of the opioid class are crucial to the advancement of pharmacogenetics. Cost analyses of preoperative genotyping and the prevention of adverse events must be considered. Access to affordable, noninvasive genetic testing within healthcare institutions will promote the pharmacogenetic influence on patient safety.

A114

The Use of Ketamine During General Anesthesia in Military Patients With Posttraumatic Stress Disorder and the Risk of Emergence Delirium

Catherine M. Thomas, MS, CRNA; Edward G. Gyukeri Jr, MS, CRNA; Kenneth E. Heffner, DNP, CRNA
Center for Nurse Anesthesiology at Albany Medical College

Introduction: Posttraumatic stress disorder (PTSD) is characterized as recurrent memory of traumatic events causing emotional distress, aggressive behavior, and social avoidance. Ketamine improves neural connections in patients with PTSD, alleviating symptoms. This literature review investigates intravenous ketamine and its effect on PTSD and its symptoms after surgery in patients with PTSD.

Methods: A comprehensive electronic search of the literature was conducted between 2012 and 2017. Databases included PubMed through the Schaffer Library at Albany Medical College and Google Scholar. Medical subject heading (MeSH) terms post-traumatic stress disorder, emergence delirium, anesthesia, and ketamine were entered in multiple combinations to yield resources. No language restrictions were employed and only full-text articles were utilized. A total of 10 articles were used for reference, and 3 studies were chosen to be discussed in this literature review. This review was IRB exempt.

Analysis of the Evidence: In Moreno et al (2017), ketamine 125 mg/kg leads to significant memory retention latency; lower dose ketamine, 100 mg/kg, has no effect. Ketamine-treated rats spent significantly less time interacting socially. Moreno et al demonstrates ketamine may promote PTSD. McGhee et al (2014), showed no significant difference of a positive PTSD screen between intraoperative and no ketamine administration. McGhee supports that ketamine does not increase PTSD development. In Feder et al (2014), ketamine 0.5 mg/kg was associated with significant reduction in PTSD symptom severity, reduction in depressive symptoms, and tolerated without dissociative symptoms. Feder et al demonstrates reduction in PTSD symptom severity after ketamine infusion.

Recommendation for Practice: Intravenous ketamine provides analgesia and alleviates postoperative PTSD symptoms. Military personnel with PTSD who need medical and surgical treatment are at increased risk of injuring themselves as well as others due to the effects of PTSD. Research has shown intravenous ketamine may improve the safety profile and postoperative outcome of patients with PTSD and should be considered as an adjunct in general anesthesia. More research needs to be performed to further explore ketamine as a treatment for PTSD and its symptoms.

A115

The Use of Stroke Volume Variation Goal Directed Fluid Therapy

Yvette Bantilan, BSN, RN; Mounir Larhrib, BSN, RN; Obianuju J. Offor, BSN, RN; Ryan Shores, DNP, MSN, CRNA; William Self, DNP, MSN, CRNA; Debran Harmon-O'Connor, DNP, MAT, MSH, CRNA

University of North Florida, Doctorate of Nursing Practice in Nursing Anesthesia Program

Introduction: During major abdominal surgery, inappropriate fluid therapy results in organ hypoperfusion or fluid overload leading to postoperative complications. It is unclear if stroke volume variation (SVV) goal directed fluid therapy (GDT) provides a more accurate method for fluid replacement than traditional methods. The purpose of this evidence-based practice project is to present the evidence on the effectiveness of GDT using SVV for major abdominal surgeries.

Methods: Keywords from the following PICOT question were used to search 5 literature databases: Do major abdominal surgery patients (P) administered stroke volume variation goal-directed fluid therapy (I) compared with patients using standard fluid replacement methods (C) have better outcomes (O) postoperatively (T)? Three systematic reviews and meta-analyses and 3 randomized controlled trials were critically appraised.

Analysis of the Evidence: The results of these studies consistently found that SVV GDT was associated with a reduction in postoperative complications including postoperative wound infections and gastrointestinal complications. It also improved gastrointestinal system recovery, reduced mortality, and reduced hospital length of stay.

Recommendation for Practice: Two 3-hour eat-and-learn sessions were provided to 36 CRNAs in collaboration with Edwards Lifesciences at Halifax Health in Daytona Beach, Florida on the evidence of the effectiveness of SVV GDT. The setup and use of the EV1000 to monitor SVV was also provided. Anesthesia providers were also given reference cards and emailed links to videos on this topic. Quick reference guide posters were placed in all operating room suites. The frequency of use of GDT sensors was monitored through the billing department to compare 2 months before and 2 months following the educational sessions. This monitoring of frequency of sensor use will determine whether a change in practice was made following this educational effort on SVV GDT.

A116

The Use of Tranexamic Acid for the Treatment of Postpartum Hemorrhage

Margaret E. Cook, DNAP, CRNA; Lorraine N. Schoen, MSN, CRNA; Sharon M. Burns, EdD, CRNA
Texas Wesleyan University

Introduction: Postpartum hemorrhage (PPH) is a life-threatening complication of pregnancy and delivery. PPH is a worldwide obstetrical emergency, complicating 2% of all cesarean deliveries and vaginal births. Despite the World Health Organization (WHO) preventative and treatment guidelines, PPH remains a leading cause of maternal mortality, responsible for approximately 25% of all maternal deaths.

Methods: The PICO question was: For patients experiencing PPH or at high risk for PPH (population), does the administration of tranexamic acid or TXA (intervention) result in improved maternal outcomes? Improved outcomes are defined as decreased blood loss, morbidity and mortality, and fewer blood transfusions. The patient population examined in this PICO question are parturients at high risk for PPH or diagnosed with PPH. The search for evidence using PubMed, SUMsearch, and the Cochrane Library resulted in 324 potential evidence sources. Eight systematic reviews with meta-analysis, 1 systematic review without meta-analysis, 1 randomized controlled trial, and 1 nonrandomized controlled trial met inclusion criteria. The sources specifically examined TXA in the treatment, prevention, or management of PPH.

Analysis of the Evidence: The evidence confirmed that the administration of TXA within 3 hours of PPH diagnosis prevents maternal death. Administration of first dose of TXA greater than 3 hours after diagnosis of PPH favors the control. The evidence also suggests that the prophylactic administration of TXA in high-risk parturients reduces overall blood loss and decreases the risk of PPH. No increased risk of thromboembolic events with administration of TXA was demonstrated in any evidence reviewed. The World Health Organization (WHO) adapted guidelines in PPH management as a direct result of literature included in this systematic review.

Recommendation for Practice: The authors will present their findings to the stakeholders in their institutions to institute or increase the use of TXA in this setting. Findings from this review indicate that TXA should be administered to patients immediately upon diagnosis of PPH and may be indicated as a prophylactic treatment in patients at high risk of developing PPH. With the favorable side-effect profile, low-cost nature of the medication, and potential to decrease maternal morbidity and mortality, increased use of TXA is expected because of the findings of this review. Education through presentation, publication, and discussion of evidence-based findings are intended methods of disbursement of these findings.

A117

The Utilization of Ondansetron Prior to Spinal Block to Attenuate Spinal-Induced Hypotension, Bradycardia, and Vasopressor Use in ASA 1 and 2 Obstetric Cesarean Delivery Parturients

Amanda M. Thornton, BSN, RN, CCRN; Hallie J. Evans, DNP, CRNA, ARNP; Andrew Birky, MSN, CRNA, ARNP

Florida International University

Introduction: The Bezold-Jarisch reflex and sympathectomy occur at high rates under spinal anesthesia, which results in hypotension and bradycardia. Traditional spinal-induced hypotension treatments are somewhat efficacious. Maternal loss of consciousness, vomiting, and fetal acidosis have prompted the adoption of ondansetron 5 minutes prior to spinal block as an adjunct to attenuate spinal-induced hypotension.

Methods: The purpose of this project was to answer the following question: In ASA 1 and 2 obstetric cesarean section patients, does the use of ondansetron 5 minutes prior to spinal block compared with no ondansetron reduce spinal-induced hypotension, bradycardia, and vasopressor use? CINAHL, MEDLINE, and EMBASE databases were utilized. Inclusion criteria included randomized controlled trials in English, published 2007 to present, parturients under spinal anesthesia for cesarean section, ondansetron given before spinal, and outcomes including hypotension, bradycardia, and vasopressor use. Duplicates were removed leaving 319 studies. The level of quality was based on Johns Hopkins Appraisal Tool. Seven randomized controlled trials, with a sample of 642 patients, were included for this critical analysis.

Analysis of the Evidence: Five randomized controlled trials showed 4 mg of ondansetron 5 minutes before 0.5% bupivacaine spinal anesthetic for elective cesarean delivery significantly attenuated spinal-induced hypotension and significantly decreased the dose of vasopressor requirement in ASA 1 and 2 parturients. One randomized controlled trial found prophylactic, 4 mg, of ondansetron 5 minutes prior to spinal anesthesia had a significant decrease in bradycardia over time. One randomized controlled trial found 4 mg of ondansetron before spinal anesthesia to reduce the number of parturients requiring vasopressors. Two randomized controlled trials that showed no reduction in bradycardia and hypotension used intrathecal opioids.

Recommendation for Practice: The empirical evidence shows the administration of ondansetron, 4 mg, 5 minutes prior to spinal anesthesia significantly attenuates maternal hypotension responsible for negative side effects and reduces vasopressor use. Recommended methods include the use of ondansetron 5 minutes prior to spinal anesthesia, left uterine displacement to avoid aortocaval compression, fluid preloading, fluid coload, limit intrathecal opioids, and vasopressor use as needed. The implementation of an evidence-based spinal-induced hypotension management algorithm to reduce variations in practice will meet Centers for Medicare & Medicaid Services guidelines for safe, high quality, cost-effective healthcare.

A118

Thromboelastographic-Guided Blood Transfusion In Cardiac Surgical Patients

Barbara Ramos, BSN, RN; CDR Valerie J. Diaz, DNP, CRNA, ARNP, NC, USN; Christine Daneshgar, MSN, CRNA, ARNP

Florida International University

Introduction: US healthcare expenditure in 2015 was \$2.7 trillion. The increased use of blood resources for cardiac surgery contribute to healthcare cost and challenge stakeholders to reduce spending without compromising quality and patient safety. The use of thromboelastography (TEG)-guided transfusion therapy is a point-of-care assessment tool designed to determine when transfusion is appropriate.

Methods: The purpose of this evidence-based project was to answer the following clinical question: In adult patients undergoing cardiac surgery, how does the implementation of TEG-guided transfusion therapy minimize transfusion needs, compared with the use of laboratory studies during the intraoperative period? The literature search included 3 databases: EMBASE, MEDLINE, and CINAHL, yielding 645, 90, and 24 citations, respectively, for a collective total of 759. Upon application of inclusion and exclusion criteria, 37 articles were reviewed and 10 study designs were selected inclusive of 4 systematic reviews, 2 meta-analyses, 2 randomized controlled trials, 1 literature review, and 1 randomized controlled trial.

Analysis of the Evidence: Randomized controlled trials of cardiac surgical patients compared TEG to coagulopathy lab tests to determine when to transfuse. The TEG-guided algorithm reduced consumption of blood products in patients undergoing elective coronary artery bypass graft (CABG) and reduced risks of transfusion-related complications and total costs after CABG. Meta-analysis of TEG point-of-care testing (POCT) demonstrated that these transfusion strategies reduced the risk of transfusion by 10.6%. The POCT group received less PRBCs, platelets, and FFP. TEG use also reduced blood loss in massive bleeding cases. Moreover, TEG-based management reduced total blood product usage by 58.8%, and short-term outcomes were better compared with the coagulation test group.

Recommendation for Practice: Five million Americans need blood annually, and 20% of those are cardiac surgical patients. The actual cost of a unit of blood ranges from \$500 to \$1,200 for a hospitalized patient, and Medicare expenditure for blood transfusions is \$4.6 billion yearly. TEG-guided transfusion therapy provides a formalized protocol to utilize blood resources judiciously to maintain quality and patient safety while decreasing transfusion costs in the cardiac surgical population. Current evidence supports a restrictive TEG-guided transfusion protocol will decrease the frequency of allogenic blood transfusions thereby decreasing healthcare expenditure.

A119

Transversus Abdominis Plane Blocks for Postoperative Cesarean Delivery Pain

Tiffany Whiting, BSN, RN; Brooke Blasser, BSN, RN

University of North Florida

Introduction: Patients having cesarean deliveries experience postoperative pain delaying recovery and increasing morbidity. The transversus abdominis plane (TAP) block reduces pain by blocking T6 to L1 innervations. It is unclear if TAP blocks effectively reduce pain following CS. The purpose of this project is to describe the evidence on the effectiveness of TAP blocks in reducing postoperative cesarean delivery pain.

Methods: Keywords from the following PICOT question were used to search the CINAHL Plus, PubMed, Cochrane library, and MEDLINE databases: Do patients having a caesarean section (P) who receive a transversus abdominis plane block (I) compared with patients who do not receive a transversus abdominis plane block (C) have less pain (O) postoperatively (T)? From this search, 3 systematic reviews with meta-analyses and 1 randomized controlled trial were critically appraised.

Analysis of the Evidence: The results of these studies consistently found that TAP blocks lessen the severity of postoperative pain, reduce postoperative opioid consumption, decrease the need for rescue analgesia, and increase time to first request for pain medication after abdominal surgery, inclusive of cesarean delivery. From this evidence, it is recommended that TAP blocks be used as a part of a multimodal approach to anesthesia and enhanced recovery in patients undergoing cesarean delivery to reduce total opioid use.

Recommendation for Practice: A 15-minute PowerPoint presentation was given to CRNAs and anesthesiologists at the University of Florida Health Jacksonville. Informational handouts were posted on bulletin boards and in clinical areas throughout the obstetrics (OB) unit. Follow-up emails were submitted to OB anesthesiologists and OB physicians. Records were requested from the information technology department to monitor the number of TAP blocks performed for 2 months prior and 2 months after the presentation. A practice change will be determined with a comparison of preintervention and postintervention data. Follow-up discussions with OB recovery nurses were used to determine patient experiences postcesarean delivery with TAP block.

A120

Use of a Checklist for the Postanesthesia Care Unit Patient Handoff

Reed Halterman, MSN, CRNA

Augusta University

Introduction: In the perioperative setting, patient care is transferred numerous times to different providers. During this transfer of care, handoff reports are used to pass critical health information to the receiving provider. With no specific guidelines in place, these handoffs can lack structure, formality, and result in key pieces of information being lost. The use of a handoff checklist is a potential solution for this issue.

Methods: The purpose of this literature search was to answer the following clinical question: Do adult patients admitted to the PACU who have their care transferred using a standardized handoff checklist compared with patients who were not transferred using a formal checklist have more important intraoperative data conveyed to the receiving nurse without increasing duration of handoff? The search used GALILEO, PubMed, CINAHL, Ovid, and NGC. Inclusion criteria were English language, adult population, and published between 2012 and 2017. Sixty articles were found that related to the PICOT with 7 articles selected that consisted of: 2 randomized controlled trials, 1 controlled trial without randomization, 1 systematic review of qualitative studies, 2 quality improvement (QI) projects, and 1 descriptive study.

Analysis of the Evidence: The literature reviewed showed that a standardized handoff checklist decreased omission of critical information. A quality improvement project was conducted to develop and implement standardized handoff checklist. Preintervention and postintervention data were collected. With the use of the standardized handoff checklist, omission of critical health information decreased in all 5 areas measured: procedure decreased from 19% to 2%; allergies, 23% to 4%; input and output, 16% to 0%; antiemetic used, 21% to 4%; and lines, 19% to 11%. There was also a dramatic increase in the number of complete handoffs given when the tool was used, from 13% to 82%.

Recommendation for Practice: The use of a standardized checklist has been shown to improve the information transferred during handoff from 1 provider to the next. The goal of this project was to take that knowledge and use it to improve knowledge transfer and decrease omissions during the handoff period between the anesthesia staff and PACU staff. The project was successful in implementing a standardized checklist and echoed the success of the articles reviewed. Further education will be necessary to improve and maintain this success. Similar projects can be easily replicated in other settings, in this facility and others, to improve and deliver the best care possible for patients undergoing anesthesia care.

A121

Using Gastric Ultrasound to Prevent Pulmonary Aspiration

Mark Chambers, BSN, RN

Florida Gulf Coast University

Introduction: Despite advances in perioperative screening and management, pulmonary aspiration of gastric contents remains a major concern to anesthesia providers. Point-of-care gastric ultrasound has been proposed as a method to more definitively screen for the presence of retained gastric content, helping to inform decisions regarding perioperative management of patients at risk for pulmonary aspiration.

Methods: How can point-of-care ultrasound assessment of gastric contents aide in the perioperative management of patients at risk for pulmonary aspiration? An electronic database search was conducted utilizing PubMed, MEDLINE (ProQuest), CINAHL (EBSCO), the Cochrane Library, and the Trip Medical Database. Individual and combined search terms included gastric ultrasound/ultrasonography, gastric content/volume, aspiration pneumonia/pneumonitis, anesthesia, point-of-care ultrasound (POCUS), ultrasound assessment, gastric antrum, preoperative assessment, and full stomach. Twelve articles were chosen for review. Inclusion criteria consisted of peer reviewed articles and studies between 2000 and 2018 with a focus on gastric ultrasound technique, assessment, and implications for practice in anesthesia.

Analysis of the Evidence: Gastric ultrasound can definitively determine the presence and amount of retained gastric content. Any solid content or any liquid volume > 1.5 mL/kg constitutes “full stomach,” increasing aspiration risk. Patients are placed in the right lateral decubitus position using the left lobe of the liver, aorta, and superior mesenteric artery as landmarks to identify the gastric antrum, which expands in a near-linear fashion. Measuring the largest anteroposterior and craniocaudal antral diameters, the amount of retained content can be estimated for adults (up to BMI of 40 kg/m²) and pediatric patients. Formulas for parturients have not been established. Assessment proficiency of 95% can be achieved after 30 scans.

Recommendation for Practice: Gastric ultrasound should be considered to guide perioperative management anytime NPO guidelines were not followed prior to elective procedures, NPO status is questionable or unknown, or for urgent/emergent procedures. Qualitative and quantitative assessment can aide in making informed perioperative decisions such as adjustments in the timing of surgery or anesthesia or by altering the anesthetic plan to better suit the specific situation.

A122

A Novel Approach for Aortic Valve Replacement Incorporating CRNAs

Elaine Riano, CRNA

Columbia University Medical Center

Introduction: Transcatheter aortic valve replacement (TAVR) has become the standard for patients deemed too high risk for surgical aortic valve replacement (AVR). However, femoral arterial disease can limit patient eligibility for this procedure. Nontransfemoral approaches have been developed. The suprasternal approach may allow faster turnover, earlier ambulation, and improved cost-effectiveness as compared with other AVR approaches.

Literature Review: Smith et al, in 2011, reported TAVR as the procedure of choice for AVR in high-risk patients. Due to anatomic constraints, some high risk patients are not eligible for TAVR via transfemoral approach. In 2012, Philipsen et al reported a case series of suprasternal approach. Subsequent series by Capretti et al, in 201,2018. and Borger et al, in 2018, suggest that use of the suprasternal approach can be routinely used and may evolve into the approach of choice in patients with femoral artery disease.

Description of the Case: The patient is a 66-year-old with a diagnosis of aortic stenosis and a history of stroke, metastatic lung cancer, myocardial infarction, diabetes, and hypertension. Prior to being considered for suprasternal AVR, the patient underwent multidisciplinary review, echocardiography, CT scan, cardiac catheterization, and assessment of neck mobility. Ultimately, the patient was taken to the operating room as an ASA 4 status. After placement of standard ASA monitors and an arterial line, general anesthesia (GA) was induced and the patient intubated. Central venous access via the left internal jugular vein was obtained. GA was maintained with opioids, muscle relaxants, and inhalational agent. Transesophageal echocardiography was used for monitoring as well as valve positioning during deployment.

Discussion & Conclusions: Several studies have demonstrated the feasibility and safety of suprasternal AVR, including improved outcomes in patients with certain comorbidities. Corner et al reported a lower incidence of discharge to rehabilitation and a shorter procedure time, length of stay (LOS), and time to ambulation as compared with other nontransfemoral routes for TAVR. A shorter LOS may ultimately reduce complications associated with inpatient admissions such as nosocomial infections and deep venous thrombosis. Existing studies have not directly demonstrated these outcomes though, due to their relatively small numbers. At our institution, we have found that these cases (involving invasive monitoring, TEE, and transvenous pacing) can readily be performed with an experienced CRNA as part of the anesthesia team.

A123

Airway Surgery for a Patient With Severe Aortic and Mitral Stenosis

Katherine W. Bienhoff, BSN, RN

Texas Christian University

Introduction: Patients with severe aortic and mitral stenosis require a modified anesthetic technique to prevent complications. Airway surgery typically requires decreased oxygen administration, which can further compromise oxygen delivery to the tissues. The anesthesia professional must form an anesthetic plan that appeals to the valvular anomalies, yet also conforms to the requirements of airway surgery.

Literature Review: Databases searched include MEDLINE Complete, Academic Search Complete, and CINAHL Complete. The following search was conducted: “aortic stenosis” or “mitral stenosis” or “valvular heart disease” and “noncardiac surgery” or “airway surgery” and “perioperative” or “anesthetic management” or “considerations”. Thirty-eight articles were retrieved. Four articles were retained and used for this case report.

Description of the Case: A 73-year-old male with severe aortic and mitral stenosis presented for removal of a 5-mm transglottic mass. The patient had a tracheostomy placed emergently 1 day before the scheduled procedure. Prior to induction, an arterial line was placed and a phenylephrine infusion was started. An inhalational induction technique was performed via the patient’s tracheostomy. The patient’s mean arterial pressure was maintained close to baseline using vasopressors. Normal sinus rhythm was maintained. Oxygen administration was limited to 30% or less during laser use. When the patient’s oxygen saturation began to fall, this was communicated to the surgeon who allowed for periods of hyperoxygenation. Neuromuscular blockade by rocuronium was antagonized by sugammadex at the end of the procedure.

Discussion & Conclusions: The combination of severe aortic and mitral stenosis increases patients’ risk for perioperative morbidity and mortality. Additional precautions must be taken during airway surgery when oxygen administration must be limited. Special attention must be given to the management of systemic vascular resistance, heart rate and rhythm, fluid administration, and oxygenation. Recommendations for the management of a patient with severe aortic stenosis and severe mitral stenosis requiring airway surgery include placing an arterial line prior to induction, maintaining normal sinus rhythm, keeping the mean arterial pressure close to baseline, having phenylephrine and vasopressin available, and maintaining oxygenation with periods of hyperoxygenation between laser use, if needed.

A124

Are Dural Puncture Epidurals the Best Epidural Technique?

Kimberly Younger, BSN, RN

Texas Christian University

Introduction: There are many ways to provide pain relief for patients in labor. Epidurals are one of the ways to provide relief; practitioners must debate the risks and benefits of each and decide which is best for the patient. The side effects for dural puncture epidurals are less than the side effects of a combined spinal epidural (CSE). Other topics to consider are the quality of the epidural, speed of pain relief, and the possibility of an emergent cesarean delivery.

Literature Review: Dural puncture epidurals (DPEs) have fewer failure rates with fewer replacements. DPEs have improved sacral spread. DPEs have fewer maternal and fetal side effects than a CSE. DPEs require fewer top offs than traditional continuous labor epidurals. Dural puncture decreases the onset time for adequate analgesia; however, onset time for CSE is significantly faster than DPE.

Description of the Case: A 29-year-old, patient who has asthma, acid reflux, and attended regular prenatal visits, presented at 38-weeks gestation in active labor. This was her second pregnancy with no complications in this or her previous pregnancy. The patient was dilated to a 4. The patient requested a labor epidural. Patient was prepped and draped. Epidural space was accessed with Tuohy needle and loss of resistance technique. A 25-gauge Whitacare needle was used to puncture the dura and was removed once cerebrospinal fluid (CSF) flow was confirmed. An epidural catheter was threaded into the epidural space. Test dose was given and confirmed to be negative. Epidural was dosed up with fentanyl and bupivacane. Patient rated pain 10 minutes after dose up 0/10 during contractions. The next day the patient reported that her epidural worked well, that she felt the pressure but no pain, headache, nausea, trouble voiding, or back pain.

Discussion & Conclusions: The DPE was used in this case due to the patient's previous pregnancy, the patient's desire for a faster onset, and a better sacral block than an epidural. DPEs have fewer side effects than a CSE, such as no uterine hypertonus, nonreassuring fetal heart tones, or pruritis. DPEs still have a higher risk for postpartum headache than traditional labor epidural. CSE is the fastest onset followed by DPE and then CLE. Some studies suggest that the time difference between a traditional labor epidural is minimal and not worth the risk of complications from puncturing the dura. During the laboring process, DPEs are said to require fewer top offs. The DPE has a slightly denser block upon starting the epidural with fewer windows. DPEs are better suited for patients who present a concern regarding placement of the epidural due to the positive CSF flow from a DPE.

A125

Brugada Syndrome - A Case Report

Patricia D. Juozza-Clark, MS, CRNA

Vanderbilt University Medical Center

Introduction: Brugada syndrome is associated with ventricular arrhythmias and sudden cardiac death. The purpose of this review is to note the anesthetics that are safe for administration and those that can be harmful. This case was complicated by the fact that the patient had a remote history of seizures as a child but none at the present time. Patient stated that he had trouble remembering.

Literature Review: Triggers include medications, surgery, fever, electrolyte disturbances, and changes in the autonomic nervous system tone (Dash and Pragathee, 2017). Evidence-based management of these cases is based on pathophysiology, case reports, and case series as these cases are complex and rare (Duque et al, 2017). The website www.brugadadrugs.org was established to promote drug awareness and is extensively used (Postema et al, 2013). This website cites only 1 paper for the anesthesia management for patients with Brugada syndrome, proposal cited as a class IIa drug (Kloesel et al, 2011).

Description of the Case: Patient with a history of Brugada syndrome presented for dental procedure. Patient's remote history included seizures as a child, not currently on any medications, and no seizures reported since youth, now 18 years old. Induction and maintenance of anesthesia were uneventful with cardiac defibrillation pads placed prior to induction. Upon emergence, tonic-clonic seizures were noted. At this time, Versed and propofol were given after several seizures. Patient was extubated in OR and taken to PACU. Several more seizures were noted in PACU and family was interrogated upon arrival. It was then noted that patient may have had seizures at home. Patient was admitted for observation and neurology was consulted.

Discussion & Conclusions: Brugada syndrome is concerning for sudden cardiac death. This case was complicated by seizures as a youth and propofol as a class IIa drug. Etomidate was used as the induction medication and is known to lower seizure threshold. As the history of seizures was remote, this was the elected induction agent of choice. A recent literature review (2017) supports the use of propofol for Brugada syndrome without incidence. This was used upon emergence and may have been the better choice for induction.

A126

Cardiovascular Collapse During Transurethral Resection of Bladder Tumor: A Case Report

Nicole Gonzaga, DNP, CRNA; Amanda Lackaye, BSN, RN, CCRN; Ramniwas Yadav, BSN, RN, CCRN, CNOR; Greta Mitzova-Vladinov, DNP, CRNA, CHSE

University of Miami School of Nursing and Health Studies

Introduction: A 60-year-old male presented for transurethral resection of bladder tumor (TURBT). Complicating comorbidities included end stage renal disease and severe hepatic disease. Strained communication between the circulating nurse and surgeon lead to approval of sterile water for irrigation, with subsequent cardiovascular collapse secondary to hyponatremia. Prompt interventions resulted in a positive outcome.

Literature Review: In root-cause analysis of more than 4,000 adverse events, The Joint Commission identified communication breakdown as the most common factor implicated. This issue acts as a greater threat to patients compromised by significant comorbidities. End stage renal disease in surgery is associated with increased morbidity and mortality, poorer outcomes, and risk for severe electrolyte abnormalities. Use of hypotonic irrigation solution further compounds the risk for negative cardiovascular events.

Description of the Case: General anesthesia was induced with hemodynamic stability, supraglottic airway (SGA) placement, and return of spontaneous ventilation. Thirty minutes later, EtCO₂ waveform depression was identified followed by SpO₂ desaturations. The SGA was exchanged with no improvement, and the trachea was intubated, yet the SpO₂ remained low. Flexible bronchoscopy was performed with no evidence of pulmonary edema, aspiration, or pulmonary secretions. Bradyarrhythmias were noted and stat electrolytes revealed a serum sodium of 101 mmol/L, hemoglobin 5.1 g/dL. Procedure was stopped, and ACLS protocol was initiated as the patient developed ventricular fibrillation. Sodium bicarbonate was administered, and the patient was defibrillated with successful conversion to sinus rhythm. The patient was transported to the intensive care unit intubated and discharged with no residual complications.

Discussion & Conclusions: Use of hypotonic solution can lead to severe hyponatremia during transurethral resection (TUR) procedures. In this case, strained communication and inadequate preparation in the operating room resulted in the use of a large volume of water irrigation, which resulted in patient compromise and cardiovascular collapse. Patient comorbidities played a significant role, as postdialysis status may mislead a differential diagnosis. Hepatic disease limited anesthetic options, and general anesthesia hinders the detection of TUR syndrome. Due to urine and blood in the irrigation, monitoring intake and output is not reliable in urologic procedures. Precautions must be taken to ensure patient safety and timely detection of complications. Prompt identification and intervention by the anesthesia provider resulted in a positive outcome for the patient.

A127

Case Report: Pediatric Patient with Osteogenesis Imperfecta

Ashley Jacobs, CRNA

Vanderbilt University Medical Center

Introduction: Pediatric patients with osteogenesis imperfecta present challenges for the anesthetist including airway management with consideration of minimizing risk of cervical/mandibular/dental fractures, peripheral IV starts using little to no tourniquet pressure, blood pressure cuff versus arterial line use, ventilation challenges due to thoracic deformities, and challenges in positioning to prevent fractures.

Literature Review: Osteogenesis imperfecta (OI) is a rare (1 in 20,000) autosomal inherited connective tissue disease associated with a deficiency or dysfunctional form of type 1 collagen that results in highly fragile bones. At least 7 different types have been identified ranging from mild disease to lethal outcomes. Clinical symptoms include bone fragility, bone deformities, hypermobile joints, failure to thrive, hearing loss, and blue sclera. Anesthetic implications can include difficult intubations, minimizing fracture risk, and challenges in positioning.

Description of the Case: A 3-month-old, full-term female (4 kg, 48 cm) with type 3/4 OI presented for gastrostomy placement for dysphagia, asymptomatic aspiration, and reflux. Other history includes fractures of left and right femurs and ribs 6 through 9 at time of birth, NICU x 6 weeks for feeding difficulties, and passive smoke exposure. Medications include Protonix once per day. Patient had no previous surgeries. CBC and BMP were within normal limits. Swallow study revealed evidence of intermittent silent tracheal aspiration. General anesthesia was performed via inhalation induction. PIV was started without use of tourniquet. Intubation was successful with use of glidescope and neck stabilization. An arterial line was started, and NIBP measurements were not used. Careful positioning of patient was achieved with additional padding. At the end of the procedure, the patient was extubated awake and taken to recovery room.

Discussion & Conclusions: OI patient presented need for careful consideration of anesthetic. This patient was induced via inhalation induction with careful consideration of neck stabilization. All monitors placed except for NIBP. PIV was obtained without use of tourniquet and arterial line via use of ultrasound. Induction augmented by use of IV medications. Glidescope used to minimize cervical movement. Patient edentulous but otherwise careful consideration of teeth was given. Patient positioning was supine and patient was padded at all bony prominences. At case completion, patient was reversed and extubated awake. Patient was taken to recovery room with oxygen blow-by. Patient did not show evidence of additional fractures in recovery room.

A128

Lidocaine Infusion During Laparoscopic Cholecystectomy to Decrease Preoperative Opioid Requirements

Kyle Harper BSN, RN

Texas Christian University

Introduction: Multimodal analgesia is part of the new wave of opioid sparing anesthesia techniques that seeks to treat pain while decreasing opioid use. Lidocaine infusion is 1 of the ways this is being done. Opioids increase the risk for postoperative nausea and vomiting and airway obstruction, and lidocaine infusion assists in treating surgical pain while reducing the risk for the deleterious effects of opioids.

Literature Review: Participants in the lidocaine infusion group received as little as 50% the dose of fentanyl as the control group in the first 24 hours postoperatively. Also, the lidocaine group recorded less patient controlled analgesia button pushes and required less additional pain medicine. The lidocaine group also used less opioid at home following hospital discharge. Risk for lidocaine toxicity is relatively low, as studies show the plasma levels of lidocaine are well below toxic threshold immediately upon termination of the infusion.

Description of the Case: A 45-year-old morbidly obese female presents to the operating room for laparoscopic cholecystectomy. She possesses multiple risk factors for postoperative nausea and vomiting and postoperative airway obstruction, necessitating the reduction of preoperative opioid use. A 1.5-mg/kg lidocaine bolus was given intravenously with induction of anesthesia and a 2-mg/kg/h lidocaine infusion was initiated after intubation and terminated after extubation. No opioids were given intraoperatively, and the patient reported a pain score of 0 for the initial 30 minutes in recovery room, then received 100 mcg fentanyl over the next 35 minutes. On the floor overnight, the patient received 4 mg morphine and 3 doses of tramadol before being discharged home in the morning.

Discussion & Conclusions: The analgesic effects of lidocaine infusion are multifactorial. The first factor is sodium channel blockade. Next, lidocaine infusion produces anti-inflammatory effects including reducing levels of interleukin 6 and interleukin 8, both of which are thought to be involved in hyperalgesia and central sensitization. Finally, lidocaine infusion inhibits dorsal spinal horn neurons, preventing pain transmission up the spinothalamic tract. Participants in the lidocaine group required less fentanyl and reported lower pain scores than the control group. Lidocaine is a safe and effective method to provide analgesia and decrease opioid use.

A129

Management of Gravity Intravenous Infusions in an Austere Environment Utilizing the DripAssist Infusion Rate Monitor

MAJ John E. Buonora, PhD, CRNA

Joint Base Lewis McChord Madigan Army Medical Center

Introduction: Providing medical care in austere environments offers unique challenges. Total intravenous anesthesia (TIVA) is arguably the most compact, portable, robust, and complete anesthetic delivery system for the austere environment. Presented here is a case study involving 3 critically wounded patients who required multiple infusions of IV medications in the austere environment of an armed conflict zone using the DripAssist Infusion Rate Monitor.

Literature Review: In austere environments it was our experience that it was not if technology was going to fail, but when technology was going to fail. The ability to regulate a gravity infusion by counting drops should always be part of the IV infusion and medication administration plan. Most anesthesia providers are comfortable with the concept of titrate to effect. In austere environments, providers can expect to manage multiple patients in preoperative and postoperative areas while simultaneously administering anesthesia.

Description of the Case: The 541st Forward Surgical Team (FST) (Airborne) deployed in support of Operation Inherent Resolve (Syria, 2017). Following an attack, 3 trauma patients needed 7 critical infusions while awaiting 10 hours for transportation to a higher level of care. We maintained propofol infusions on patients 001 and 006 at 20 to 200 mcg/kg/min. Patient 006 received a maintenance norepinephrine infusion at 0.05 to 0.3 mcg/kg/min and TXA (one g in 250) infused over 8 hours. Patient 004 received a ketamine maintenance infusion at 0.2 mg/kg/h. Each of the infusion rates was set using the DripAssist Infusion Rate Monitor. Over the course of 10 hours, we rotated the DripAssist among each of the 7 infusions to confirm accuracy and adjustment of the infusion rates as needed.

Discussion & Conclusions: The lessons learned in Syria to improve delivery of gravity IV infusions are relevant here in the United States, especially when we review the infrastructure devastation that hurricanes brought to Puerto Rico and Texas. The ability to deliver an accurate gravity infusion and to confirm dose and rate of medication delivered remains a fundamental nursing task. Basic mathematical calculations for drop and dosage rate need to be reviewed periodically to maintain the skill set. The DripAssist Infusion Rate Monitor proved to be an invaluable tool for infusion rate verification, as well as maintaining and monitoring gravity infusions during our deployment in an austere environment. Our experience demonstrated that DripAssist Infusion Rate Monitors would prove equally useful in any situation using gravity infusions.

A130

One-Lung Ventilation in the Postlaryngectomy Patient

Morgan Alexander BSN, RN

Texas Christian University, Harris College of Nursing School of Nurse Anesthesia

Introduction: Patients that are status postlaryngectomy (total) can provide a significant challenge when lung isolation is required. This case report details the lung isolation technique used to facilitate one-lung ventilation in a postlaryngectomy patient and discusses other options for lung isolation in a patient with a challenging or unique airway anatomy.

Literature Review: A review of current literature was completed. Case studies of similar patients were found, as well as scholarly articles related to postlaryngectomy (total) anatomy. No literature was found on a postlaryngectomy patient receiving lung isolation with a bronchial blocker.

Description of the Case: A 74-year-old male with a past medical history of laryngeal cancer, coronary artery disease, head and neck radiation, and total laryngectomy presented for a segmentectomy of the upper lobe of the right lung via thoracotomy. General anesthesia was induced and a single lumen endotracheal tube was placed to the laryngectomy stoma in the anterior cervical region. An internal airway exam was completed with a fiberoptic bronchoscope, and minimal distortion of the carina and main bronchi was noted. An Arndt bronchial blocker was positioned with the aid of a fiberoptic bronchoscope to the right main bronchus. Lung isolation was verified after placement and remained adequate for the entire case. At the conclusion of the case, spontaneous respiration was resumed and the patient was extubated and transferred to cardiovascular intensive care unit.

Discussion & Conclusions: There are many devices and techniques available to facilitate one-lung ventilation. A patient with a unique airway anatomy precludes the use of many devices and can be a challenge to achieve and maintain lung isolation. An Arndt wire-guided endobronchial blocker was selected for use in the subject of this case study in part due to immediate availability at the facility where the surgery was performed. Due to the patient's unique airway anatomy, the ability of the Arndt blocker to be used alongside a fiberoptic bronchoscope made the Arndt blocker advantageous in this situation. Other lung isolation that may be useful in a status postlaryngectomy patient include double lumen endotracheal tubes, the EZ-blocker bronchial blocker, and the Univent endotracheal tube and bronchial blocker. Communication between the anesthesia team and the surgeon is crucial for success in these challenging airway situations.

A131

Prevention of Opioid-Induced Hyperalgesia Following Remifentanyl Infusion: A Case Report

Lauren Gray, BSN, RN

Texas Christian University

Introduction: This case report discusses prevention of opioid-induced hyperalgesia (OIH) in the patient receiving an intraoperative remifentanyl infusion. High doses of intraoperative remifentanyl (~0.3 mcg/kg/min) have been associated with increased pain and opioid consumption during the first postoperative day. An intraoperative approach using ketamine, gabapentin, nitrous oxide, or gradual withdrawal of remifentanyl may reduce the incidence of OIH.

Literature Review: A systematic review and meta-analysis of 1,494 patients found an association between high doses of intraoperative remifentanyl and increased postoperative pain. High doses of intraoperative remifentanyl were associated with higher pain intensity and higher opioid consumption during the first postoperative day (Fletcher et al, 2014). An analysis of 42,815 cases compared intraoperative remifentanyl with other opioids. The study analyzed pain perception, opioid consumption, and pain control satisfaction. Remifentanyl was associated with greater opioid consumption (Wolt et al, 2016).

Description of the Case:

Remifentanyl infusion rates of 0.3 mcg/kg/min have been associated with an increase in pain sensation and opioid consumption during the first 24 hours following surgery. This case report discusses the care of a patient who experienced increased pain sensation following remifentanyl infusion with the goal of presenting prevention strategies. Embase was searched using the keywords remifentanyl and opioid-induced hyperalgesia. The literature review found that when using a remifentanyl infusion, OIH may be prevented by concurrently administering intravenous ketamine, by administering oral pregabalin during the preoperative interval, or by using inhalational nitrous oxide as a portion of the anesthetic. In addition, literature review findings indicate that a practice change to slowly discontinuing remifentanyl infusion by decreasing the rate over time as opposed to the current trend of abrupt cessation may prevent the long-term potentiation of C-fibers that accompanies OIH.

Discussion & Conclusions: Ketamine intravenous bolus during induction followed by infusion during surgery decreased OIH as measured by decreased postoperative pain intensity and morphine requirement in those receiving remifentanyl infusion (Hong et al). Pregabalin before surgery increased time from end of surgery to first analgesic requirement, decreased amount of pain medication, decreased postoperative pain intensity (Lee et al, 2013). A study found that abrupt cessation of a remifentanyl drip was associated with higher incidence of OIH when compared with gradual cessation over 90 minutes after surgery (Alves et al, 2014). Administering 70% nitrous oxide decreased postoperative OIH for 12 to 18 hours when compared with an anesthetic using 100% oxygen (Echevarra et al, 2011).

A132

Radiation Safety: Improving Case Management

Duncan Martin, RN

Texas Christian University

Introduction: A case was performed that used a large amount of radiation. This prompted an analysis with research into the physics of radiation, the health effects of radiation, the mechanisms of protection, and recommendations for future cases involving radiation.

Literature Review: Sources utilized in this case report included an AANA review on radiation, journal articles citing studies on radiation exposure, and articles addressing appropriate shielding techniques and the amount of radiation those methods decrease exposure. Research was performed to see what harmful effects that long-term, low-dose, stochastic radiation causes and what a CRNA can do to circumvent those risks. The findings were applied and recommendations were made on what could be done differently.

Description of the Case: The case consisted of a 33-year-old male patient needing a percutaneous nephrolithotripsy for large staghorn intrarenal calculi. The patient has numerous comorbidities including spina bifida, hydrocephalus, restrictive lung disease, chronic kidney disease, and numerous congenital anatomical abnormalities making his body habitus abnormal. Due to the difficulty of passing a guidewire in the initial procedure, the patient was sent to interventional radiology to have an introducer passed so the patient could come back to the OR later that day for procedure. The patient had a total of 3 same-day surgeries and OR personnel was exposed to radiation with each procedure. Radiation safety measures that were utilized are described.

Discussion & Conclusions: The discussion section outlines how radiation is measured and what harmful effects radiation causes when medical personnel are unprotected. A literature review was done regarding radiation exposure to anesthesia professionals, methods used to protect them, and how much each method decreases exposure. The research was then applied to the case described and an evaluation was performed on what could have been done differently and what was done correctly. Lastly, recommendations were made on how all anesthesia providers could apply several safety techniques and education into their own practice.

A133

Synthetic Hallucinogenic Drugs

Kelly Moon, MSN, CRNA; Christopher Humston, MSN, CRNA; Renata Miketic, MD; Joseph Tobias, MD; Peter Ma, MD

Nationwide Children's Hospital

Introduction: The designer drug classification of illicit substances has gained the attention of law enforcement agencies, healthcare providers, and concerned families around the world. There has been a significant increase in the abuse of these new designer drugs and healthcare providers will see an increased prevalence of patients using these substances. Clinicians need to be knowledgeable regarding these substances and how to provide safe and appropriate anesthesia care.

Literature Review: NBOMe is a full agonist at the 5-HT_{2A} receptor. This receptor is responsible for complex behaviors and thought processes, from working memory to affective disorders such as depression and schizophrenia. Stimulation of this receptor produces the hallucinogenic effects recreational users are seeking. Patients ingesting NBOMe frequently display signs of serotonin syndrome, a potentially fatal complication related to the overstimulation of the serotonin receptor. Diagnosis is purely clinical and differentiation is essential for the provision of safe anesthesia care.

Description of the Case: A 16-year-old male presented to the emergency department for assessment due to recent neurologic changes and abnormal findings on MRI at an outside facility. Upon evaluation, the patient was demonstrating left-sided weakness and persistent shaking without definitive seizure activity. Another MRI was ordered and the patient was placed under general anesthesia to obtain optimum MRI quality. The MRI revealed large zones of signal abnormality suggesting acute leukoencephalopathy. Exact etiology for these findings was unknown due to the patient not providing information regarding illicit drug use. Blood tests and cerebrospinal fluid analysis were all negative. Based on the lack of etiology, neurosurgical consultation determined a brain biopsy was indicated. After the patient's admittance to the ingestion of NBOMe, the diagnosis of toxic leukoencephalopathy and serotonin syndrome was determined.

Discussion & Conclusions: NBOMe is a designer synthetic hallucinogen that acts through the serotonin receptor, 5-HT_{2A}. Toxicity is primarily related to the exaggerated serotonergic stimulation producing seizures, hypertonicity, hyperthermia, and rhabdomyolysis. Anecdotal experience in our patient also suggests that long-term use may result in irreversible damage to the central nervous system. Anesthesia providers should maintain a high level of suspicion for NBOMe use in any patient presenting with serotonin syndrome-like manifestations while also reporting the recent use of recreational drugs. As no antagonists currently exist, treatment for NBOMe intoxication remains largely supportive. Providers will see an increase in the number of patients presenting with serious adverse effects related to illicit drug use. Education regarding recognition and management is imperative to providing safe anesthesia care.

A134

The “Pause”, Hardwiring Peer Support

Buffy Krauser Lupear, DNP, CRNA, APRN; Cindy Kildgore, MSHA, BSN, CNOR; James W. Kendall, LCSW, CEAP

Vanderbilt University Medical Center

Introduction: Despite focused efforts to ensure quality and safe patient care, critical incidents continue to occur. The definition of a critical incident is different to each healthcare provider and is not limited to patient care experiences. Historically healthcare providers receive limited preparation during training on coping with the emotional/physical stressors following a critical incidents.

Literature Review: Literature acknowledges healthcare providers sustain emotional and physical stress following a critical incident. However, the potential emotional and physical stress a healthcare provider experiences as a consequence of a critical patient incidence has often been dismissed as “part of the job”, or associated with the stigma of not being a strong clinician and needing mental help.

Description of the Case: More than 1,000 members of our perioperative healthcare team received a REDCap survey to assess their experience with critical incidents during their career. Of the 246 responses 75.4% had experienced a critical incident, and 72% indicated speaking with a peer in the same area of specialty as their coping mechanism of choice. When asked, 81.3% of the 246 respondents indicated they would participate in a Peer Support Program.

Discussion & Conclusions: Using this information, we have developed a Peer Support Team in our institution to ensure all of our perioperative team members receive the appropriate support following a critical incident. The development of this Peer Support Program was a collaborative effort with the Department of Anesthesia, Perioperative Nursing, surgeons, and our Employee Assistance Program.

A135

Tranexamic Acid Use in Total Hip Arthroplasty

Cramer Hurt, BSN, RN

Texas Christian University

Introduction: Hip replacements are the most common orthopedic surgery and result in high blood loss. Due to the high cost and poor outcomes related to blood transfusions, providers are now using antifibrinolytics, such as TXA, as a safe and effective alternative. TXA's unique pharmacology allows the medication to inhibit the activation of plasmin and decrease the amount of blood loss during surgery.

Literature Review: A thorough literature review was performed using the following keywords: anesthesia, tranexamic acid, orthopedic surgery, total joint arthroplasty, and blood loss. Seven articles from the database were chosen to be included within the case report. These articles highlight the abundance of research expressing the safety and efficacy of the use of TXA on total joint arthroplasty.

Description of the Case: A 71-year-old, 93 kg, male presented for a left total hip arthroplasty. The patient's medical history included hypertension and hyperlipidemia. Pertinent lab results included hemoglobin, 14.3 g/dL, and hematocrit, 40.3%. Direct laryngoscopy was performed with a Glidescope size S4. The airway was secured with a 7.5-mm endotracheal tube. Airway placement was verified. Prior to incision, the patient received cefazolin, 2 g, and tranexamic acid, 1 g, intravenously. Anesthesia was maintained by adjusting the expired sevoflurane. Sugammadex, 180 mg, and tranexamic acid, 1 g, were administered intravenously during closure of the surgical wound. Spontaneous respirations returned with adequate tidal volumes. The endotracheal tube was removed with suction applied to the end of the endotracheal tube. Estimated blood loss was 150 mL.

Discussion & Conclusions: Total hip and knee arthroplasties are among the most common types of orthopedic surgeries performed in the country. A major concern for providers during these specific cases is intraoperative blood loss. The antifibrinolytic medication, TXA, acts upon the clotting cascade by inhibiting the conversion of plasminogen to plasmin and therefore decreasing the amount of fibrinolysis. TXA can be administered in a variety of routes and has been proven to decrease the amount of intraoperative blood loss and the need for blood transfusions for total hip and knee arthroplasties. The medication offers a safe and effective alternative to blood transfusions for total hip and knee arthroplasty. Research expresses that TXA will be the mainstay in total joint cases for many years to come.

A136

Unrecognized Hyponatremia Following General Anesthesia in a Pediatric Patient: A Case of Desalination Despite the Use of Isotonic Fluid

Lori M. Corsmeier, MSN, CRNA; James S. Furstein, PhD, DNAP, CRNA, CPNP-AC

Cincinnati Children's Hospital Medical Center

Introduction: Concern for iatrogenic hyponatremia has led clinicians to challenge the fluid management guidelines set forth by Holliday and Segar. Today, the use of isotonic fluid has largely replaced hypotonic fluid in the perioperative period to reduce hyponatremic risk. Nonetheless, the risk remains due to a variety of inciting factors. This case report describes a case of hyponatremia following general anesthesia for dental rehabilitation in an otherwise healthy child.

Literature Review: The development of hyponatremia is dependent on the presence of antidiuretic hormone (ADH) and a source of free water. While long attributed to the use of hypotonic fluid, hyponatremia can also occur with isotonic fluid in the presence of elevated ADH as sodium is excreted in the urine and free water is retained. Nonosmotic stimuli of ADH secretion abound in the perioperative period including dehydration, hypoglycemia, stress, narcotic administration, and vomiting. Therefore, perioperative isotonic fluid administration has the potential to result in dilutional hyponatremia.

Description of the Case: A healthy 20-month-old female received an uneventful anesthetic consisting of sevoflurane, muscle relaxant, oxymetazoline, fentanyl, morphine, ketorolac, dexamethasone, and lactated Ringer's solution. Postoperatively she quickly met discharge criteria. Hours later she had several episodes of emesis followed by new onset tonic-clonic seizure activity. In the ER she was noted to be lethargic but arousable to sternal rub, with reactive pupils, cool extremities, dry mucous membranes, and sunken eyes. Lab work revealed a serum sodium of 121, potassium of 4.7, glucose of 106, and acidosis with bicarbonate of 17, chloride of 85, and an anion gap of 19. Head CT scan demonstrated mild cerebral edema. Following 2 (20 mL/kg) fluid boluses, her sodium was 130 and her mental status markedly improved. She was admitted for evaluation and all electrolyte derangements corrected without further intervention.

Discussion & Conclusions: Despite its isotonic nature, the use of lactated Ringer's solution to replete volume loss in the presence of elevated ADH levels can lead to sodium excretion and retention of free water resulting in hyponatremia. Although this patient had a prolonged NPO period followed by low PO intake and emesis, it is unlikely dehydration induced her symptoms as hypokalemia would be anticipated. While fentanyl may cause transient hyponatremia, this is a remote possibility as the total dose was 1 mcg/kg. Endocrine testing yielded normal thyroid function and ACTH stimulation testing demonstrated normal baseline cortisol levels with a robust response to cosyntropin. Ultimately, isotonic fluid may have contributed to the development of hyponatremia. While rare, clinicians should remain cognizant of the potential for perioperative hyponatremia following isotonic fluid administration in pediatric patients.

A137

Viagra and General Anesthesia

Jananne Horchi McKinnon, CRNA, MSN; Jordan C. Miller, CRNA, MSN

Vanderbilt University Medical Center

Introduction: With over 20 million men diagnosed with erectile dysfunction in the United States, the prevalence of phosphodiesterase type 5 (PDE5) inhibitor use in the surgical patient population is increasing. Sildenafil, commonly prescribed for erectile dysfunction uses nitric oxide and can trigger critically low hypotension in conjunction with general anesthesia. This study reviews the mechanism of action of sildenafil and the risks associated with general anesthesia.

Literature Review: As of April 2018, our research has resulted in 583 articles. After review, a total of 5 articles were evaluated based on their relevance to our case and to noncardiac-related surgical procedures. The underlying theme of each article references PDE5 inhibitors mechanism of action and its ability to cause hypotension. Additional research was done to describe the known cardiovascular depressant effects of general anesthesia and to demonstrate the correlation that both PDE5 inhibitors and general anesthesia alter hemodynamics in a similar fashion.

Description of the Case: During the preoperative anesthetic interview, the patient disclosed use of sildenafil approximately 12 hours prior. After induction, the patient became severely hypotensive and was refractory to first line regimens such as fluids, phenylephrine, and ephedrine. After approximately 20 minutes, we were able to stabilize the patient with vasopressin and fluid resuscitation. Sildenafil is a selective PDE5 inhibitor. Nitric oxide (NO) is released from endothelial cells and activates soluble guanylate cyclase, resulting in the conversion of cyclic guanosine triphosphate (cGTP) to cyclic guanosine monophosphate (cGMP). cGMP inhibits entry of Ca, resulting in vasodilation. Phosphodiesterase is responsible for the breakdown of cGMP. Sildenafil, as a PDE-5 inhibitor, blocks the breakdown of cGMP and prolongs the actions of NO to cause vasodilation.

Discussion & Conclusions: The goal of this case review is to shed light on the prevalence of PDE5 inhibitors in our surgical patient population, review the mechanism by which they exert their effects, and explain the damaging side effects that can occur when combined with general anesthesia.