

2013 Poster Abstracts



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2013 Research Abstracts – Oral

A1

Cerebral Oxygen Saturation During Trendelenburg Positioned Robotic Surgery in a Diverse Surgical Sample

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Introduction: Demands associated with the Trendelenburg position (TP) are known with little attention given to regional cerebral tissue O₂ saturation (SctO₂) in those undergoing robotic surgery. This is the first study to report on SctO₂ in a wide range of patients undergoing lengthy TP and robotic surgery. Reports in the beach chair position suggest cerebral desaturation (CD) occurs frequently. We measured SctO₂ during robotic surgery in patients in the TP with CO₂ insufflation (C-INSF) and a control robotic thyroid surgery group who were supine with no C-INSF recording relevant variables and CD.

Methods: Forty-two consecutive patients in 25 to 45 degrees of TP for ≥ 125 minutes were studied. Management was at providers' discretion; information was captured on an Innovian™ system. The INVOS® 5100C Cerebral Oximeter (Covidien, Boulder, Colorado) recorded SctO₂ after forehead sensors were placed with neutral head positioning. Providers were shielded from the NIRS measures which were archived on a USB device. CD was defined as a $>20\%$ decrease from baseline SctO₂ or a value $\leq 55\%$ for ≥ 10 minutes. Patients were visited on postoperative day 1 to assess for adverse cerebral outcome. Eleven robotic thyroid cases served as controls.

Results: TP group: 13♂ and 29♀, aged 22 to 73, BMI 22 to 36, underwent general (N=3), urological (N=14), and gynecological (N=25) surgery. Two patients had CD lasting 150 minutes and 190 minutes and 2 had episodic CD lasting 10 to 35 minutes. These 4 cases were ♀ aged 22 to 60 in 38 to 45° TP. Eleven cases had multiple episodic CD for ≤ 15 minutes. Twenty-seven cases had no CD. Incidental observations: consistent fall in SctO₂ with phenylephrine, increase with ephedrine. EtCO₂ seemed to be a powerful direct modifier of SctO₂. High MAP was inconsistently associated with high SctO₂. Two cases went open with a sudden fall in SctO₂. BMI seemed not to be associated with observed SctO₂. Pulse oximeter was $\geq 97\%$ in cases. The control group had no observed CD. There were no adverse events on follow-up.

Conclusions: Prior studies of SctO₂ in older ♂ during robotic prostatectomy are equivocal. Our study is the first to include ♂ and ♀ in TP robotic surgery noting that 36% had CD sometimes protracted in duration. In all cases, pulse oximetry values were $\geq 97\%$. Low MAP and low EtCO₂ had deleterious effects on SctO₂. Despite no agreed-upon metric of what SctO₂ constitutes an abnormality we wonder: Is there utility in monitoring the brain as an index organ? Does prolonged TP result in effects we have not fully considered? Does cerebral autoregulation fail during TP robotic surgery and general anesthesia? Should phenylephrine be studied in terms of its effects on SctO₂ in the setting of steep TP? We plan a follow-up with neurocognitive testing.

Source of Funding: We thank Covidien, Boulder, Colorado, for providing us with a dedicated INVOS® 5100C Cerebral Oximeter and electrode arrays.

Comparative Resuscitative Methods for Desipramine Toxicity Utilizing Lipid Emulsion in Swine

Melissa Waterman, BSN; Arthur D. Johnson, RN, PhD; Joseph O'Sullivan, CRNA, PhD

US Army Graduate Program in Anesthesia Nursing

Introduction: A toxic dose of the antidepressant desipramine causes cardiovascular collapse and ultimately asystole. Resuscitation is difficult and almost always unsuccessful as cardiopulmonary bypass was the only effective treatment. Anecdotal evidence suggests that infusion of lipid emulsion may be an effective treatment. No studies have determined the optimal combination of lipid rescue and traditional ACLS therapy for a toxic dose of desipramine. The purpose was to determine the optimal combination of lipid rescue and traditional ACLS therapy for treatment overdose of this widely used antidepressant.

Methods: This study was a prospective, experimental, mixed research design. Seven swine were assigned to 8 ACLS protocol resuscitation groups: vasopressin/lipid; epinephrine/lipid; lipid; epinephrine; vasopressin; epinephrine/vasopressin; epinephrine/lipid/vasopressin; and CPR. Each subject was administered a toxic dose of desipramine (7-10 mg/kg) until there was a nonperfusing arrhythmia. Each resuscitation protocol was implemented. Survival was defined as return of spontaneous circulation to a systolic blood pressure ≥ 60 mm Hg. An odds/ratio and Fisher's Exact test was used for data analysis.

Results: Vasopressin had a profound effect on resuscitation. All groups with vasopressin had a significant survival rate vs all those groups without vasopressin ($p=0.000$). Also the vasopressin only group was significantly better than the epinephrine only group ($p=0.00$). There was no significant difference between all groups with lipid vs nonlipid groups ($p=.77$). The odds of survival for the vasopressin only group was 65-fold greater than compared with the epinephrine only group. Also of note, there was a 12.8 greater odds of survival in all groups that used vasopressin vs all groups that did not. No swine in the CPR group survived.

Conclusions: The use of vasopressin only was the best resuscitation method to restore spontaneous circulation with desipramine toxicity in this swine model. There was no significant improvement with lipid emulsion infusions with this model. The use of vasopressin for resuscitation for desipramine toxicity appears to be more effective than epinephrine or lipid emulsion infusions using ACLS protocols.

Source of Funding: TriService Nursing Research Program.

Diversify and Conquer: The Quest for Minority Nurse Anesthetists

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Introduction: Currently, minorities account for 36.6% of the United States' total population, but only 16.8% of the nation's registered nurses are classified as minorities and that number is reduced to 9.8% when classifying minority Certified Registered Nurse Anesthetists. The aim of this study is to identify potential obstacles that keep interested minorities from entering the nurse anesthesia profession.

Methods: A self-developed survey was designed to collect data from minority individuals interested in nurse anesthesia. The online survey was completed by attendees of Diversity in Nurse Anesthesia Mentorship Program (DNAMP) information session, and a link of the survey was sent via email to individuals that expressed interest in minority research. The survey was available online for 3.5 weeks (March 1-27, 2013).

Results: A total of 78 surveys were included. Participants from across the country identified with African American, Asian, Latino, and other ethnic backgrounds. Most found information regarding the profession on the Internet. Of the respondents, 40% did not feel that the information received was sufficient. Several selected that they would feel more comfortable receiving information regarding the profession from someone who shares their ethnic background. Financial obligations were selected by 37% as being the main obstacle keeping them from becoming a nurse anesthetist. Other obstacles included standardized test scores and limited information. Fear of being misunderstood or isolated due to cultural differences were also identified obstacles.

Conclusions: The survey results highlighted potential barriers keeping interested minorities from entering the nurse anesthesia profession. Information regarding the nurse anesthesia profession was not found to be sufficient. However, organizations such as the DNAMP are equipping a more diverse population of nurses with the knowledge necessary to pursue careers as nurse anesthetists. The results of this study may help nurse anesthesia institutions gain better insight as to how to best recruit and retain minority students.

Effects of Epidural Normal Saline Bolus on Parturient Motor Function Recovery

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Introduction: Epidural anesthesia can be used for many types of surgical procedures as well as for laboring analgesia. Prolonged motor block can extend postprocedure recovery time and be dissatisfying to the patient. Studies have demonstrated that a normal saline bolus administered via an epidural catheter can reduce time to motor and sensory recovery following surgery. However, limited research exists in the parturient population. The purpose of this study was to determine if a normal saline bolus administered via continuous lumbar epidural will reduce the time to motor and sensory recovery for labor analgesia following vaginal delivery.

Methods: Prospective, double blind, randomized, controlled study of 46 parturients in active labor with continuous epidural infusions were randomly assigned to either receive a simulated or real bolus prior to epidural catheter removal. A 30 mL saline bolus was administered or simulated. Motor and sensory block were assessed every 15 minutes using the modified Bromage scale and “cold test” until full motor function and time to 2 dermatome sensory regression were noted. Descriptive and inferential statistics were used to analyze results. P values less than 0.05 were considered significant.

Results: Means of age, height, weight, BMI, gravida and parity were evenly distributed between groups. Initial motor function determined by modified Bromage Scale was 1 for treatment and control groups ($P=0.94$). The mean time to full motor recovery was 83.2 minutes for saline group and 100.2 minutes for control group. Initial sensory dermatome level was T10 for treatment group and T9 for control group ($P=0.87$). The mean time to 2 dermatome sensory regression was 29.3 minutes for the saline group and 36.1 minutes for the control group. Overall, the time to full motor and sensory recovery was reduced in the saline group; however, no statistically significant differences were noted between the 2 groups ($P > 0.05$).

Conclusions: Previous research in surgical patients receiving epidural anesthesia demonstrated a significant reduction in motor or sensory recovery with a 30 mL normal saline epidural bolus. The results of this study demonstrated trends toward faster motor and sensory recovery in the parturient population. However, these differences were not statistically significant. The benefits of using a normal saline epidural bolus to reduce time to full motor and sensory recovery may be limited to surgical patients receiving higher concentrations of local anesthetics in their epidural.

Effects of Intraosseous Infusion of Whole Blood in a Swine Model

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US Army Graduate Program in Anesthesia Nursing

Introduction: When a patient is in hypovolemic shock, it is essential to establish vascular access rapidly so lifesaving resuscitation can be implemented including the administration of whole blood. Typically the patient's veins have collapsed preventing easy vascular access making the procedure not only difficult but also time consuming and delaying treatment. The austere far-forward battlefield presents many additional environmental and tactical obstacles to the military, including the potential of mass casualties. These factors may lead to excessive delay in obtaining vascular access and loss of life.

Methods: This was a prospective mixed, experimental study. The question that guided the study was: Are there statistically significant differences in free hemoglobin and time to administer 900 mL of blood between IV (n=7) and intraosseous (IO) (n=7) groups. Each pig had 900 mL of blood exsanguinated. The blood was administered to IV or IO groups under 300 mm Hg of pressure. Samples were collected at baseline, from blood bags, and immediately after administration. Free hemoglobin was calculated and is considered a precise and accurate method of determining the amount of lysis of the red blood cell.

Results: The free hemoglobin at baseline and from the blood bag from was < than 1 $\mu\text{mol/L}$ for all samples prior to blood administration. After administration of the whole blood, the free hemoglobin ranged from 8 to 27.5 $\mu\text{mol/L}$ (mean = 10.23 ± 10.52) in the IV group and 8 to 15.7 $\mu\text{mol/l}$ (mean = 7.2 ± 5.82) in the IO group. Time for administration was 8.68 to 19 minutes (mean = 13.48 ± 4.1) for the IV group compared to 8.30 to 60 minutes (mean = 28.7 ± 19.51) for the IO group. Multivariate analyses of variance indicated no significant differences in free hemoglobin or administration time ($p=.065$).

Conclusions: Early intervention is essential to prevent death from uncontrolled bleeding. Establishing IV access for resuscitation remains a persistent challenge. Based on this study, whole blood transfusion by IO route is a viable option to resuscitate a hemorrhaging patient with no added risk of hemolysis. The time for administration was shorter for the IV compared to the IO group, but the difference was not statistically significantly different. When IV access is difficult or impossible to accomplish and early resuscitation is imperative for survival, IO access is an appropriate option.

Effects of QuikClot Combat Gauze, Fluid Resuscitation, and Movement on Hemorrhage Control

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US Army Graduate Program in Anesthesia Nursing

Introduction: Trauma resulting in uncontrolled hemorrhage is the major cause of death in both the civilian and military populations. During the Vietnam War, aggressive high-volume resuscitation in the treatment of hemorrhagic shock became the standard. However, subsequent studies showed that such resuscitation resulted in increased hemorrhage because of dilution of the clotting factors and an increase in blood pressure. Therefore, the standard is low-volume resuscitation until bleeding is controlled. It is not known if the use of QuikClot Combat Gauze (QCG) allows for greater latitude fluid resuscitation.

Methods: This prospective, experimental study compared the effectiveness of QCG to a control group on hemorrhage control; the amount of crystalloid volume infusion on rebleeding; and the effect of movement on hemorrhage. Swine were assigned to the QCG (n = 11) or the control group (n = 11). The femoral artery and vein were transected and allowed to bleed for 1 minute. QCG or a standard dressing was placed into the wound. Rebleeding was observed for 35 minutes. If hemostasis occurred, 5 liters of crystalloid were given, and the wound was observed for bleeding. If no bleeding, the extremity was moved.

Results: There were no statistically significant differences between groups relative to the initial 1 minute hemorrhage, activated clotting time, body weights, core temperatures, arterial blood pressures, blood volume, or amount of NPO fluid deficit replacement indicating that the groups were equivalent on these parameters (p = 0.83). A multivariate analyses and post-hoc Tukey test indicated significant differences in the groups relative to amount of hemorrhage over 35 minutes (QCG=50 SD ± 154 mL; control = 351, SD ± 354 mL) (p = 0.018); amount of fluid resuscitation before hemorrhage (QCG = 4818, SD ± 603 mL; control = 209, SD ± 600 mL) (p = 0.001); and the number of extremity movement before hemorrhage (QCG = 36.6, SD ± 1; control = 0.9 SD ± 2.7) (p= 0.001).

Conclusions: Limited data exist relative to the effectiveness of QCG; however, the military recommends the agent as the first-line treatment of severe hemorrhage. This study suggests that the agent is effective in controlling hemorrhage and that the clot formed is robust enough to withstand more resuscitation fluid compared to the control group of standard dressing. Providers should take caution to avoid movement of a patient who has had wound and hemorrhage. However, the results of this study show that the clot formed with QCG is strong enough to withstand more movement than a standard dressing.

Source of Funding: This research was funded by the TriService Nursing Research Program, Uniformed Services University of the Health Sciences.

Effects of Tetrahydropalmatine (THP) on PTSD-induced Changes in Rat Brain Gene Expression

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US Army Graduate Program in Anesthesia Nursing

Introduction: Posttraumatic stress disorder (PTSD) is one of the most devastating injuries associated with war. It is speculated that the symptoms of PTSD derive from changes in gene expression and neurotransmitter regulation within the brain. The herbal extract, tetrahydropalmatine (THP), has been shown to decrease anxiety.

Unfortunately, there are no studies evaluating the potential therapeutic properties of herbal medications as related to changes in PTSD-induced gene expression. The aim of this research proposal was to investigate the effects of THP on gene expression in a PTSD rodent model.

Methods: Eighty male Sprague-Dawley rats were used for this prospective, between subjects, experimental study. Half of the rats were PTSD-induced using a restraint/shock stress model. Groups were then randomly assigned to receive an injection of either 0.9% saline, THP, midazolam, or THP with midazolam. After injection and behavioral testing, the subjects were euthanized and the amygdala and hippocampus were sent for RT-PCR gene expression analysis. A 2-tailed MANOVA and post hoc analysis were used to compare gene expression changes between PTSD-stressed and nonstressed rats and between treatment groups.

Results: Of the genes interrogated, 37 of 90 genes in the amygdala and 62 genes in the hippocampus related to CNS neurotransmitter systems were found to have statistically significant changes in gene expression and regulation between treatment groups. Significant transcriptional fold changes (up or down regulation) were found in important genes involved in dopamine, serotonin, acetylcholine, and GABA neurotransmitter systems.

Conclusions: These results provide quantifiable data that demonstrate gene expression changes in PTSD-stressed and nonstressed rats receiving various treatments. These findings contribute important data to the limited molecular details pertaining to the understanding of the genetic mechanisms involved in the neurobiology of PTSD. Additionally, these results expand the knowledge and provide a foundation for future investigation of PTSD and potential treatment options.

Source of Funding: TriService Nursing Research Program.

Evaluation of the Herbal Medicine, Tetrahydropalmatine (THP), on PTSD-Induced Rat Neurobehavior

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

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

Results: There were significant differences in anxiety between the groups. The PTSD-stressed rat groups had significantly reduced time on the open arms of the EPM demonstrating significant increased anxiety compared to the nonstressed groups. Data pertaining to memory evaluation via MWM and hypervigilance via the ASR instrument also showed significant changes between the 8 groups.

Conclusions: While a single dose did not significantly decrease anxiety or enhance memory in the PTSD-stressed rats, the PTSD-stressed model was validated. These data support the use of this stringent PTSD-stressed rat model and warrant future studies that may yield significant results demonstrating attenuation of debilitating PTSD neurobehavior. Further investigation is recommended to evaluate multidose or prophylactic regimens.

Pharmacokinetics of Intravenous, Tibial, and Sternal Intraosseous Epinephrine During CPR in a Swine Model

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Introduction: When a patient has a cardiac arrest, it is essential to rapidly establish vascular access to administer lifesaving drugs. The patient's veins have collapsed making vascular access difficult and time consuming. The austere far-forward battlefield presents many additional environmental and tactical obstacles including the real possibility of mass casualties and patients with lost extremities. The American Heart Association recommends that 1 mg epinephrine be administered by intravenous (IV) route; if access cannot be attained, the drug should be administered by the intraosseous (IO) route.

Methods: The purpose of this prospective, experimental study was to compare the maximum concentration (C_{max}) and time to maximum concentration (T_{max}) of epinephrine administered by tibial IO, sternal IO, and IV routes in swine in cardiac arrest during CPR. Adult swine were assigned to 3 groups: peripheral IV (N=6), tibial IO (N=6), or sternal IO (N=6). IV KCL was used to induce cardiac arrest; after 2 minutes, CPR was initiated at a 30:2 ratio; 1 minute later, epinephrine 1 mg was administered. Samples were collected 0, 0.5, 1, 1.5, 2, 2.5, 3, 4, 5, 7.5, and 10 minutes and analyzed using HPLC MS/MS.

Results: The investigators used a multivariate analyses of variance with a Tukey post-hoc and found no significant differences in C_{max} for the IV group (mean = 471 ± 349 ng/mL) compared to the tibial IO group (mean = 155 ± 65 ng/mL) or sternal IO group (mean = 650 ± 343 ng/mL) (p > 0.05). The C_{max} of sternal IO group was significantly higher compared with tibial IO group (p = .009), but not different between sternal IO and IV groups (p = .294). The IV T_{max} (mean = 3 ± 1 minutes) was significantly shorter than the tibial IO (mean = 5.5 ± 1.6 minutes) (p = 0.003) but no difference compared with the sternal IO (mean = 2.3 ± .75 minutes) (p = .29). Further, the sternal IO T_{max} was significantly shorter than the tibial IO T_{max} (p = 0.000).

Conclusions: The C_{max} was higher for the sternal IO compared with the IV, but there were no statistical significant differences between the 2 groups. Both groups were higher than the tibial. Also, there no significant differences in the sternal IO and IV groups relative to T_{max}, but the sternal IO was significantly shorter than the tibial IO. The reason for these findings may be that the the adult sternum is rich in red marrow (more vascular) compared with the tibia which is primarily yellow. Based on this study, the sternum is an acceptable method of delivering epinephrine in a cardiac arrest.

Source of Funding: TriService Nursing Research Program.

The CRNA Doctoral Faculty Shortage: Is There Hope?

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Introduction: A doctoral faculty shortage may have an impact on educating a sufficient number of future CRNAs in light of the move to the entry level practice doctorate. The primary purpose of this quantitative study was to explore potential demographic and financial factors that may contribute to the doctoral CRNA faculty shortage. An exploration of the potential noneconomic and economic barriers such as student loan repayment, household income status, number of dependents, and yearly salary were examined. Clinical practice compared to faculty financial compensation was central to this research study.

Methods: A quantitative design was selected to examine the background characteristics and barriers associated with intentions to pursue a doctorate and a doctoral faculty position. A survey tool was constructed and data was gathered supporting its validity and reliability. The sample was selected to closely mirror the composition of the AANA membership. After IRB approval, 5,000 AANA members (all CRNAs) were invited to participate and 227 members opted out. Of the remaining 4,773 AANA members, 763 (16%) completed the survey.

Results: Eleven percent of the sample indicated they planned on pursuing a doctorate, and 56% of the sample indicated they definitely had no plans to pursue a doctorate. The remaining 33% indicated perhaps they would or were undecided. The DNP degree was the doctorate most likely pursued by respondents. Student loan obligation ($P<.001$) and years of experience ($P<.001$) were found to be barriers to pursuing doctoral faculty positions. A combination of student loan forgiveness ($P<.001$), competitive salary ($P<.001$), and presence of instructional teaching workshops ($P<.001$), predicted CRNA intentions to pursue doctoral faculty opportunities.

Conclusions: Specific factors that can assist in a recruitment action plan for future doctoral faculty, based on evidence rather than anecdotal reasoning, exhibits a leadership approach to problem solving. Identifying economic and noneconomic barriers to the CRNA doctoral faculty void is essential to educational stakeholders seeking solutions to the doctoral faculty shortage. Using current evidence supports efforts for higher education institutions strategic recruitment action plans and advocates for governmental funding pertaining to doctoral level nurse anesthesia education.

The Effect of QuikClot Combat Gauze, Hypothermia, Fluid Challenge, and Movement on Hemorrhage Control

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Introduction: Trauma represents the leading causes of morbidity and mortality in both the civilian and military populations with uncontrolled hemorrhage as the major cause of death. Hemorrhage remains the leading cause of death even when the individual survives long enough to be transported to a medical treatment facility. Hypothermia is common in trauma victims particularly on the battlefield and causes coagulopathy and propensity for increased bleeding. The effectiveness of the hemostatic agent, QuikClot Combat Gauze (QCG), in a hypothermic model has not been investigated.

Methods: This was a prospective experimental study. Swine were assigned to the QCG group (n = 11) or a control group (n = 11). Pigs were cooled to 34 degrees; the femoral artery/vein were transected. After 1 minute, QCG was placed into the wound. The control group underwent the same procedures but with standard dressings. After 35 minutes the wound was observed for bleeding for 5 minutes. If hemostasis occurred, up to 5 liters of crystalloid were given until bleeding occurred. If no bleeding occurred, the extremity was abducted, adducted, extended, and flexed up to 40 times or until hemorrhage occurred.

Results: Multivariate analysis of variance (MANOVA) indicated no significant differences between the groups relative to weight, volume of blood, amount of 1 minute bleeding, or core body temperatures indicating that the groups were equivalent on these parameters ($p > 0.05$) but significant differences in the groups relative to bleeding for 5 minutes, amount of crystalloid, and the number of movements ($p < 0.05$). Results are reported in means and standard deviations: bleeding for the 5 minutes (QCG mean = 24 ± 65 mL; control mean = 413 ± 309 mL) ($p = 0.001$); amount of crystalloid administered (QCG mean = $4,545 \pm 1,507$ mL; control mean = $1,363 \pm 2,335$ mL) ($p = 0.001$); and the number of movements (QCG mean = 29 ± 18 ; control mean = 10 ± 189) ($p = 0.034$).

Conclusions: QCG is statistically and clinically superior in hemorrhage control compared with the standard pressure dressing group. Furthermore, it produces a more robust clot that can withstand more intravenous fluid allowing for latitude in resuscitation and more movement than a standard dressing. The movements were severe and should be avoided in patients with an inguinal injury. However, the investigators wanted reproducible movements that would test the robustness of a newly formed clot. Based on this study, QCG is an effective hemostatic agent for use in civilian and military trauma management.

Source of Funding: TriService Nursing Research Program.

The Influence of Elective Surgery on Health in Veterans With Chronic Posttraumatic Stress Disorder

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Introduction: Posttraumatic stress disorder (PTSD) is common, can be chronic, and has been associated with greater risk of postoperative mortality in veterans. Therefore, the purpose of this study was to determine if elective outpatient surgery had a persistent and deleterious effect on the physical or mental health of veterans with chronic PTSD, and to explore factors that contributed to health change after elective surgery.

Methods: A longitudinal, mixed-method, quasi-experimental, nonequivalent control group study was conducted. Physical and mental health, depressive symptom severity, posttraumatic symptom severity, and pain severity were measured in 29 veterans with chronic PTSD before surgery and 1, 4, and 12 weeks after surgery. For comparison, parallel data were collected from 31 community dwelling veterans who did not undergo surgery at baseline and 1, 4, and 12 weeks after baseline. Subjects in the control group who displayed clinically significant or subjectively distressing changes in health status after surgery were interviewed to identify factors associated with postoperative health change.

Results: Subjects in the surgical group reported significant declines in subjective physical and mental health status after 1 week, but not 4 or 12 weeks after outpatient elective surgery. Depressive symptom severity and posttraumatic symptom severity were unchanged at 4 or 12 weeks after surgery. Subjects reported that this physical and mental distress was the result of acute postoperative pain but that underlying chronic pain remained influential throughout their postoperative course. In particular, the presence of underlying chronic pain complicated both self-management and medical management of acute surgical pain after discharge from the hospital.

Conclusions: Patients with chronic PTSD were able to undergo common elective outpatient surgeries without experiencing lasting deleterious effects on their mental and physical health. However, further research and quality improvement projects are needed to address the complicated pain management needs of this population, especially after hospital discharge.

Source of Funding: Triservice Nursing Research Program Graduate Student Grant N11-PO2.

Workplace Incivility Affecting CRNAs: A Study of Prevalence, Severity, Consequences, and Proposed Interventions

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Introduction: Incivility (such as disrespectful, rude communication and/or behavior) among employees in the healthcare settings may have detrimental effect not only on the targeted healthcare provider but also on patient safety. Limited research is available on incivility among Certified Registered Nurse Anesthetists (CRNAs) in healthcare settings in Michigan. This study examines the prevalence and types of incivility and its influence on professional burnout among CRNAs in Michigan. It also proposed interventions suggested by CRNAs to curb incivility.

Methods: Data were collected between October and November of 2012 via Qualtrics survey. The response rate was 22.6% (385/1700). The Nursing Incivility Scale (NIS) and the Copenhagen Burnout Inventory (CBI) were used to measure workplace incivility and professional burnout. Qualitative data were also collected to provide recommendations to address workplace incivility.

Results: CRNAs reported that the sources of workplace incivility were general employee personnel or nonemployee individuals (63.5%), physicians (62.3%), other CRNA practitioners (51.3%) and CRNA supervisors (37.6%). Female respondents reported higher levels of incivility compared to male respondents. A statistically significant, direct relationship existed between workplace incivility and professional burnout (Chi square test, Pearson correlation = .518, $P < .001$). When controlling for gender, type of employment arrangement, type of employment class, hours worked per week, and years in the CRNA profession, workplace incivility was associated with professional burnout ($P < .0001$). The only statistically significant factor associated with professional burnout was experiencing workplace incivility. Analysis of the qualitative data revealed recommendations on prevention, coping with, and management detection of workplace incivility. The most notable recommendation was the utilization of a zero tolerance policy for practice, regardless of title.

Conclusions: CRNAs experience incivility from various sources especially by general employees, nonemployees and physicians. Such incivility leads to professional burnout. Future studies should investigate the influence of incivility on healthcare and the effectiveness of interventions to prevent the incivility that CRNAs are experiencing.

2013 Evidence-Based Abstract – Oral

A14

The Implementation of a High-Fidelity Simulation Process Improvement Protocol Using Malignant Hyperthermia

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Introduction: Anesthetists rarely practice crisis management intervention posing a significant risk to patient safety. High-fidelity patient simulation (HFPS) is an experiential outcome-based educational strategy used in comparable high-risk industries to rehearse crisis intervention. Research has demonstrated improved clinician confidence, competence, knowledge, and performance; accelerated speed and quality of learning; and decreased human error. This protocol explored the feasibility of conducting HFPS training evolution using malignant hyperthermia (MH) recording barriers and participant satisfaction.

Literature Review: Bruce et al conducted a study of graduate nursing students to evaluate HFPS on students' knowledge, competence, and confidence in the assessment and management of cardiac emergencies. It was demonstrated that HFPS increased knowledge retention and with repeated exposure is likely to improve confidence and competency. Chopra et al investigated efficacy of HFPS as a training tool among 28 anesthesia providers with varied experience in a single facility and found that simulation trained anesthetists develop better response times and deviate less from standard treatment guidelines.

Results: Results support feasibility of implementing HFPS training with 16 anesthetists completing the MH evolution (61.5% vs 10 nonparticipants [38.4%]). Barriers encountered included work schedule conflicts, simulation equipment failure, and negative comments from some anesthetists about simulation. Median scores from the MH HFPS anonymous questionnaires suggest participant satisfaction with HFPS training and relevance to their clinical practice as reported on all 9 Likert type scale questions. Participants were also asked 2 open-ended questions that yielded overwhelming requests for further HFPS training evolutions related to both crisis management and common intraoperative complications encountered in clinical practice.

Conclusions: This process improvement protocol demonstrated feasibility of implementing HFPS training. Despite the barriers encountered, participation was greater than half of staff anesthetists in the institution where it was implemented. Investigators believe successful implementation was enhanced by buy-in from stakeholders who worked closely with investigators to ensure all anesthetists were given an opportunity to participate. Overall, anesthetists acknowledge HFPS is gaining increased acceptance, recognize its educational value, and may soon become a credentialing requirement.

2013 Research Abstracts – General

A15

A Comparison of Outcomes Between Epidural Catheter Replacement and Intrathecal Catheter Placement in Obstetrical Patients Following Accidental Dural Puncture

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Introduction: Accidental dural puncture (ADP) leading to postdural puncture headache (PDPH) is a known complication of labor epidural placement with a reported incidence as high as 75%. We compared the prevalence of PDPH and epidural blood patch (EBP) in laboring patients managed with intrathecal catheter placement versus repeated epidural placement at a different level following ADP.

Methods: IRB approval was obtained. Retrospective data over 2 years yielded 33 consecutive patients who had experienced an ADP. Patients were divided into 2 treatment groups. Group 1 had an epidural replaced at another interspace, and Group 2 had an intrathecal catheter threaded at the time of ADP. The incidence of PDPH and EBP were collected and compared between the 2 groups.

Results: Group 1: Thirteen women had their epidural replaced after ADP with 11 (84.6%) experiencing a PDPH and 9 (69.2%) requiring an EBP. Group 2: Twenty patients had intrathecal catheters threaded after ADP with 12 (60%) experiencing a PDPH and 9 (45%) requiring an EBP. The incidence of PDPH and EBP did not differ statistically between the epidural replaced group (Group 1) and intrathecal catheter placement group (Group 2) (PDPH, $P = 0.132$; EBP, $P = 0.157$). However, evaluation with the Odds Ratio demonstrated patients who had an epidural replaced (Group 1) after an ADP had a 3.67 times higher risk for PDPH (95% CI 0.64-21.15) and a 2.75 times higher risk of requiring an EBP (95% CI 0.63-11.97).

Conclusions: The outcomes between the 2 groups did not differ statistically; however, Group 1, the patients with the epidural replaced at a different level after ADP, did have a higher risk of both PDPH and EBP.

A Mathematical Model to Estimate Blood Volume

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Introduction: Perioperative intravenous (IV) fluid management is controversial. Fluid therapy is guided by inaccurate algorithms and changes in the patient's vital signs that are nonspecific for changes to the patient's blood volume. Anesthetic agents, patient comorbidities, and surgical techniques interact to further confound clinical assessment of volume status. An adaptation of the Jacob-Trowbridge model (JTM; a mathematical model used to guide acute normovolemic hemodilution) may be used to estimate blood volume based on changes in hematocrit (HcT) following administration of a fluid bolus.

Methods: Data were obtained from the Daxor Corporation. Measures included ideal blood volume (iBV), baseline hematocrit (bHcT), and actual blood volume (aBV) calculated with an albumin I-131 tracer dilution technique. Blood volumes were estimated for each patient by calculating: (1) Based on iBV, the predicted drop in HcT after fluid bolus (FB) of 5% of iBV (p D HcT); (2) Based on aBV, the actual drop in HcT after FB (a D HcT; in practice a second HcT would be drawn); and (3) The ratio of p D HcT/a D HcT (CF; an estimate of the patient's predicted blood volume (pBV) as a proportion of iBV). Spearman's r and Pearson's r were used to assess correlation between pBV and aBV.

Results: The modified Jacob-Trowbridge model was applied using 10 measurements on 9 unique subjects (subject 2 was measured on 2 different occasions) consisting of 1 female and 8 males, with a median age of 78 years (49-84 years). All subjects had a history of intravascular volume abnormalities either related to plasma or red cell volume. The pBV and aBV were significantly correlated with a large effect size ($df = 8$, $r = 1.0$, $p < .01$; $r = .99$, $p < .01$).

Conclusions: Patients with a blood volume deficit should demonstrate a greater than expected drop in HcT in response to a fluid challenge, while patients with blood volume overload should demonstrate a drop in HcT that is smaller than expected. The modified Jacob-Trowbridge calculation and fluid challenge paradigm demonstrated here may be useful to quickly determine a patient's volume status in the clinical setting. Further study is needed to clarify best practices for perioperative IV fluid administration.

A Pilot Survey on the Sleep Behaviors of Student Registered Nurse Anesthetists

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Introduction: The continuous nature of anesthesia requires extended hours, overnight shifts, and call. Inconsistent scheduling patterns and shift work often result in chronic partial sleep deprivation and fatigue in anesthesia providers. Clinical schedules assigned to student registered nurse anesthetists (SRNAs) mirror those of anesthesia providers. Whether SRNAs experience sleep disturbances has yet to be assessed. The purpose of this study was to explore the sleep behaviors of SRNAs.

Methods: Fifty-one Jacksonville SRNAs were invited to anonymously complete an online survey. Quantitative data were collected using an adaptation of the Questionnaire for the National Study of Sleep-Related Behaviors of Nurse Anesthetists.

Results: Descriptive analysis of n=27 surveys found 88% of SRNAs receive 6 or fewer hours of sleep per clinical day, 100% feel sleepy during clinical hours, and 82% have fair or poor quality sleep.

Conclusions: This study was able to clarify the sleep behaviors of SRNAs. The majority of SRNAs may be experiencing episodes of inadequate sleep and daytime sleepiness during clinicals. These findings suggest sleep disturbances may be prevalent in this population. Further investigation with a larger sample size could further validate these findings.

A Study of Employee Engagement, Job Satisfaction, and Employee Retention of Michigan CRNAs

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Introduction: Employee engagement is an employee's emotional connection to their organization that motivates employees to become fully involved and enthusiastic about their work. Studies have shown that hospitals with engaged employees have improved patient safety and satisfaction scores, reduction in medical errors, and lower malpractice claims. Review of the literature shows there has been multiple studies measuring CRNA job satisfaction. However, there has been no published research on CRNA employee engagement. This study measures Michigan CRNA employee engagement, job satisfaction, and retention.

Methods: Data was collected between December 2012 and January 2013 via Qualtrics© survey. The response rate was 16.5% (280/1700). The Index of Work Satisfaction (IWS), the Utrecht Work Engagement Scale (UWES), and the Anticipated Turnover Scale (ATS) were tools used to measure work satisfaction, engagement and turnover. Qualitative data was also collected to give insight into the respondent's answers.

Results: The response rate for this survey was 16.5%. The UWES measures 3 variables to determine work engagement, which were: vigor (4.87), absorption (4.37), and dedication (5.48). A paired t-test showed significance between the means with $p < .001$. Work engagement was measured on a continuum from very low to very high. CRNAs measured average for absorption and high in both vigor and dedication. The IWS job satisfaction score was 16.42 (0.9-37.1), which is in the second quartile. Professional status, autonomy and interactions are variables that measured in the third quartile. Task requirement, pay and organizational policy fell within the second quartile. The ATS mean score sum was 2.94 (1-7), with a mean standard deviation of 1.74.

Conclusions: Michigan CRNAs experience average to high levels of engagement in the workplace but are not highly engaged. CRNAs also experience higher levels of job satisfaction than nurses, but the results indicate that CRNAs experience job dissatisfaction. The results of the survey shows that the components of professional status, autonomy, and interactions contribute to CRNA job satisfaction. Components that promote CRNA job dissatisfaction were task requirements, pay and organizational policy. Despite these findings, Michigan CRNAs do not plan to leave their current place of employment.

AANA Foundation Office-Based Anesthesia Study

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Introduction: Office-based surgery is a rapidly-growing segment of anesthesia practice, with some 10 million procedures performed annually in office-based settings. AANA first developed its Standards for Office-Based Practice in 1999. This study assessed the compliance of CRNAs in office-based practice with the AANA Standards for Office-Based Practice. Since 24% of elective surgeries in the United States are performed in office-based settings, studying outcomes is critical to improve patient safety.

Methods: Potential respondents were identified through information provided on the annual AANA Member Surveys. Aggregate survey data showed that 12% of respondents provided office-based anesthesia services. A 24-item online survey using the Zoomerang® platform was administered to 669 CRNAs. Researchers determined that a sample size of 536 was needed to obtain a 95% confidence interval, with a confidence interval of 4.

Results: The survey yielded 669 respondents, attaining a 95% confidence level. Most respondents (83%) had practiced over 10 years and spent less than 50% of their time in office-based practice. Reported compliance with AANA Standards for Office-Based Practice was over 90% in most categories. Surgeries most frequently performed were cosmetic (56%), GI endoscopy (56%), oral surgery (24%), ophthalmology (18%), infertility (17%), gynecologic (16%), and foot and ankle (14%). Over 90% of respondents cared for PS I and II patients, while 55% also managed PS III patients. Care across the life span was provided, with 17% indicating they cared for patients 2 to 10 years old, 59% stating they took care of patients 11 to 20 years old, and 46% provided care for patients over 80 years of age.

Conclusions: Duration for office-based cases was 31 to 90 minutes for 41% of respondents, with 19% indicating that cases took 91 to 180 minutes. Postoperative care was most frequently managed by an RN (67%) followed by the CRNA (18%). Most respondents (95%) indicated that resuscitative drugs were available in office-based settings. Only 3% of those responding were involved in cases that required reporting to their malpractice insurance carrier. The majority of those cases (65%) were airway-related, and 15% entailed hospital admission. In this sample, reported rates of compliance with the AANA Standards for Office-Based Practice were high, and the incidence of damaging events and adverse outcomes was low. Consistent with reported outcomes research, when damaging events occurred, most entailed respiratory issues. Advantages to office-based practice include convenience for patients and providers and cost savings relative to care provided in hospitals or ambulatory surgical centers. Potential challenges in these settings include limitations in facilities, technology, personnel, available medications, and regulatory safeguards. Prospective outcome studies demonstrating evidence and the adoption of the AANA Standards for Office-Based Practice is essential to ensure continued high quality care to further reduce adverse outcomes in office-based practice settings.

Accuracy of Using Digital Palpation of an Endotracheal Tube Pilot Balloon to Identify Acceptable Endotracheal Tube Cuff Pressures

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Introduction: Proper management of cuffed endotracheal tubes (ETTc) during mechanical ventilation is fundamental for providing safe anesthesia care. Routine measurement of ETTc pressures after endotracheal intubation is not done in most practices. Additionally, assessment and close monitoring of ETTc pressures is often overlooked and underemphasized by anesthesia providers.

Methods: The primary aim was to determine if pilot balloon palpation is an adequate method for detection of appropriate ETTc pressures. The secondary aim was to determine if years of experience is related to the provider's ability to accurately assess proper inflation of ETTc. The study population consisted of a variety of anesthesia providers with differing years of experience. Participants palpated the pilot balloon of 5 randomly assigned mannequins previously inflated to different pressures. Participants reported their assessment of each balloon individually and completed a short survey.

Results: When the cuff was inflated to 16, 20, 30, 45, and 70 cm H₂O, the percentage of participants who accurately assessed the ETTc pressure was 81%, 51%, 58%, 23% and 62%, respectively. For cuff pressures of 30, 45, and 70 cm H₂O, the median years of provider experience was lower for those that assessed ETTc pressures correctly than those with more years of experience who did not correctly assess the ETTc pressures (30 cm H₂O p=0.01; 45 cm H₂O, p=0.04; 70 cm H₂O, p=0.03). The ability to accurately assess ETTc pressure did not differ between providers who used palpation as one of their means of assessment versus those who did not. The number of ETT intubations per month did not increase the provider's ability to accurately assess ETTc pressures.

Conclusions: There was some evidence to suggest provider's years of experience were associated with ability to accurately assess cuff pressures, while the overall results suggest digital palpation method for assessing ETTc pressure is not accurate.

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Analgesia After Ileostomy Closure: Role of Intrathecal Hydromorphone on Postoperative Bowel Function

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Introduction: An Enhanced Recovery Pathway (ERP) is a program designed to reduce the physiologic stress response to surgery and facilitate recovery by optimizing pain control, avoiding hypervolemia, and promoting early feeding and ambulation. A component of ERP is the use of single-injection intrathecal analgesia to improve postoperative analgesia, mobilization, and shorten hospital length of stay in ileostomy closure. The objective was to compare postoperative gastrointestinal recovery time and quality of analgesia among patients enrolled in ERP that did and did not receive intrathecal hydromorphone.

Methods: Few studies have addressed the effectiveness of intrathecal hydromorphone administration in ileostomy closures in relation to narcotic administration during the intraoperative period, in the PACU, and during the first 24 hours inpatient. More information is needed in order to assure this type of analgesia is effective during the 3 defined time periods. By looking at narcotic administration during these time periods we will be able to make a conclusion as to the effectiveness of the intrathecal.

Results: Of 228 patients meeting criteria, 180 (78.9%) patients received intrathecal opiate analgesia as part of ERP during the study. Patients receiving intrathecal analgesia required less opiate analgesia in the PACU (median 25.0 mg OME vs. 0 mg OME; $p=0.01$), at 24 hours (3.8 mg OME vs. 0 mg OME; $p<0.001$) and 48 hours (25.0 mg OME vs. 7.5 mg OME; $p=0.02$) postoperatively. The time to return of bowel function was significantly different in favor of patients that did not receive intrathecal analgesia ($p=0.03$). However, no difference in postoperative ileus or small bowel obstruction (intrathecal 6% vs. no intrathecal 6%; $p=0.97$). No significant differences in other postoperative complications or 30-day hospital readmission.

Conclusions: When used as part of an ERP, the use of single injection intrathecal analgesia for patients undergoing ileostomy closure results in decreased systemic opiate requirements up to 48 hours after surgery. However, this reduction in systemic opiate analgesia does not appear to confer any significant advantage for gut recovery or postoperative morbidity. Enhanced recovery pathways that utilize multimodal analgesia plus judicious use of systemic opiates may have similar postoperative outcomes than pathways that incorporate intrathecal analgesia.

Are Bedside Screening Tools Accurate in Predicting Difficult Intubation in the Morbidly Obese?

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Introduction: Several reviews have asserted that endotracheal intubation is more difficult in obese patients. However, other studies refute these findings, lending to a lack of consensus regarding how to measure obesity as a risk factor for difficult tracheal intubation (DTI). The objective of this study was to examine the accuracy of screening tools in predicting DTI in the morbidly obese.

Methods: Data from 148 morbidly obese patients presenting for bariatric surgery were analyzed using the chi square and 2-tailed statistical analysis tests and included the following criteria and screening tools: BMI, OSA, Mallampati score, thyromental distance, range of joint motion of neck, direct laryngoscopy, and ease of tracheal intubation.

Results: DTI occurred in 17 (11%) of the patients and was anticipated in 8 (47%) of the 17 patients based on bedside screening assessments. Differences in mean age and mean BMI between the overall group and the DTI group was not clinically significant ($P = 0.36$ and $P = 0.26$, respectively). There was no difference in the presence of OSA in the DTI group compared with the group of patients without DTI. DTI occurred with greater frequency in patients with Mallampati scores of III (46%) and IV (100%) or short thyromental distance (45%).

Conclusions: The results of this study confirm the incidence of DTI in the morbidly obese (11%) to be similar to the 12% and 15.5% reported in the review by Brodsky et al and Juvin et al, respectively. Advanced age, BMI, nor presence of OSA was independently associated with DTI in the morbidly obese. Presence of high Mallampati scores or short thyromental distance was associated more frequently with DTI indicating the combination of the Mallampati test and thyromental distance may yield a more accurate prediction of DTI in the morbidly obese.

Assessment of Usage, Attitudes, and Experiences With OFIRMEV (Intravenous Acetaminophen)

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Introduction: Patients consider pain to be one of the most undesirable outcomes after a surgical procedure.

Uncontrolled pain has been linked to higher rates of metabolic, thromboembolic, cardiovascular, gastrointestinal, and cognitive issues. Although narcotics historically have been a staple of pain management, they have many side effects that may compromise patient safety and quality of recovery. The "multimodal approach" to pain management is a well-researched area that uses a combination of drugs and other therapies to reduce postoperative opioid use. Intravenous (IV) acetaminophen has the potential to fill an important role in a multimodal acute postoperative pain management regimen.

Methods: An electronic survey was created to qualitatively assess the usage, attitudes, experiences, and barriers to use regarding OFIRMEV (intravenous acetaminophen) in addition to demographic inquiries. The survey was posted on the Michigan Association of Nurse Anesthetists Association (MANA) website, and an email was sent with a link to the Internet survey to 2,256 CRNAs and SRNAs who had email addresses on file with the MANA.

Results: The majority of respondents were practicing CRNAs with 10 or more years of experience and with an average case load of 3-5 cases per day. Approximately 25% of respondents reported having never used OFIRMEV, while 33% reported weekly use. OFIRMEV was used 5% less at facilities with restricted use than those without this restriction. The professional's decision to use the drug was influenced more by cost than by facility restriction. OFIRMEV was cited to be most frequently used in orthopedic and general surgery populations followed by gynecologic surgeries, with notable use in the pediatric and ENT populations. Approximately 10% of respondents reported the use of OFIRMEV in a febrile patient. OFIRMEV was most often administered during the intraoperative time period. Nearly 96% of respondents reported observing no side effects while using OFIRMEV.

Conclusions: OFIRMEV is a relatively new drug and, not surprisingly, our study noted that cost is a prohibitive factor that limits provider use based on personal decision and most likely facility restriction. Nearly 75% of respondents confirmed using a multimodal approach to pain management, which follows the current literature's recommendations. There continues to be a learning curve with new drugs; however, these respondents indicated the use of OFIRMEV in many surgical populations and a variety of operative settings, yielding no side effects and good results.

Breaking Up is Hard to Do: A Study of Divorce and Separation Rates in Graduate Nursing Students

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Introduction: External stressors can affect sustainability of the relationship between couples. Increasing workload, changing jobs, moving, are all likely to put additional strain on a couple. Graduate nursing schools may present all of these issues at one time. The hypothesis is that graduate nursing students may experience a higher than average divorce and separation rate when compared with the general population.

Methods: Secondary data from the general social survey was utilized for this study. The General Social Survey (GSS) is a publicly published survey of societal trends, which is managed by the National Opinion Research Center (NORC) at the University of Chicago. Data on divorce, separation, educational level, and other demographics were evaluated from 15,723 individuals in the general population. The status of divorce or separation was evaluated between 2000 and 2010. From this population, there were 314 registered nurses, 29 of which had indicated the completion of graduate level education.

Results: Means comparison of divorce rates in registered nurses when compared with the general population showed a statistically significant higher rate of divorce ($p=0.008$), as well as a statistically significant higher rate of divorce and separation ($p=0.027$) when separation from the spouse was considered. Means comparison of divorce rates in graduate nurses showed no statistically significant variation compared with either the general population ($p=0.644$) or the registered nurse population ($p=0.21$).

Conclusions: There appeared to be a statistically significant higher rate for undergraduate nurses to experience a higher divorce and separation rate. There is no statistical significance found within graduate students. Relying on existing literature and research, this data will need to be explored to evaluate the differences in how the nursing profession and graduate school affects marital relationships, examine key differences in these populations, and to identify implications for future research.

Changes in Cerebral Oxygen Saturation During Transcatheter Aortic Valve Implantation

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Introduction: Cerebral oxygen saturation (rSO₂) is a noninvasive monitor used as an indicator of cerebral oxygen balance and brain perfusion. Decreases in rSO₂ are associated with cerebral ischemia and increased perioperative morbidity. During transcatheter aortic valve implantation (TAVI), significant hemodynamic manipulation is necessary for successful valve placement. The magnitude and duration of changes in rSO₂ during this period of hemodynamic manipulation is unclear. In this study, we investigate the changes in rSO₂ in patients undergoing TAVI.

Methods: Ten consecutive ASA physical status IV patients undergoing TAVI at a university tertiary teaching hospital were prospectively studied. Baseline (awake) rSO₂ values were obtained prior to induction of general anesthesia. Magnitude and duration of changes in rSO₂ after induction, during rapid ventricular pacing, valvuloplasty, valve deployment, and at procedure end were recorded. Cerebral oxygen desaturation was considered significant if it was 20% or more below baseline.

Results: Baseline awake rSO₂ values in these patients were 54% ± 7. After induction of general anesthesia, rSO₂ increased in all patients (+6 to +46%). Cerebral oxygen saturation then decreased in all patients during rapid ventricular pacing for valvuloplasty and valve deployment (-1% to -58%), and in 6 of these patients, this decrease was below baseline awake values. Three patients (33%) experienced a significant decrease in rSO₂ ≥20% below baseline during rapid ventricular pacing and valve deployment (-20% to -55%). Cerebral oxygen saturation returned to postinduction values after 12 ± 10 minutes.

Conclusions: The period of rapid ventricular pacing during valvuloplasty and valve deployment in patients undergoing TAVI is associated with a decrease in rSO₂. Baseline rSO₂ values in this patient population are at the lower limit of normal, and significant cerebral oxygen desaturation may be limited by an improvement in rSO₂ after induction of general anesthesia. Further prospective studies are warranted to investigate the ability of rSO₂-directed therapy to decrease morbidity and mortality of patients undergoing TAVI.

Contamination of Intravenous Fluids by Writing on the Infusion Bag: Fact or Fiction?

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Introduction: Laboratory experiments were conducted to ascertain whether Sharpie® brand black permanent marker ink will leach through intravenous infusion bags. The practice of writing directly on infusion bags is a frequent yet controversial practice of anesthesia providers. There are no known standards that exist that pertain to this practice.

Methods: Several types of intravenous bags containing different intravenous solutions were measured at ambient temperatures and at 40C° during 15-minute intervals to over a period of 24 hours. Both visible and ultraviolet spectrophotometric scans and measurements were conducted at 300 to 600 nm on each intravenous solution contained in the bags (polyvinyl chloride laminate #146, 2207, 1909 or a copolymer of ethylene and polypropylene). Known wavelengths for black Sharpie® Fine point markers were specifically examined. Writing with Sharpie® pens on filter paper and surgical tape was also conducted.

Results: A total of 17 experiments were conducted with intravenous bags and solutions. There appeared to be no visible or ultraviolet spectrophotometric evidence of leaching of the ink from Sharpie® pens. These experiments included 14 different intravenous bags from 5 different types of manufacturers. The solutions were 0.9% normal saline solution, 6% hetastarch, lactated Ringer's solution, dobutamine and Plasma-Lyte A solutions. Four different lot numbers of Sharpie® pens were used in these studies. Surgical tape that was written on using Sharpie® markers readily exhibited visible evidence of permeability through the 3M silk tape.

Conclusions: The experiments conducted would appear to indicate that the infusion containers tested maintained an intact barrier to the application of Sharpie® brand permanent marker ink. Writing on surgical tape does not stop the permeability of Sharpie® pens. This study could serve as a suitable pilot study for others to conduct a much more comprehensive study using a greater number of intravenous containers, solutions, and ink markers.

Continuous Labor Epidural and Combined Spinal Epidural: Is There a Superior Approach?

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Introduction: Due to advances in development and increasing safety of anesthetic techniques in the past 50 years, there has evolved a wide variety of pain relief options available to the parturient. We did this study to present a comparative analysis of the continuous labor epidural (CLE) with combined spinal epidural (CSE) for the delivery process. The purpose is 2-fold: (1) to provide evidence-based data regarding regional anesthesia options for the parturient approaching eminent childbirth, and (2) to educate obstetric healthcare providers on the availability and different care modalities encountered with the selection and use of each approach.

Methods: Continuous labor epidural and combined spinal epidural are 2 techniques used extensively in the obstetric community by anesthesia providers and, as such, have been studied at length. According to the National Vital Statistics Report, 61% of women who delivered vaginally in 2008 received an epidural or spinal anesthesia within the 27 reporting states. Though it is generally recognized that nerve conduction techniques offer the safest and most satisfactory outcomes, clinical controversy continues to exist regarding the superiority of one type of technique over another.

Results: A retrospective chart review totaling 100 parturient charts: 50 from a CSE group and 50 from an epidural group receiving regional analgesia. Demographics, outcomes, and interventions were compared. Data was collected via the institutions' electronic medical record (EMR). In comparing the CSE with the traditional epidural there was no significant difference for general demographic variables, descriptive variables of the mother, pregnancy, delivery, and measurements of the fetus. The CSE group had better pain reduction but higher vasopressor usage. In addition, there was greater failed epidurals with the traditional method.

Conclusions: Evidence-based quality improvement (EBQI) should guide our practice to improve patient care and outcomes in both labor and delivery and anesthesia. The outcomes of this study showed no appreciable difference in complication rates of CSE vs CLE. This is clinically significant because many anesthesia practices are currently restricted because of misconceptions that the CSE has clinically higher risk of complications. Some current restrictions of the CSE method are based on fear of PDPH and fetal complications. These concerns were unsubstantiated based on the results of the study. Conversely, the CSE parturients reported greater pain reduction when compared with the parturient with the CLE.

Creating a University-Based Evidence-Based Practice Dissemination Colloquium

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Introduction: Evidence-based practice (EBP) skills are essential to collect, evaluate and apply research to clinical nursing practice. Currently, graduate nursing students including nurse anesthesia students at Drexel University College of Nursing and Health Professions are conducting literature searches, evaluating the quality of that literature through critical appraisal, and applying this evidence to clinical practice in the core graduate course, Evidence-Based Approaches to Practice. The university lacked a method to distribute this evidence outside the classroom in which the course was taken. This gap was bridged with the development and implementation of the 2013 Drexel University EBP Colloquium. The purpose of this poster is to describe the EBP Colloquium developed to disseminate this evidence to other students and faculty within the university and answer pertinent clinical questions generated by graduate nursing students.

Methods: Students who had completed the EBP course were invited to submit an abstract of their project, which they had completed in their course to present at the EBP Colloquium. The EBP graduate nursing core course is taught each quarter throughout the year to as many as 300 graduate students. The abstracts were reviewed by a committee of Drexel nursing faculty.

Results: For the first year of this project, 21 abstracts were reviewed and 18 were accepted for either poster or 15-minute PowerPoint presentations. As a result of the EBP Colloquium, 4 graduate students submitted abstracts to present at local and national conferences. The graduate students presented at the Drexel EBP Colloquium on February 13, 2013.

Conclusions: As a result of this first EBP Colloquium in the Drexel University College of Nursing and Health Professions, graduate nursing students presented their EBP projects at local and national conferences for the first time. The future plan is to provide this opportunity annually to graduate nursing students who have completed the nursing graduate core course, Evidence-Based Approaches to Practice.

Cricoid Pressure: Nurse Anesthetist's Knowledge and Perceptions

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Introduction: Pulmonary aspiration is a risk of anesthesia with potential negative outcomes. Cricoid pressure, or “Sellick’s maneuver,” is a method used by anesthetic providers in the prevention of aspiration of gastric contents during laryngoscopy. There are discrepancies in provider utilization that may be related to a deficiency in proper training and education on competent application. The purpose of this research study was to determine education methods of cricoid pressure application in correlation with integration into practice.

Methods: Following IRB approval, a nonexperimental, self-reporting, anonymous survey containing 10 questions was sent out to 1,000 randomly selected nurse anesthetists throughout the United States. The survey consisted of demographic questions, years in anesthesia practice, the presence or absence of formal training, education, and regular incorporation into daily practice, finger technique and pressure applied, and related negative outcomes experienced. SPSS software was utilized in the analysis of data collected.

Results: Of the 1,000 surveys sent, there were 241 completed responses (response rate 24.1%). There were 204 respondents (84.7%) formally trained in the application of cricoid pressure vs 37 (15.3%) never formally trained. Regarding knowledge of cricoid pressure, one question showed very little difference between the groups (35.1% correct for nontrained vs 35.8% correct for formally trained), while the other question showed more of a notable difference (18.9% correct for the nontrained compared with 33.8% correct for the formally trained). The majority of respondents (87.8%) answered that it would be beneficial to incorporate training of cricoid pressure in advanced airway clinics/ACLS.

Conclusions: Pulmonary aspiration is a concern for nurse anesthetists and cricoid pressure is controversial in its effectiveness as a method of prevention. While there are anesthesia providers that have never been formally trained who perform cricoid pressure regularly, the data collected in this study was inconclusive as to declare a need for formal training in regard to knowledge of proper application techniques. Further research may be conducted to identify safety and efficacy of cricoid pressure application as it correlates with provider training and education in order to optimize patient outcomes.

CRNA/AGNP-ACs: Is There a Need for This Dually Certified Provider in Rural Hospitals?

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Introduction: Rural hospitals are experiencing decreased healthcare reimbursements and increased demand for better patient outcomes. Advanced practice registered nurses (APRNs) certified as both Certified Registered Nurse Anesthetists and Acute Care Nurse Practitioners specializing in adult and gerontology care (CRNA/ACNP-AGs) may help to address these economic challenges. It is unclear whether this new type of provider would be acceptable to hospital administrators. The purpose of this study is to survey hospital administrators about the benefit and utilization of CRNA/ACNP-AGs in rural hospitals.

Methods: An online survey was developed utilizing SurveyGizmo, with data being collected via survey research. Survey Design and Analysis, a research consulting firm, oversaw the project. Nebraska, Kentucky, Florida, South Carolina, California, and Georgia state hospital associations distributed the survey to their members via email. Additionally, administrators of hospitals of the states of New York, Iowa, Missouri, Maine, New Hampshire and Vermont received the survey via email. Data analysis was performed by a statistician and a professional economist with a speciality in healthcare policy.

Results: Of the 1,121 Institutional Review Board (IRB) approved surveys, 171 have been returned giving a response rate of 15.25%. Preliminary results show that 55% of respondents believe CRNA/ACNP-AGs would be beneficial in rural hospitals. Of those beneficial responses, 50% said they would hire CRNA/ACNP-AGs in the near future. Moreover, 32% of those that completed surveys would likely hire this provider within the next 5 years. Hospital size correlated to hire is as follows: acute beds of 25 beds or less - 32%; less than 200 beds but more than 25 beds - 26%; and more than 200 beds - 41%. Sixty percent of the respondents agreed that overall patient care in the hospital would improve with CRNA/ACNP-AGs in their hospitals.

Conclusions: It appears from the results of this survey that hospital administrators are receptive to this type of dually certified APRN. The administrators see the benefits CRNA/ACNP-AGs would bring to the hospital by reducing healthcare costs while enhancing patient outcomes. This healthcare policy change may help to fulfill the call to expand the APRN role. It is anticipated that this type of provider will help to close some of the gaps in rural healthcare and would increase access to healthcare, especially in underserved populations.

Emergent Airway Management Outside of the Operating Room: A Retrospective Study

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Introduction: Out of the operating room emergencies, occurring at various times and days of the week, often require urgent airway intervention by anesthesia providers. Immediate access to necessary airway equipment helps ensure high intubation success rates with the fewest number of attempts. Our level-one trauma institution's anesthesia department completed a 5-year retrospective study on out of the operating room intubations with 2 objectives: (1) Determine if anesthesia providers had adequate equipment available for successful intubation, (2) Analyze patterns in location and timing of intubations.

Methods: The study design is a retrospective chart review. All patients that required urgent or emergent out of the operating room intubations from 2007 to 2011 by the anesthesiology service were included. The responding anesthesia team consists of any combination of CRNAs, CRNA students, anesthesia residents, and/or attending anesthesiologist. After obtaining IRB approval, an extensive chart review was performed for data collection and patient data was transferred to an Excel spreadsheet to maintain confidentiality. Data were analyzed utilizing descriptive statistics.

Results: A total of 974 patients required intubation outside of the OR by anesthesia providers. The average age was 59 years and average BMI was 30. Intubation locations included 4 intensive care units and other nonintensive care units. Little difference was noted between locations or timing in the use of our anesthesia service. First attempt intubation success rate was 89.4% and remained consistent during the study in patients with a BMI under 40. Patients with a BMI greater than 40 had first attempt intubation success rates increase from 66.7% in 2007 to 93.1% in 2011. Videolaryngoscopy (VL) use increased from 2.7% in 2007 to 54.4% in 2011. Respiratory failure was the most common indication for intubation (52.8%).

Conclusions: Our first attempt intubation success rate of 89.4% is comparable to similar studies, attributing to the adequacy of intubation equipment. No appreciable pattern was seen in the timing of intubations or anesthesia usage. Trended data indicated a large increase in VL use during the study. The increased VL use was associated with an improvement in first attempt intubation success rates in patients with a BMI greater than 40, suggesting its usefulness in out of the OR intubations. Statistical significance was not calculated, limiting the study's efficacy.

Examining Transfer of Care Processes in Nurse Anesthesia Practice: Introducing the Patient Protocol

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Introduction: While it may be ideal to have the same anesthetist care for a patient throughout the entire perioperative period, the unpredictable nature of operating room activities and schedules mandates that an incoming anesthetist must relieve an outgoing anesthetist for circumstances such as breaks, meals, and the end of a scheduled work shift. To minimize potential crises attributed to the transfer of care in the perioperative period, it is prudent to develop a mechanism that systematically facilitates swift communication between providers thereby promoting situation awareness and improved patient safety.

Methods: Phase I of the study involved the development and distribution of a transfer of care practices questionnaire. The Phase I questionnaire was developed to gain a better understanding of current transfer of care processes, identify components of an anesthetic thought to be crucial to communicate during the transfer of care, and identify the need for a standardized tool for use during transfer of care events. A transfer of care checklist was then developed in Phase II of this study. Once the prototype checklist tool was established, the checklist, along with guidelines for use, was pilot tested.

Results: Phase I – Most of the responses included the terms history, procedure, and allergies, important items to communicate when transferring care. The characteristic identified as most likely to lead to adoption of a standardized transfer of care process was “improving patient safety.” Most respondents reported no barriers to the use of a checklist when transferring care if it promoted patient safety. Phase II – The PATIENT checklist tool was developed from the results of Phase I and incorporates standards of anesthesia practice, as well as characteristics of effective checklists. One hundred percent of respondents either agreed or strongly agreed that the PATIENT checklist tool provides an effective way of organizing important information.

Conclusions: Evidence from this study suggests the current transfer of care process is generally inconsistent and unsystematic. The development of a standardized transfer of care communication tool can serve to promote situation awareness in a swift and organized manner and may minimize variation in handoff processes that exists in practice today. Checklist tools, as components of standardized and systematic processes, have the potential to assist providers with identifying, organizing, and communicating important information to overcome inevitable human fallibilities and improve performance.

Source of Funding: AANA Foundation Postdoctoral Fellowship.

Generation Smartphone: The Use of Cell Phone Technologies While Performing Anesthesia Care

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Introduction: A recent position statement by the AANA addresses the potential benefits and risks of wireless technology use during patient care. There is an evolution in the use of wireless technology as a tool in healthcare delivery. However, the prevalence of the use of cell phone technologies among Certified Registered Nurse Anesthetists (CRNAs) is unknown. Therefore, the primary objective of this study is to explore the prevalence of cell phone use among CRNAs during anesthesia care. Insight is also gained regarding CRNAs' perceptions of the effects of cell phone usage on vigilance and patient safety.

Methods: A 15-question self-designed survey was created using the Qualtrics® survey tool. After obtaining an exempt approval from the UNF Institutional Review Board, participants were recruited among CRNAs attending the 2013 Spring and Fall Florida Association of Nurse Anesthetists' meetings. Participants were provided with an informed consent and invited to volunteer in the study. The survey was distributed on computer tablets via the survey link to obtain a convenience sample of 70 CRNAs (n=70). All data collected remained anonymous, and results of this study are presented in its aggregate form.

Results: The results of 32 completed surveys reveal that a majority of participants (84%) use cell phone technologies during anesthesia care at least 25% of the time. The primary use appears to be the utilization of anesthesia applications, and to look up anesthesia-related articles and information while the least use of these technologies were to access social networking sites and to make phone calls. Seventy two percent of responders agreed or strongly agreed that the use of cell phone technologies while providing anesthesia could be beneficial to patient care. Nevertheless, 44% responders agreed or strongly agreed that cell phone use while providing anesthesia care introduces a potential significant safety risk to patients.

Conclusions: The initial result of this survey reveals that more CRNAs integrated smartphone technologies into the care of their patients. The majority of participants in the study perceived that smartphone technologies may help improve patient care. Eighty-one percent did not believe that the use of cell phone technologies ever affected their concentration or distracted them from patient care. However, many responders acknowledged the potential risk to patient safety. Therefore, CRNAs should use their best judgment when using cell phone technologies to avoid unnecessary distractions.

How Can a Modified Climate Survey Help Your Departmental Planning?

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Introduction: Organizational climate refers to the perceptions of the work environment by the employee.

Employee perceptions can have important effects on individual and organizational outcomes. The use of climate surveys as an analytic tool for organizational improvement is widely accepted in multiple settings. The study department is a dynamic group within an urban academic medical center. The number of nurse anesthetists has increased 59% over the past 6 years. There was a recent change in leadership and growth is estimated at 40% within the next 3 years. Participation was voluntary and consent was implied with participation.

Methods: Structured individual interviews were conducted. Questions consisted of 2 demographic questions and 6 open ended questions that identified strengths, weaknesses, barriers, and opportunities about the department. Interviews were conducted in a private setting during normal working hours. Responses were kept anonymous, and questions were coded and categorized by the interviewer after all interviews were completed. Descriptive statistics were performed on all questions. The survey time was kept to less than 30 minutes in recognition that the interviewees were busy professionals who were volunteers. Data collection and analysis were completed in 7 weeks.

Results: Average interview time was 25 minutes and 59 interviews were completed (100%). Median age was 42.3 and the majority were female. Top strengths in the department identified were strong working relationships with team members (71%), case variety (49%), and practice autonomy (42%). The most common weaknesses were inadequate staffing (46%), lack of professional accountability (42%), and inefficient scheduling (32%). The top opportunities for continued professional growth included increased availability of onsite educational activities (32%), availability to participate in hospital committees (24%), and a transparent clinical ladder system (12%). In response to “what do you think is the top concern among staff,” 85% agreed that workforce issues (staffing, scheduling, timely relief) were the greatest concern. In response to “what barriers interfere with you performing your job,” 49% reported none; however, the most commonly identified issue was the role of the anesthesia technician (26%). The last section was an open discussion for suggestions, and the common theme was there should be an improvement in general communication and consistent messages.

Conclusions: Staff identified positive working relationships and case variety as motivators for being employed in this department. Identified issues were related to work/life balance and communication. Although there were some outstanding issues, the organized identification of these issues allowed for the creation of a goal directed strategic plan. Understanding how employees experience their organizations should be evaluated and can guide strategic planning. Chief nurse anesthetists are encouraged to examine the feasibility of this technique for their department. Identifying high priority concerns and organizing staff feedback allow staff members to be stakeholders in the change process.

Impact of Surgical Type on Informed Consent for Anesthesia

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Introduction: Informed consent is the process whereby a patient is informed of and comprehends the risks and benefits of a medical intervention. It is currently unknown if the severity of surgery influences the type of anesthesia-related risk that patients prefer disclosed to them during the informed consent process. The primary objective of this prospective survey was to determine if patient expectations with regard to disclosure of perioperative risks depends on the severity of surgery. A total of 500 consecutive patients presenting to our preoperative evaluation clinic were asked to complete a survey designed to assess expectations about disclosed perioperative risks based on the severity of surgery.

Methods: According to Paterick, Carson, Allen & Paterick, 2008, when physicians and patients take medical informed consent seriously, the patient-physician relationship becomes a partnership, with shared authority, decision making, and responsibility for outcomes. Physicians are required to disclose significant risks in order to obtain consent for surgical procedures and anesthesia; however, it is not an expectation that all conceivable complications be discussed with patients. The professional standard does not give explicit guidelines regarding the disclosure of risks.

Results: Of the 500 questionnaires administered, 442 were returned for a response rate of 88%. Next day surgery was planned for 64% of the responders. Overall, fear of death was the greatest concern. Specifically, 66%, 53%, and 38% stated death would be their greatest concern if they were undergoing major, moderate, or minor surgery ($p < 0.001$). Death became a lesser concern with reduced severity of surgery. The perceived risk of nausea/vomiting ($p < 0.001$) and peripheral nerve injury ($p = 0.006$) increased with decreasing severity of surgery. Perceived risk of stroke and heart attack were not influenced by severity of surgery ($p > 0.05$ for both comparisons).

Conclusions: Our preliminary findings indicate that overall fear of death is the greatest concern regardless of surgical severity. Less severe risks, such as nausea/vomiting and nerve injury, become of greater concern with lower severity of the surgical procedure.

Source of Funding: Mayo Clinic College of Medicine, School of Health Sciences, Master of Nurse Anesthesia Program, Department of Anesthesiology.

Implementation and Sustainment of a Regional Anesthesia Team: A Novel Process Improvement Process

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Introduction: Over the last 2 decades there has been a significant increase in the use of regional anesthesia for postoperative analgesia and surgical anesthesia in the military. The performance of regional anesthetic techniques at Naval Hospital Jacksonville were frequently identified as a major cause of surgical case delays. Additionally, both internal and external customer feedback identified problems with patient education, postoperative patient follow-up, and surgical team communication. A novel continuous process improvement approach, the Jacksonville Kaizen Production System (JKPS), was used to analyze and address the problems with the delivery of regional anesthesia.

Methods: Phase I consisted of a 1-month review of the regional anesthesia process including each patient receiving regional anesthesia and all aspects of the patient's care from check-in on the day of surgery and through the time the patient entered the operating room. Phase II of the project involved a 3-day Rapid Improvement Event (RIE). This RIE allowed the team members to identify the problem, determine the current status of the problem utilizing Value Stream Analysis, develop a future state Value Stream, and implement the new regional anesthesia process. Phase III consisted of follow-up and metric analysis to determine the effectiveness of the intervention.

Results: Prior to the RIE only 10% of regional anesthesia patients were identified before the day of surgery as regional anesthetic candidates and provided with preoperative regional anesthesia information. Over 50% of case delays were caused by the administration of regional anesthesia, resulting in surgeon dissatisfaction. Less than 15% of the ambulatory surgery patients receiving regional anesthesia had postdischarge follow-up. At 30 and 60 days following the implementation of a standardized regional anesthesia team/process, surgical delays due to regional anesthesia were eliminated. Seventy-five percent of regional anesthesia patients were identified before the day of surgery and received regional anesthesia education. Additionally, the process has afforded greater time to train both SRNAs and staff CRNAs in regional anesthetic techniques.

Conclusions: Utilization of the JKPS process was useful in identifying inefficiencies in the regional anesthesia process, implementation and sustainment of a new and more efficient process, and examining the effectiveness of the intervention. This process resulted in improved operating room efficiencies.

Management of Patients With Hereditary Hemorrhagic Telangiectasia Undergoing General Anesthesia: A Cohort From a Single Academic Center's Experience

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Introduction: Hereditary hemorrhagic telangiectasia is a rare autosomal dominant disease characterized by capillary malformation leading to multisite cutaneomucosal telangiectasias and multiorgan arteriovenous malformations can present challenges to anesthetic care.

Methods: This was a retrospective observational study. A computerized search from January 1, 2002 through December 31, 2011 of the Mayo Clinic medical records database was performed for patients with hereditary hemorrhagic telangiectasia who underwent general anesthesia. Medical records were reviewed for patients with definite or suspected hereditary hemorrhagic telangiectasia based on the Curacao diagnostic criteria who underwent general anesthesia during the study period.

Results: We identified 74 patients with hereditary hemorrhagic telangiectasia who underwent 163 surgeries. The majority had pulmonary arteriovenous malformations (56.7%), iron deficiency anemia (64.7%), and high levels of disease burden with a median American Society of Anesthesiologist Physical Status score of 3. Most surgeries were related to treating conditions associated with hereditary hemorrhagic telangiectasia, with the majority being procedures to the nasal mucosa for recurrent epistaxis (47.2%). A sizeable proportion of procedures to the nasal mucosa required transfusion of blood (12/77). One case of epistaxis required 11 units of blood until it was successfully controlled. Another notable complication included migration of a coil to a pulmonary arteriovenous malformation into the cerebral circulation.

Conclusions: Surgical patients with hereditary hemorrhagic telangiectasia often present with multiorgan involvement. The anesthesia provider needs to be aware of the high prevalence of pulmonary arteriovenous malformations, which may be asymptomatic but can lead to embolic complications. Hemorrhage from epistaxis can be severe and relatively focal procedures to the nasal mucosa can require blood transfusions.

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Postoperative Nausea and Vomiting Prophylaxis: Efficacy Without a Protocol

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Introduction: Postoperative nausea and vomiting (PONV) is ranked highly as an undesirable postsurgical outcome. With increased awareness and education, one would expect that PONV prophylactic recommendations to be engrained into practice by now. The goal of this retrospective chart review was to estimate the incidence of PONV at a large urban hospital that lacked a protocol and determine whether or not the patients were appropriately treated. The findings would help to determine whether or not a risk factor based protocol may improve the efficacy and reduce the cost of prophylactic PONV treatment.

Methods: During a 7-month period, a retrospective chart review was conducted to determine if patients were adequately treated according to the well-known Apfel risk scoring system. The randomized study group included adult patients, ASA I to IV, undergoing laparoscopic procedures. A total of 225 patients who underwent a laparoscopic procedure had their risk factor score determined and compared with how many antiemetic prophylactics they received perioperatively. They were then deemed as being adequately treated, overtreated, or undertreated. Descriptive statistics were used to present the results.

Results: Overall, there was a 14.7% incidence of PONV. Apfel risk score (RS) distribution (and PONV incidence) was 4% (0%) for RS 1, 35.1% (11.4%) for RS 2, 56% (16.7%) for RS 3, and 4.9% (27.3%) for RS 4. One hundred percent of the patients in the RS 1 group were overtreated, and 81.2% in the RS 4 group were undertreated. Classification of PONV prophylaxis (and PONV incidence) within the sample was: 28.0% undertreated (19.0%), 40.4% adequately treated (12.1%), and 31.6% overtreated (14.1%). Proportion of laparoscopic surgery type (and PONV incidence) was: bariatric 16.0% (38.9%), gynecological 32.0% (6.9%), and general 51.6% (12.1%).

Conclusions: These data show that despite adequate and overtreatment, PONV still occurs. The incidence of PONV for this high risk set of laparoscopic patients is on the lower end of reported literature; therefore, sufficient awareness and education of PONV prophylaxis appears likely at this institution. While the PONV incidence in the undertreated group can be improved upon, a protocol is not recommended to be placed into practice for all surgical patients. Instead, an inservice to present findings, current literature, and discuss solutions to PONV prophylaxis in bariatric patients is warranted.

Postsurgical Complications in Patients With Polycythemia Vera

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Introduction: Polycythemia vera (PV) is a myeloproliferative disorder (MPD) characterized by extramedullary hematopoiesis, granulocytosis, and megakaryocytosis. PV patients face an increased rate of life-time thromboembolic and hemorrhagic events. However, PV patients' increased perioperative risks are not well known. Ropper et al (2009). reported that stroke and transient ischemic attacks are complications of PV. Ruggeri et al's study (2009) showed 188/245 patients with chronic MPD had an increased postoperative risk of thrombotic and bleeding episodes. Xin et al (2009) found that of the 71 patients studied, thrombosis and embolism occurred in 34, hemorrhage in 10, and splenomegaly in 44 patients.

Methods: A retrospective chart review at the Mayo Clinic was conducted. Patients' records were reviewed for perioperative thromboembolic and hemorrhagic events occurring between 6/1/2006 and 5/31/2012. The Mayo Clinic database found a total of 4,463 patients diagnosed with potential PV. Confirmed PV patients who underwent local or general anesthesia were isolated. A total of 47 surgeries requiring anesthesia for PV patients were identified. The 47 surgical events received in-depth chart review, with special attention to perioperative and 30-day postprocedural complications, demographic, epidemiologic, preexisting comorbidities, anesthetic management, and surgical procedure information.

Results: Forty patients underwent 47 surgeries. Eleven and 5 patients had experienced previous thromboembolic (23%) and hemorrhagic events (11%), respectively. At time of surgery 18 patients were anemic (38%), 5 polycythemic (11%), 7 thrombocytopenic (15%), and 4 thrombocythemic (8.5%). The most commonly performed surgery was splenectomy (12 = 25.5%). The only patient who experienced thrombotic event was 89-year-old female who underwent surgery for bowel ischemia from mesenteric venous thrombosis and experienced postoperative pulmonary emboli and deep vein thromboses. Blood product transfusions were required for 17 surgeries (36%); however, in most cases, transfusions could be expected based on the surgery and/or patient characteristics. Exceptions included a patient who required platelet transfusions for a postoperative hemorrhage post neck dissection.

Conclusions: Thromboembolic events are frequent in PV patients. Only 1 event was noted in this cohort, probably due to existing hypercoagulable state. Blood product transfusions were frequent in this cohort but could be anticipated. Comparative studies of PV patients and controls are needed to determine if PV patients are at increased risk of perioperative complications.

Source of Funding: College of Medicine, Mayo Clinic, Department of Anesthesiology.

Relationship of the Intravenous Anesthetic Induction Agent Etomidate and ATP Release From Cardiac Myoblasts

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Introduction: Adenosine triphosphate (ATP) is an energy source utilized by cardiac muscle cells. ATP also is a chemical mediator that acts extracellularly as a vasodilator by binding to P2Y receptors on vascular endothelial cells, causing release of nitric oxide. When tissues become hypoxic they release mediators such as ATP, causing vasodilation at the arteriole level, leading to increased perfusion to the tissues. The induction agent etomidate has little or no effect on myocardial metabolism or cardiac output, suggesting that it would have little or no effect on ATP release from myocardial cells.

Methods: Myoblasts, embryonic progenitor cells that give rise to cardiac myocytes, species *rattus norvegicus*, were obtained through American Type Culture Collection bioresource center. The myoblasts were subcultured and exposed to a calculated dose of etomidate, to equal plasma concentrations of an induction dose, alongside nontreated control groups. Extracellular ATP concentrations were determined by the Adenosine 5'-triphosphate (ATP) Bioluminescent Assay Kit. When ATP is the limiting reagent, light emitted is proportional to ATP present. The light reading was then further extrapolated to indicate the amount of ATP released from the myoblasts.

Results: There was no statistical significant difference in the amount of ATP release from cardiac myoblasts after exposure to etomidate when compared with the control groups ($p=0.6112$) using 1ne-way analysis of variance. There was no statistical significance when groups were compared with each other ($p>0.05$) using the Tukey's multiple comparison post-hoc test.

Conclusions: The expected results were to have significantly less ATP release in the cardiac myoblasts exposed to etomidate, demonstrating that a decrease in vasodilation is required to maintain adequate perfusion. The results imply that there is no significant relationship between exposure to etomidate and ATP release from cardiac myoblasts when compared with the controls. However, this study could be modified in the future to study ATP as it relates to cardiac perfusion.

Risk Factors Associated with Arterial Catheter Cannulation Resulting in Severe Vascular Complication

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Introduction: Arterial cannulation provides hemodynamic information that aides anesthesia practitioners in precise treatment during critical periods of care, but the benefit of the provided information does not come without risk. Emboli from proximal site cannulation, excessive trauma, prolonged shock or vascular disease have previously been identified as contributing factors to the onset of tissue necrosis and vascular damage. Due to conflicting reports provided by prior research, a need for a large-scale investigation into the occurrence of risk factors associated with arterial line cannulation was identified.

Methods: A smaller arterial cannulation risk factors study found the incidence of abnormal radial arterial flow was not related to duration of cannulation or to the size or material of the cannula. Hematoma and female gender significantly increased incidence of abnormal radial flow. A retrospective comparison of 4,392 patients with arterial catheters found the most common complication was vascular insufficiency, bleeding and infection. A separate prospective study found axillary catheters had a lower rate of obstruction, ischemia, and thrombosis than radial catheters. Risk factors were use of vasopressors, prior artery injury, >48 to 72 hours cannulation, female, hematoma, DIC, and reduced cardiac output.

Results: The goal of this study was to clearly identify the occurrence of vascular complications associated with arterial cannulation. Patients requiring arterial line placement in the operating room, with documentation available in the academic center's Charts+ data system between 2004 and 2011, were included in this retrospective study. Data collection began at the time of arterial line insertion and ended 30 days postplacement. A total of 76,844 patients were included in the research population. From this large population a diagnosis of vascular insult resulting from arterial cannulation was confirmed in 28 (.036 %) of the 76,844 arterial lines placed in the operating suite. Data evaluation revealed vascular compromise occurred in 19 radial (.025 %), 4 brachial (.005%), and 5 femoral (.007%) arterial lines.

Conclusions: Study findings indicate that placement of an arterial line is a relatively safe practice, and the benefits of use in the operating room appear to outweigh the low risk that may occur from placement. Knowledge of risk factor occurrence may heighten awareness of the need to take preventive measures to alleviate arterial line cannulation vascular damage.

Source of Funding: Research support was provided by the College of Medicine Mayo Clinic's Department of Anesthesiology, Rochester, Minnesota. The Mayo Center for Translational Scientific Activity was used for basic statistical analysis.

Sticky Situation: Best Practice to Secure Endotracheal Tubes in the Operating Room

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Introduction: Endotracheal tube placement and securement is an essential skill for anesthesia providers. A paucity of data exists regarding the ideal method of securing endotracheal tubes in the surgical setting to prevent dislodgment or unintentional extubation.

Methods: This study examined the extubation force required to dislodge an endotracheal tube in an intubating mannequin in supine, lateral, and prone positions using 4 varieties of tape and 3 taping techniques. A digital force meter was fastened to the distal end of the endotracheal tube, and manual force was applied either vertically or laterally while a fiberoptic bronchoscope was used to visualize tube dislodgement out of the trachea. Five trials were conducted for each position, tape type, tape method, and direction of force (n=540).

Results: Tape type ($p < 0.0001$) and taping method ($p < 0.0001$) were both determined to be statistically significant. 3M™ Durapore™ resisted extubation force the most (100.27 ± 23.38 N), followed by Kendall™ Curity™ (67.87 ± 13.04 N), Hy-Tape® (57.15 ± 11.71 N), and 3M™ Transpore™ (35.44 ± 8.30 N). Taping the endotracheal tube to both the mandibular and maxillary borders resisted extubation force the most (76.25 ± 32.09 N) of all 3 taping methods tested. Using this taping technique along with 3M™ Durapore™ tape provided the most protection against extubation force (mean 122.704 N).

Conclusions: Choice of tape and taping method can provide effective resistance to forces capable of dislodging a secure airway. The best practice was the use of 3M™ Durapore™ tape and securing the endotracheal tube to both the mandibular and maxillary borders, providing improved resistance to extubation force.

Summary of Patients Receiving Naloxone Within 48 Hours of Extubation From General Anesthesia

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Introduction: Little is known regarding the characteristics of patients who experience postoperative oversedation from opioid medications. Patients transferred from the PACU to non-ICU inpatient beds indicate that these patients are stable and felt to be at a low risk for adverse events during the postoperative period. However, some patients still decompensate in the postoperative ward following PACU discharge. Weingarten's 2012 study identified that a substantial proportion of postoperative code events required administration of naloxone for respiratory depression, and the majority of those patients were prescribed opioid medication preoperatively.

Methods: The medical records of patients who were administered naloxone within 48 hours following discharge from anesthetic care following general anesthesia at our institution, between December 1, 2007 and December 31, 2010, underwent an in-depth retrospective chart review. Demographic, preoperative, surgical, anesthesia care and postoperative variables were identified and described.

Results: During the study period, 135 patients experienced postoperative oversedation from opioid medications. Patients had a mean age of 65.5 ± 14.6 years, 56 males, 23 morbid obesity, 17 with obstructive sleep apnea, 16 neurologic disease, and 32 use of opioid medications. Most patients underwent general (40), orthopedic (33), or thoracic (21) surgery. Anesthesia was supplemented with neuroaxial analgesia in 17 cases. Median intravenous morphine equivalents were 39.7 [27.6, 51.0] mg. Phase I recovery was 129 ± 65 minutes. The median time to the administration of naloxone was 8.0 [2.4, 19.7] hours, and 108 (80%) were administered opioids within 2 hours of naloxone administration. The most common indication for naloxone was respiratory depression (70) or mental status changes (58). Twenty-three patients were transferred to the intensive care unit.

Conclusions: Postoperative oversedation does occur. When that occurred, naloxone was typically administered the day of surgery and within 2 hours of opioid medication administration. Naloxone administration could not be directly attributed to serious postoperative morbidity or mortality. The information from this study will be used in a future case control study to determine potential associations of naloxone administration with patient and anesthetic factors.

Source of Funding: Mayo Clinic, Department of Anesthesiology, Rochester, Minnesota.

The Effect of a Nontechnical Skills Intervention on First-Year Student Registered Nurse Anesthetists' (SRNAs) Skills During Crisis Simulation

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Introduction: Simulation-based education provides a safe place for student registered nurse anesthetists (SRNAs) to practice prior to entering the clinical setting. Since 80% of human error is attributed to the anesthetist's lack of nontechnical skills, simulation-based education needs to include a nontechnical component of instruction to enhance patient safety. The purpose of the study was to determine if an educational intervention on nontechnical skills could improve the performance of nontechnical skills during anesthesia crisis simulation with a group of first-year SRNAs. Four categories of nontechnical skills (situation awareness, decision-making, teamwork, and task management) were rated and statistically analyzed the SRNAs simulated crisis performance utilizing the anaesthetist nontechnical skills (ANTS) assessment tool. The ANTS, developed by Fletcher et al in 2002 at the University of Aberdeen, Scotland, identifies the behavioral markers for evaluating anaesthetist nontechnical skills with preestablished reliability and validity (Cronbach's alpha ranged from 0.79 to 0.86, interrater reliability at the categorical level $rwg = 0.55-0.67$).

Methods: A quasi-experimental one-group pretest-posttest design using nonequivalent dependent variables was utilized in this study. Thirty-two SRNAs were videotaped as the principal anesthesia provider for 6 simulated intraoperative crisis events: 3 pretest simulations, an educational intervention 1 week later, and 3 posttest simulations 3 weeks after the pretest. The dependent variables, nontechnical skills, and technical skills were scored utilizing the anaesthetist nontechnical skills system (ANTS) and the key action scoring system by 4 experienced nurse anesthetist educators.

Results: The sample consisted of women (53%), age ($M=32.5$), and years of critical care experience ($M=4.55$). A 1-tail t test revealed the posttest nontechnical skills mean score was greater than pretest scores, $t(31) = 1.99$, $p = .028$. The mean posttest scores ($M = 13.3$, $SD = 1.73$) were higher than the mean scores on the pretest ($M = 12.7$, $SD = 2.12$). The standardized difference in the means, $d = 0.28$, indicated a small effect size. Based on a 1-tail paired-samples t test, $t(30) = 1.81$, $p = .04$, mean gain scores for standardized nontechnical skills were significantly greater than mean gain scores for standardized technical skills. The standardized difference in the means, $d = 0.35$, indicates a medium effect size.

Conclusions: Lack of nontechnical skills is often the cause of human error. Failure to educate and evaluate nontechnical performance can jeopardize patient safety. In this investigation, one 3-hour educational intervention of nontechnical skills can improve the performance of nontechnical skills. The use of ANTS is a valuable tool in the measurement of nontechnical skills assessment of first-year SRNAs.

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The Effect of Propofol on the Release of Adenosine Triphosphate in Rat Cardiac Myoblasts

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Introduction: Extracellular adenosine triphosphate (ATP) is a powerful modulator of physiologic responses on a variety of different cell types. Marked efflux of ATP from cardiac myocytes is documented in response to various stimuli including hypoxia, acidosis, and mechanical stress. The maximally fixed cardiac oxygen extraction limits supply in times of demand to rely on augmented flow and vasodilation. ATP interacts with endothelial cell purinergic receptors causing the release of the vasodilator nitric oxide from the endothelium. The purpose of this study is to explore the effect of 2,6-diisopropylphenol on the release of ATP and subsequent vasodilator effects on coronary vasculature.

Methods: Isolated rat cardiac myoblasts were incubated and subcultured. Control groups consisted of cells in Dulbecco's Modified Eagle's Medium (DMEM), cells in DMEM plus 2,6-diisopropylphenol carrier dimethyl sulfoxide (DMSO), cells in Krebs-Henseleit (KH), and cells in KH with DMSO. Based on clinical doses of 1.5 to 2.5 mg/kg of free drug, the treatment groups included exposure to 2,6-diisopropylphenol concentrations of 11, 22, and 33 mmol/L in DMEM or KH. Both control and treatment groups were selected based on similar generation times and confluence. After exposure to treatment for 15 minutes, soluble luciferin/luciferase reagent and Promega Luminometer were employed to quantify ATP release based on the intensity of light emission. Trypan blue testing was utilized to validate the manual cell counting method and to exclude ATP release from nonviable cells.

Results: Statistical evaluation consisted of 1-way analysis of variance and Tukey's multiple comparison test. There is no statistical significance comparing 2,6-diisopropylphenol treatment groups to the controls ($p=0.4319$). Tukey's multiple comparison test reveals no significance between all groups ($p>0.05$).

Conclusions: Myocardial ischemia is a common perioperative mortality and morbidity factor that necessitates a tailored anesthetic that provides coronary perfusion pressure support in conjunction with a decrease in myocardial oxygen demand. The administration of propofol produces negative inotropic effects and reduction in systemic vascular resistance. A thorough understanding of the mechanism of improved oxygen delivery to the myocardium through coronary vasodilatation can contribute to evidence-based anesthesia practice. Results from the study demonstrate no statistically significant ATP release from cardiac myoblasts treated with 2,6-diisopropylphenol compared with control groups ($p>0.05$). Therefore, ATP mediated coronary vasodilatation through the purinergic receptor activation mechanism cannot be attributed to the hypothesized myoblast source. Further research can focus on ATP release from 2,6-diisopropylphenol treated cardiac myoblasts exposed to chemical or mechanical stress.

The Effects of Intravenous Acetaminophen on Narcotic Use Following Total Knee Arthroplasty

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Introduction: In the United States, more than 73 million surgeries are performed annually; up to 82% of these patients experience postsurgical pain. Unrelieved postoperative pain cannot only cause discomfort and suffering but also physiological and psychological changes that contribute to negative outcomes. A multimodal analgesia approach has been shown to improve the relief of acute postoperative pain with an improvement in compliance of the analgesia regimen. Intravenous (IV) acetaminophen is commonly used alone or as adjuncts to opioid therapy to improve acute postoperative pain relief. The purpose of this study is to determine the effect of IV acetaminophen administered perioperatively on the amount of rescue opioids administered following total knee arthroplasty.

Methods: A retrospective analysis of total narcotic usage for 24 hours postoperatively following total knee arthroplasty at Phelps County Regional Medical Center occurred from January 1, 2012 to March 31, 2013. Patients were divided into the control or experimental groups based on the date of surgery. The control group did not receive IV acetaminophen, while the experimental group received 1 gram IV acetaminophen intraoperatively and every 6 hours postoperatively for 24 hours. Both the control and experimental groups received continuous femoral and sciatic regional blocks or a combined spinal/epidural (CSE). The doses for the continuous femoral and sciatic regional blocks and CSE were identical for both the control and experimental groups. The continuous femoral and sciatic blocks were initiated intraoperatively and each infused 15 cc/hr of 0.5% ropivacaine. The CSE was performed intraoperatively with up to 15 mg bupivacaine administered intrathecally. The epidural was initiated postoperatively and infused 10 cc/hr of 0.2% ropivacaine with a patient-controlled bolus (2 cc per 15 minutes). All neuroaxial and peripheral analgesic infusions were maintained throughout the 24 hours postoperatively. The patient's postoperative narcotic medication usage was totaled, and all narcotics were converted to IV morphine using the GlobalRPH narcotic converter. The converted total narcotic usage was then compared between the control and experimental groups.

Results: Fifty-five control group patients and 44 experimental group patients were included in the study. The demographics were comparable between the groups. The mean total morphine usage for the control group was 24.76 milligrams (sd= 20.65 milligrams). The mean total morphine usage for the experimental group was 28.2 milligrams (sd= 35.44 milligrams). The 24-hour postoperative total narcotic usage was found to have no significant difference between the control and experimental groups ($p=0.571$).

Conclusions: Based on this study, there appears to be no statistically significant difference in the postoperative morphine requirement following total knee arthroplasty between the control group and the experimental group. Patients in the control and experimental groups had similar total narcotic means. In conclusion, in the setting of a multimodal analgesic regimen, intravenous acetaminophen provided no additional benefit to femoral sciatic blocks with spinal anesthesia or combined spinal epidurals.

The Effects of Using the ABCs of Resuscitation Wall Chart System Versus. the Broselow Tape in Determining Proper Dosing of Patients in Resuscitation Distress

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Introduction: Healthcare professionals routinely treat patients in life-threatening situations. It is well documented that faster, accurate delivery of lifesaving interventions can improve survival. The purpose of this study was to determine which resuscitation system is more effective in improving response time, patient care, and outcome.

Methods: A survey questionnaire was distributed to 50 healthcare providers. Physicians, nurses, ARNPs, and first responders were included. Eighty percent of those surveyed had greater than 10 years of experience. Information was collected by asking the respondents to compare their experiences using both systems and to quantify those results and give qualitative information as well. Tabulation of the responses was analyzed.

Results: In the past 12 months, the healthcare providers treated more than 70 pediatric and adult patients requiring a form of resuscitation. Both the ABCs of Resuscitation and the Tape system were used. Almost unanimously, they felt the ABCs of Resuscitation included more precalculated medications and size specific equipment and is unique as it incorporates information for treating patients older than 10; it includes categories for 12, 17, and adult, and reflects weight-based dosing, compared with the Tape system, which ends at 10 years of age. The overdosing or underdosing of patients was reduced when using the ABCs chart. More than 90% found the ABCs of Resuscitation to be more user friendly and easier to read than the Tape system.

Conclusions: Using the ABCs of Resuscitation leads to quicker response time. This improved patient care leads to a higher rate of survival and patient outcome. Rapid response teams highly endorsed the use of the charts and suggested placing them in code carts. The ABCs conforms to the 2010 American Hospital Association and American College of Emergency Physicians Rapid-Sequence Intubation guidelines. Simulated mock codes have reproduced these results, showing that when seconds count, the ABCs can reduce errors and improve patient outcomes. We look forward to the next algorithm of lifesaving criteria.

The Use of Ketamine and Posttraumatic Stress Disorder

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Introduction: Current literature on posttraumatic stress disorder (PTSD) and ketamine use has shown conflicting results. Recent studies suggest ketamine administration may decrease posttraumatic stress disorder severity. Other studies suggest that ketamine increases the incidences of reexperiencing, avoidance, and hyperarousal in the PTSD patient. According to the Diagnostic and Statistical Manual of Mental Disorders (DSM IV), PTSD is classified as an anxiety disorder and, therefore, ketamine is not an absolute contraindication. With current literature conflicting on the safety of ketamine administration in the PTSD population, we surveyed anesthesia providers to determine what they are using as guidance when choosing or excluding ketamine as an anesthetic agent with a PTSD patient. Our goal was to examine current practice of Certified Registered Nurse Anesthetists (CRNAs) regarding ketamine administration to the PTSD population.

Methods: Following IRB approval, the US Department of Veterans Affairs (VA) employed CRNAs were surveyed, based on the high concentration of PTSD-diagnosed patients in the VA system. A 25-item questionnaire was developed by the authors and a sample group of 5 VA CRNAs to ensure the questions were appropriate and answerable, as well as reviewed by doctorally prepared CRNAs for face validity.

Results: The response rate of this survey was 32.3% of the 310 surveys mailed. Reviewing the frequency that CRNAs use ketamine, 37% stated that they seldom use ketamine and 41% state they sometimes use it. Seventy eight percent of VA CRNAs that participated in the study reported that they care for PTSD patients as “often.” A combined 67% of respondents “seldom” or “sometimes” choose to administer ketamine to patients diagnosed with PTSD, whereas 31% state they “often” or “always” avoided administering ketamine to patients with PTSD. Respondents reported that they “always” screen patients for diagnosis of PTSD (54%), and they “often” or “always” used the preoperative assessment to influence their decision to administer ketamine (55%). Of the participants, only 17% utilized screening criteria when administering ketamine to a PTSD patient. Fifty-six percent of CRNAs reported no emergence reactions when ketamine was administered to PTSD patients. Among the 44% remaining, there were scattered responses reporting emergence reactions such as shouting spells.

Conclusions: Current practice does not reflect uniform ketamine administration as it relates to patients suffering from or diagnosed with PTSD. Surveyed results indicate that CRNAs are using personal clinical experiences to dictate the safety of ketamine administration to PTSD patients. Further research needs to be done to conclude whether or not ketamine should be given to PTSD patients.

Ultrasound Guided Intrajugular Central Venous Catheter Placement and the Occurrence of Pneumothorax

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Introduction: Central venous catheter insertion is the most common invasive medical procedure performed annually in the United States. Insertions of these catheters are known to have serious complications including pneumothorax. The purpose of this study is to examine the rate of pneumothorax after placement of central line catheters utilizing ultrasound guidance. Similar studies have been conducted, and results of those studies have shown reduced complication rates during central venous catheter insertion with ultrasound when compared with the traditional anatomic method. This study will add to the body of evidence-based research available to clinicians.

Methods: This retrospective study included 247 patients that underwent internal jugular central venous catheterization with the use of ultrasound between March 2004 and November 2012 at Phelps County Regional Medical Center. All central line placements were performed by the anesthesia department with the use of ultrasound. Only those patients with postprocedural radiographs were included in the study (n=222) to determination of the presence of pneumothorax.

Results: Our study resulted in 100% successful placement of central venous catheters in the internal jugular vein using ultrasound. The occurrence of pneumothorax was 0% (n=0). The occurrence of accidental carotid artery catheterization was also 0% (n=0). No attempts at central venous catheterization using anatomic landmark techniques were performed during the period of this study.

Conclusions: Previous studies have reported the presence of pneumothorax after central venous catheter placement in 0.8 to 1.7% of patients when using an anatomic landmark technique. A complication rate of 1.7% yields an annual pneumothorax rate affecting 40,000 to 85,000 people in the United States. All of the central lines in our study were placed with ultrasound guidance and resulted in zero pneumothorax. These results suggest that ultrasound guidance is the superior technique for successful placement and that its use significantly decreases the occurrence of pneumothorax. It is our hope that this study will add to the body of evidence-based research supporting universal adoption of ultrasound guided central venous catheter placement.

Veinlite: Does it Help or Hinder?

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Introduction: The intravenous route of medication administration is the preferred option for medication delivery by anesthetists in the operative area, providing the most reliable control for dosing and the resulting pharmacodynamic and pharmacokinetic properties of pharmacologic agents. Obtaining intravenous access can often become a difficult task especially in patients with comorbidities such as obesity, dehydration, anemia, drug abusers, dialysis patients, and patients receiving chemotherapy. The purpose of this study is to ascertain whether or not the use of the Veinlite LED assists or hinders vein access by practitioners in patients with veins that are difficult to see.

Methods: After being instructed in the use of the Veinlite LED device, healthcare professionals were asked to assess vein access on a human arm with and without the use of the device. A self-developed survey was then administered, asking the participant's opinion of the device and its usefulness.

Results: Fifty participants, including nursing students, registered nurses, Certified Registered Nurse Anesthetists, and student registered nurse anesthetists, were surveyed after instruction and demonstration on use of Veinlite. Participants' intravenous access experience ranged from 1 to 35 years. Eighty-nine percent (42) of participants agreed that the Veinlite is a useful device in the identification of intravenous cannulation sites. Of the participants, 45% (21) stated the Veinlite actually changed the location of choice of intravenous access of the human arm, and 79% (37) of participants would use the Veinlite in practice if it were available to them. The majority of participants, 68% (32) agreed that the Veinlite was very easy to use, while no participant stated the Veinlite was difficult to use.

Conclusions: Many anesthetists are faced with difficulties obtaining intravenous access due to many factors and different patient comorbidities. According to the results, the Veinlite would be a useful device in assisting to identify venous access sites in these patients. The device was proven to be easy to use, and most people would use the Veinlite if it were available for their use. The Veinlite may be a reasonable alternative to ultrasound and traditional intravenous identification techniques in the operative area.

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A Framework for Evaluating a Digital Pen and Paper Documentation System

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Introduction: Less than 45% of health centers have electronic anesthesia records. Factors named are cost, complexity, quality, and legal. System designers tend to focus on IT issues rather than on human needs. This has led to implementation failures. A conceptual framework was developed to examine any technology in concert with users, task, environment, and stakeholders. A usability study was performed to evaluate a digital pen and paper technology used by CRNAs to perform documentation tasks in a simulated work environment. Afterward, hospital stakeholders participated in interviews regarding this technology.

Literature Review: Yen and Gorman (2005) compared the usability of a digital pen and paper (DPP) system with that of a conventional pen for nursing documentation. Variables studied included the interaction of users, tool, task, and work environment. The nurses ultimately rejected the DPP system due to problems with usability. Participants in a Swiss study by Despont-Gros et al, (2005), found the DPP system to be both usable and useful. Dykes et al (2006) conducted a prospective interventional study regarding the feasibility of the DPP system to capture vital sign data as a bridge to a fully automated system. The DPP system was determined to not be a feasible bridge technology.

Results: CRNAs and stakeholders are concerned about computer records. Six of 7 CRNA users highly rated the DPP system via survey. Comments made during the cognitive walkthrough were not as clear cut. Themes from the audio data were ease of use, perceived usefulness, control of data entry, and reliability. The DPP system was said to be easy to learn, but issues about the dimensions of the pen were verbalized. Perceived usefulness was acceptable until technology-related reliability problems were encountered. The most frequent problem was the conversion from script to text. The ability to control the entry of data by the CRNA was important. Legal issues regarding automatic recording of data was a concern of some. The non-CRNA stakeholders suggested that a DPP system could be a good alternative input device. The stakeholders had concerns with product durability, warranty, and loss.

Conclusions: A feasibility evaluation should focus on how well technology fits with the user, the task, the environment, and the organization's willingness to accept the technology. Theoretical frameworks from the areas of human-technology interaction, usability engineering, and technology adoption are useful foundations. Proposed technology adoption needs to be a collaborative effort starting with product development and proceeding to testing, implementing, and then evaluating the entire technology change process. Both CRNA users and hospital stakeholders were used to evaluate a DPP system as a possible solution for improving implementation rates of electronic anesthesia documentation.

Activated Charcoal Adsorption of Volatile Anesthetic Agents for Anesthesia Machine Preparation for Malignant Hyperthermia Susceptible Patients

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Introduction: Malignant hyperthermia (MH) is a rare anesthesia specific disease that carries a 70% mortality rate if untreated. MH is the result of a genetic mutation of the ryanodine receptor (RyR) in skeletal muscle cells. The RyR regulates intracellular Ca^{+2} . A MH susceptible patient has mutated RyRs and when exposed to triggering agents, hypermetabolism of skeletal muscle cells occurs. Triggering agents are volatile anesthetic agents (VAA) and succinylcholine. Current guidelines for preparing the anesthesia machine to deliver a “clean” anesthetic free of VAAs are outdated. The advent of activated charcoal filters now makes it possible to deliver a “clean” vapor free anesthetic. Activated charcoal filters are easy to use, simply placing them between the breathing circuit and the inspiratory and expiratory limbs of the anesthesia workstation.

Literature Review: A thorough review of the literature was conducted using the Cochrane Library, CINAHL Plus, and MEDLINE databases. The search included all publications from 1985 through 2012. Non-English articles were excluded. Keywords were: malignant hyperthermia, anesthesia, preparation, vapor free, and activated charcoal. The JBI model of evidence-based healthcare was the framework utilized in this project. This framework focuses on evidence generation, evidence synthesis, knowledge transfer, and evidence utilization.

Results: Anesthesia professionals should adopt the new guidelines for preparing the anesthesia machine for MH susceptible patient, which includes activated charcoal filters on both inspiratory and expiratory limbs. The Malignant Hyperthermia Association of the United States (MHAUS) recently updated its guidelines to include the use of activated charcoal filters in preparation of the anesthesia machine for MH susceptible patients. “New” guidelines for preparing the anesthesia machine for the MH susceptible patient include one, not all, of the following: (1) Flush with high FGF according to manufacturer’s recommendation, which can take longer than 90 minutes. Replace breathing circuit, CO₂ absorbent and disconnect vaporizers. Then, continue to deliver a “trigger” free anesthetic with high FGF >10 L/min. (2) Use activated charcoal filters. No other steps necessary. (3) If feasible, use a “vapor free” anesthesia machine that has never been exposed to VAAs. (4) If feasible, use an ICU ventilator that has never been exposed to VAAs. Activated charcoal filters are different than inactivated charcoal filters in that the carbon surface area available to adsorb VAA is 120 times greater in the activated form.

Conclusions: Previous guidelines for preparation of the anesthesia machine for MH susceptible patients have significant shortcomings, namely dealing with residual VAA in the soluble reservoirs of newer machines. Activated charcoal filters mitigate this shortcoming. Regarding the treatment of an MH occurrence, treatment remains the same: dantrolene! No definitive recommendations can be made pointing to the use of activated carbon filters in the treatment of an MH event. The significant and expedient drop in VAA ppm with the use of activated carbon filters, however, suggests their efficacy in treatment during an MH occurrence.

Acute Normovolemic Hemodilution: A Blood Conservation Technique?

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Introduction: Complications associated with allogeneic blood transfusions have led to an interest in autologous blood procurement. Acute normovolemic hemodilution (ANH) removes the patient's blood immediately prior to surgery and replaces it with crystalloid/colloid. This hemodilution allegedly reduces blood loss intraoperatively and enables the restoration of whole blood postoperatively. ANH has been proposed as a safer alternative to transfusion and a means to decrease the frequency of transfusion. The purposes of this review are to evaluate the safety and efficacy of ANH based on current literature.

Literature Review: A literature search was performed using the online databases Ovid MEDLINE and The Cochrane Library. Keywords searched were acute normovolemic hemodilution. Inclusion criteria were the English language, studies published since 2000, randomized controlled trials comparing ANH to allogeneic transfusion, and literature reviews. Studies that were not controlled were excluded. Six randomized control trials and one meta-analysis that met inclusion criteria were selected.

Results: An analysis of the studies shows inconsistencies. One study demonstrated a significant decrease in postoperative infection in the ANH group. Conversely, other trials were not able to show a significant reduction in postoperative complications with ANH. Several did show a decrease in the number of allogeneic transfusions in the ANH group, though not all with statistical significance. Additionally, ANH may be detrimental in surgeries that require strict fluid management. A meta-analysis concluded that the efficacy of ANH is likely to be small. ANH modestly reduced bleeding, and ANH patients received 1 to 2 fewer units of blood. However, studies were unable to consistently show that ANH avoids allogeneic transfusion.

Conclusions: Discrepancies in the literature make it difficult to firmly recommend the practice of ANH. However, the inconsistencies can be attributed to the variability of transfusion triggers, amount of blood withdrawn, blood loss, and procedure. The advantages of ANH do appear to be clinically significant. ANH may reduce both the exposure to allogeneic blood and postoperative complications in a variety of surgeries. The risks associated with ANH also appear to be minimal. Therefore, ANH can be clinically considered as a blood conservation technique, despite the inconclusive research.

Administration of Lidocaine With Venous Occlusion Versus Lidocaine Alone for Attenuation of Propofol-Induced Pain

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Introduction: Diprivan is known to produce pain and discomfort on intravenous (IV) injection. In some rare but severe cases it has been implicated in patients developing bronchospasm and myocardial ischemia from the intense pain. To prevent this pain upon injection lidocaine has been administered alone and with venous occlusion. It is unclear which of these techniques is more effective. The purpose of this paper is to describe the evidence on the effectiveness of lidocaine IV compared with lidocaine IV with venous occlusion in preventing pain with Diprivan.

Literature Review: The databases PubMed, Google scholar, Ovid, and Medline were searched using the keywords from the following PICO statement: In patients undergoing general anesthesia (P), is intravenous lidocaine in conjunction with venous occlusion (I) more effective at preventing Diprivan induced pain (O) compared with intravenous lidocaine without venous occlusion (C)? From this literature search 3 randomized controlled trials (RCTs) were identified and critically appraised.

Results: Each of the 3 RCTs has an average sample size of 137 patients. Each RCT had control groups that gave lidocaine IV before Diprivan administration and treatment groups that gave lidocaine with venous occlusion before Diprivan administration. The results in these 3 RCTs found that the lidocaine with venous occlusion statistically significantly decreased pain on injection compared with the lidocaine group that did not use venous occlusion. These studies also found that lidocaine as an IV bolus without a tourniquet also decreased pain but not as much lidocaine with venous occlusion.

Conclusions: It is recommended from the results of these studies that lidocaine with venous occlusion before the administration of IV Diprivan be used to decrease the pain of injection due to Diprivan. Use of venous occlusion in conjunction with lidocaine bolus is the most successful intervention for the prevention of pain and provides a better anesthesia experience for the patients.

An Algorithm for Perioperative Use of Continuous Subcutaneous Insulin Infusion Pumps

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Introduction: Diabetes mellitus (DM) is a metabolic disorder characterized by hyperglycemia as a consequence of either inadequate insulin production (type I DM) or the inadequate use of insulin by the cells (type II DM).

Currently, there are 26 million Americans with diabetes. It is estimated that 300,000 of those diagnosed with type I DM are using continuous subcutaneous insulin infusion (CSII) as a method to control their blood glucose. CSII is an alternative to traditional daily insulin injections. It has been shown to simulate normal physiologic insulin delivery by mimicking the normal pancreatic secretion of insulin in response to varying glucose levels. Individuals diagnosed with type I DM are more likely to require surgery, and nearly 50% of those diagnosed will undergo surgery during their lifetime. With this expansion in CSII utilization and the increased probability of diabetics requiring surgery, it is more likely healthcare providers will encounter surgical patients managing their diabetes with an insulin pump. The purpose of this project was to develop an algorithm to guide healthcare providers in the planning and management of surgical patients with CSII.

Literature Review: An evidenced-based practice (EBP) model was utilized to answer the question, “In type I DM patients, how does the use of a continuous subcutaneous insulin infusion affect glycemic control during the perioperative period?” An extensive literature review was conducted and an evidence discovery table was created in the area of DM management to include the perioperative implications of CSII use for surgical patients. Expert opinion was obtained from a panel of anesthesia providers and endocrinologists to determine a best practice approach to CSII use in this population.

Results: An algorithm was constructed based on the discussion panel and current recommendations discovered throughout an in-depth literature review. The algorithm was formally presented to the anesthesia department at a large military treatment facility (MTF) as a method to approach the perioperative planning and management of patients with a CSII. Expert opinion resulted in practice recommendations for the use of CSII in the perioperative arena. The algorithm gives providers options for glycemic control to include the use of CSII.

Conclusions: CSII use has increased in the diabetic population and presents unique management challenges in the perioperative arena. Anesthesia providers at one MTF now have an algorithm at their disposal to guide their anesthetic practice when managing patients presenting with CSII. Further research and EBP projects are needed in order to determine the best practice approach for all patients undergoing surgery with CSII in the future.

An Evidence-Based Review of Forced Air Warming Devices and the Risk of Surgical Site Infections

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Introduction: Inadvertent perioperative hypothermia has undesirable consequences including coagulation defects, delayed postanesthetic recovery, and surgical site infections (SSIs). A forced air warmer (FAW) is often used in the OR as this device is efficacious in preventing perioperative hypothermia. There are concerns FAWs increase the risk of surgical site infections because they act as a vector or cause unwanted air flow disturbances. We examined the question: Do forced air warmers devices increase the risk of surgical site infections in general, vascular, or orthopedic surgical cases?

Literature Review: Evidence included systematic reviews with or without meta-analysis, clinical practice guidelines, human clinical studies, and laboratory or simulation studies. The following databases were examined: PubMed, Academic Search Complete, and the Cochrane Collaboration for the period from 1990 to 2012. The following search terms were used alone or and in combination: convection warmer, convection warming, forced air warmer, force air warming, infection, contamination, and complications. Evidence was appraised according to the method proposed by Stetler et al.

Results: Fifteen of 192 possible evidence sources met the inclusion criteria. All the sources suffered serious methodological problems. Only 3 studies followed subjects warmed intraoperatively with FAWs to determine if there was an increased incidence in SSIs. One of these 3 reported an increase in SSIs with the use of an FAW, but there was no randomization, blinding, control of potential confounders, and the effect of history was unknown. Other studies suggested FAWs may harbor bacteria and cause unwanted airflow disturbances. Often these studies were not conducted in a real world setting, and it is not know if the FAW was properly maintained. Many of these studies were funded by a company competing with the FAW manufacturers.

Conclusions: The evidence did not conclusively suggest the use of FAWs increases the risk of surgical site infection. Given the efficacy of these devices in preventing inadvertent perioperative hypothermia, FAWs should continue to be carefully maintained and used per the manufacturer's directions until well-conducted large scale trials examine the issue.

An Evidence-Based Review of the Pharmacokinetics of Epinephrine Administered Via the Intraosseous Route During Cardiac Arrest

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Introduction: Intraosseous (IO) access, enabling the rapid administration of epinephrine during cardiac arrest, is crucial to promoting optimal postresuscitation outcome in patients with poor vascular access. Many sources report IO administered epinephrine is bioequivalent to IV administered epinephrine during cardiac arrest. However, there is a question whether existing evidence supports that assertion.

Literature Review: A keyword-based search strategy was executed using online databases to locate high-level evidence sources to answer the question. The collected evidence was appraised and leveled using the Melynck, Fineout-Overholt method.

Results: The search of the literature revealed 33 potential sources of evidence of which 4 met inclusion criteria. All included evidence sources that were randomized controlled trials using animal models.

Conclusions: There is no definitive evidence supporting bioequivalence between IV and IO administered during cardiac arrest with ongoing CPR. Intravenous epinephrine provides increased and faster appearing serum concentrations than IO administered epinephrine. There is evidence indicating epinephrine given via the sternal IO route during cardiac arrest more closely approaches equivalence with IV administered epinephrine than the tibial IO route. Based on this review, the clinician should use proximal IO infusion sites such as the sternum or humerus whenever possible when administering advanced cardiac life support drugs to rapidly achieve maximal therapeutic plasma concentrations.

Source of Funding: The American Association of Nurse Anesthetists Foundation.

An Evidence-Based Review of the Use of QuikClot Combat Gauze for Hemorrhage Control

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Introduction: Trauma represents a leading cause of morbidity and mortality. Uncontrolled hemorrhage related to the traumatic event is often the major cause of complications and death. Significant blood loss predisposes individuals to hypothermia, coagulopathy, acidosis, infection, and multiple organ failure. These complications result in an increase in morbidity and mortality even after successful resuscitation. Therefore, early control of hemorrhage and rapid hemostasis are essential not only for initial survival but also for optimal recovery. It is of paramount importance for healthcare professionals to find and implement the most effective methods of managing hemorrhage. The use of hemostatic agents may be one of the easiest and most effective methods of treating hemorrhage, preventing complications and death. The PICO question guiding this search for evidence was: Is the hemostatic agent QuikClot Combat Gauze (QCG, Z-Medica Corporation, Wallingford, Connecticut) effective and safe in controlling hemorrhage in trauma patients in the prehospital setting?

Literature Review: The search revealed 103 sources of evidence with 11 meeting the inclusion criteria after removing duplicates. All 8 randomized controlled trials (RCTs) examining QCG used a porcine model. The remaining 3 sources, 1 case series and 2 case reports, involved human subjects. The evidence was appraised by the method proposed by Melynck and Fine-Overholt.

Results: The evidence addressing the effectiveness of QCG is a combination of human and animal research. Each evidence source contained limitations. The human research was low-level evidence with the potential for bias and lacked generalizability. The evidence using animal models investigating QCG were all RCTs, but it falls lower than the human evidence in the evidence hierarchy.

Conclusions: The current evidence appraised for this review did not conclusively demonstrate that QCG is an effective hemostatic agent for use in trauma patients, but the results were promising in supporting QCG. In addition, the evidence did not describe serious side effects, exothermic reaction, and thromboemboli formation associated with other hemostatic agents. Further investigation to determine the effectiveness of hemostatic agents, specifically QCG, in the management of trauma casualties in the prehospital setting is required. These studies are particularly warranted since QCG is recommended by the US military. This should include higher-level human studies such as multicenter prehospital randomized controlled trials. With proper ethical safeguards and procedures, it is possible to conduct these important investigations.

Source of Funding: In 2011, the AANA Foundation awarded Brian T. Gegel, CRNA, a doctoral fellowship to complete his doctoral studies at Texas Wesleyan University and continue his research in hemostatic agents.

An Evidenced-Based Review of Dexmedetomidine Effectiveness on the Prevention of Preoperative Anxiety and Emergence Delirium in Pediatric Patients

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Introduction: Children having surgery are often distressed preoperatively and are also at risk for emergence delirium (ED). The increased incidence in these behaviors compromises the safety of the child and is a concern for anesthesia providers. Interventions such as oral midazolam, parental presence during induction, and intraoperative use of opioids are commonly used to help decrease preoperative anxiety and ED. Dexmedetomidine, an alpha-2-adrenergic agonist with sedative, anxiolytic, and analgesic properties with minimal respiratory depression makes it an alternative to other interventions.

Literature Review: The search strategy consisted of online literature searches using Ovid, PubMed and the Cochrane Database of Systematic Review to locate the highest level evidence available. Included were human randomized clinical trials (2000 to present) comparing oral or mucosal dexmedetomidine to pharmacological and nonpharmacological treatments published in English language peer reviewed journals. Search terms included: children, anesthesia, preoperative anxiety, emergence delirium, agitation, dexmedetomidine, nonpharmacologic interventions, and pharmacologic interventions.

Results: Seven randomized control trials (RCT) level II quality of evidence sources meeting all inclusion criteria were identified. The evidence reviewed revealed mixed results when comparing dexmedetomidine with other pharmacological interventions in regard to preoperative anxiety and ED. No evidence was found comparing dexmedetomidine with nonpharmacological interventions. The evidence did not confirm dexmedetomidine to be superior to other pharmacological interventions in providing sedation and anxiolysis in pediatric patients in the preoperative setting or decreasing risk of ED. Possible clinically relevant side effects were noted. Limitations included small sample sizes and potential problems with instrument validity and reliability.

Conclusions: The varied results of dexmedetomidine effectiveness in reducing preoperative anxiety and ED and the limitations of the evidence confirm the need for further research in its use as a premedication in the pediatric population. Possible areas of focus might include optimal dosing and route and timing of administration with the development of valid and reliable evaluation instruments. Anesthesia providers should consider the pharmacodynamic properties of dexmedetomidine, patient history, and costs when deciding on preventative interventions for preoperative anxiety and ED in the pediatric population.

Anesthetic Implications for Patients with Lambert-Eaton Myasthenic Syndrome

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Introduction: Lambert-Eaton myasthenic syndrome (LEMS) is a rare antibody-mediated autoimmune disorder affecting presynaptic P/Q-type calcium channel of the nicotinic motor endplate resulting in motor weakness. LEMS patients are at increased risk for postoperative respiratory complications (PRC) from generalized weakness and difficulty reversing nondepolarizing muscle relaxants (NDMR). The purpose of this study is to describe a cohort of patients with LEMS undergoing anesthetic care, with a focus on PRC. A computerized search of the Mayo Clinic medical records was performed to identify all patients with LEMS receiving anesthetic care from 1/1/1990 to 12/31/2010, followed by systematic chart review.

Literature Review: Initial review of LEMS literature consisted of assessing the current information available, evaluating the level of merit, and gauging the anesthetic guidance offered by these studies. We continued by using literature to help define inclusion criteria for our study. This included signs and symptoms, pathophysiology, diagnosis criterion, and treatment options. Furthermore, differentiation from other neuromuscular disorders was emphasized during this process. Additional literature review revealed multiple case studies discussing anesthetic management for patients with diagnosed or presumed LEMS.

Results: A total of 37 patients with LEMS underwent 60 procedures. Among these, 43% (16) had autoimmune LEMS while the remaining 57% (21) had a paraneoplastic syndrome. All patients were symptomatic and had detectable antibodies and/or electromyography evidence of LEMS. Of note, 31 procedures were directed toward diagnosis or treatment of lung cancer (52%). Succinylcholine was used in 10 procedures (17%) and NDMR in 18 procedures (30%). Two possible prolonged responses to muscle relaxants were noted: a 56-year-old woman required 5 hours of mechanical ventilation (MV) following the administration of succinylcholine. An 85-year-old man required 4 hours of MV following a single rocuronium administration. Bilevel positive airway pressure ventilation for hypercarbic respiratory failure was required for 2 patients. One patient died 3 days after surgery of complications from lung cancer.

Conclusions: In this cohort, most patients with LEMS underwent anesthetic care without notable respiratory complications; however, complications did occur. This suggests that patients with LEMS continue to be at risk of postoperative respiratory events with contemporary anesthetic management.

Source of Funding: Mayo Clinic, Department of Anesthesiology, Rochester, Minnesota.

Aprepitant: A New Modality for the Prevention of Postoperative Nausea and Vomiting

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Introduction: Postoperative nausea and vomiting (PONV) affects as many as 30% of all surgical patients, and as many as 80% of high-risk patients. It is standard practice to incorporate prevention strategies for PONV into the anesthetic plan. Aprepitant, a selective high-affinity antagonist of the NK1 receptor with a 9- to 13-hour half-life, may be an effective treatment for PONV. This work describes the evidence from the literature of the effectiveness of adding the drug aprepitant to present day antiemetic therapy for PONV in surgical patients.

Literature Review: A literature search was done to answer the PICO question: Does the addition of prepitant to traditional multimodal antiemetic therapy decrease PONV in surgical patients? Five randomized controlled trials (RCTs), 1 prognostic study, and 1 post hoc analysis were critically appraised.

Results: Four RCTs and 1 post hoc analysis comparing the effectiveness of aprepitant to ondansetron found aprepitant had similar efficacy in preventing PONV, and it was more effective in decreasing the incidence of PONV 24 to 48 hours postoperatively compared with ondansetron. One RCT and 1 prognostic study found the preoperative use of aprepitant compared with no preoperative PONV prophylaxis decreased the severity of nausea and episodes of PONV. The prognostic study found the length of hospital stay was significantly shorter with aprepitant. Frequency of use of antiemetic drugs postoperatively was decreased for patients receiving aprepitant preoperatively.

Conclusions: Based on these studies it is recommended that aprepitant be used to treat patients at high risk for PONV, or for whom postoperative vomiting could lead to catastrophic adverse outcomes.

Bleeding Risks With Pradaxa, a New Oral Anticoagulant, and Its Implications in Perioperative Anesthesia

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Introduction: Coumadin has been a major oral anticoagulant on the market since 1954. A new rival to Coumadin, Pradaxa (dabigatran) was approved by the FDA in 2010 to prevent stroke and blood clots in patients with atrial fibrillation. Unlike Coumadin, Pradaxa does not require any monitoring test to assess the extent of anticoagulation. However, there have been reports of various bleeding events with patients using Pradaxa. Pradaxa is an irreversible competitive direct acting thrombin inhibitor which has a shorter half-life, about 14 to 17 hours, and a predictable pharmacodynamics and pharmacokinetics. Clinical trials on patients with atrial fibrillation and acute venous thromboembolism have found Pradaxa to be at least as effective as Coumadin. In order to reduce the risk of epidural hematoma after neuraxial anesthesia, it is imperative for the practitioners to follow the published recommendations. This extensive literature review poster consolidates pharmacokinetics, pharmacodynamics, clinical trials, and case reports to provide anesthesia practitioners with foundational knowledge about risks of bleeding with Pradaxa and its implications in regional anesthesia.

Literature Review: An extensive literature review was conducted to consolidate pharmacokinetics, pharmacodynamics, clinical trials, and case reports regarding Pradaxa. A variety of the resources were used for the literature search including MEDLINE, CINAHL, ASRA, and NIH through Western Carolina University's library. The resources were all published within last 5 years. The search keywords included Pradaxa, dabigatran, bleeding risks, anesthesia, and guidelines.

Results: Anesthesia providers might find it difficult to control bleeding in patients taking Pradaxa. Holding Pradaxa for 49 hours prior to surgery was associated with similar bleeding events with those patients holding their warfarin doses for 114 hours. To reduce bleeding risks with acute cases, dialysis of the patients is recommended by the manufacturing company. Anesthesia providers need to follow up on future phase IV, post marketing, studies and case reports. Current studies and case reports limit the scope of this literature review to reflect the guidelines by American Society of Regional Anesthesia and other healthcare institutes.

Conclusions: Patients older than 74 years taking oral anticoagulant Pradaxa (dabigatran) are at increased risk of extracranial bleeding. Major GI bleeding events have been reported in elderly patients. Additionally, patients with decreased renal function have increased bleeding risks with Pradaxa. Perioperative hematology consults have been recommended for those patients with CrCL <30 mL/min taking Pradaxa.

Cleaning Practices for Laryngoscope Handles: A Call for Formal Standards

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Introduction: Healthcare facilities commonly sterilize laryngoscope blades between uses and place them in sealed packaging. The practice for cleaning and disinfecting laryngoscope handles varies between facilities.

Laryngoscope handles usually do not make direct contact with oral mucosa during laryngoscopy, and they are frequently not considered to require a high level of disinfection between uses. Laryngoscope blades make contact with handles after laryngoscopy, potentially cross-contaminating handles. CRNAs have a duty to limit the risk of infection to patients, other healthcare providers, and themselves.

Literature Review: Call and colleagues were tested for bacteria on laryngoscope handles between cases. Seventy-five percent of handles were positive for bacteria. Machan discussed inconsistency in decontamination practices. She also discussed use of disposable blades. Opinions are varied about their effectiveness and safety. Most common organisms include enterococci, *Staphylococcus aureus*, *Bacillus* species, and coagulase-negative staphylococci. No gram-negative rods or bacilli, methicillin-resistant *Staphylococcus aureus*, or vancomycin-resistant enterococci were cultured from handles.

Results: There should be standard protocol for cleaning or disinfecting laryngoscope handles. Organizations have differing classifications of the risk laryngoscope handles pose in transmitting disease: semi- or noncritical. Agreement among healthcare organizations on risk classification is key in creating a national standard. Special equipment, such as disposable blades and handles or plastic sheaths, can reduce cross-contamination. Changes in equipment design can reduce transmission, such as handles with silver ions and smooth handle surfaces. Cost-effectiveness will be the ultimate factor that guides disinfection practices of handles. Providers should change gloves immediately after laryngoscopy and avoid touching surfaces with contaminated gloves.

Conclusions: It appears that thorough disinfection of laryngoscope handles between each use would be beneficial in eliminating potentially pathogenic organisms. If an anesthetist is not certain that a handle has been properly cleaned, he or she should remove it from use until it has been disinfected according to protocol. Further research is warranted, as currently published studies focus on either laryngoscope blades or the state of the laryngoscope handle prior to disinfection. Data should be obtained to determine the efficacy of various disinfection techniques.

Comparison of Nerve Stimulation Versus Ultrasound-Guided Peripheral Block Placement

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Introduction: Ultrasound-guided technology is transforming the practice of regional anesthesia. Despite its growth in popularity, it is imperative to question whether ultrasound-guided techniques are superior to traditional methods of peripheral block placement such as nerve stimulation. The purpose of this review of current literature is identification and implementation of a superior method to increase efficiency of the practitioner, efficacy of the block, and patient outcomes.

Literature Review: The authors systematically searched the electronic databases MEDLINE and CINAHL for articles published between 2008 and 2013. The authors placed emphasis on selecting randomized controlled trials (RCT) and review articles that focused on RCT. Studies pertaining to techniques other than peripheral nerve blockade and those from nonmedical journals were excluded. Novel applications unique to the use of ultrasound guidance (UG) for the placement of peripheral blocks were identified.

Results: The majority of research did not show statistically significant differences in success rates between UG and nerve stimulation approaches for peripheral nerve blockade. The similarity in success rates is likely due to the high success rate of both methods. However, the benefits of UG include decreased performance time, block onset time, number of needle insertions, and amount of local anesthetic used for the block. There are 3 distinct advantages for the use of the UG technique. These advantages are the placement of transversus abdominis plane blocks with a decreased incidence of internal gastric organ puncture, placement of rescue blocks with 2 mL or 3 mL of local anesthetic, and blockade of purely sensory nerves.

Conclusions: Based upon the literature review conducted for this study, no recommendation may be made as to the superiority of nerve stimulator vs ultrasound-guided technique in performing regional anesthesia. Due to the similar success rates between the 2 techniques, it is unlikely that nerve stimulation will become obsolete. It is recommended that the anesthesia practitioner use the method with which they are most proficient. However, ultrasound technology knowledge is an important skill for anesthesia practitioners to possess. The unique advantages of UG will lead to an increase in use among contemporary anesthesia practitioners in the future.

Concomitant Use of 5-HT Antagonists in Surgical Patients Receiving SSRI Therapy

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Introduction: The most common treatment for patients with major depressive disorders (MDD) is the second-generation selective serotonin reuptake inhibitors (SSRIs) drugs. Postoperative nausea and vomiting (PONV) affects between 20% and 30% of surgical patients receiving general anesthesia. The 5-HT₃ receptor antagonist drugs are the most common drugs used to treat and prevent PONV. The SSRI and 5-HT₃ antagonist drugs have been studied separately since the Food and Drug Administration (FDA) approved them in the mid-1980s. The interaction of these 2 classes of drugs when administered together is unclear. The purpose of this poster is to present the evidence on the incidence of PONV in patients who are taking SSRI drugs and given 5-HT₃ antagonist drugs during anesthesia.

Literature Review: The literature databases Cochrane Collaboration, CINAHL, PubMed, Embase, National Guideline Clearing House, and Google Scholar were searched to identify evidence to answer the following question: Do 5-HT₃ antagonist drugs such as ondansetron, (I) given to surgical patients who are concurrently taking SSRI drugs (P) increase the incidence of PONV (O) compared with patients who do not take SSRIs (C)? This literature search identified no randomized clinical trials (RCTs) assessing the concomitant use of SSRI and 5-HT₃ antagonists. Nonclinical trials and case reports were identified and critically appraised.

Results: Twelve nonclinical, quazi-experimental studies on rats found an increase in the incidence of nausea and vomiting behaviors associated with the use of SSRI and 5-HT₃ drugs concomitantly when compared with rats not receiving SSRI drugs. Three case reports of clinical case studies on the use of 5-HT₃ drugs with patients on SSRI drugs observed PONV in the perioperative period. The case reports illustrated that an increased amount of 5-HT₃ drug was required to treat patient symptoms of nausea and vomiting.

Conclusions: Twelve animal studies found that PONV behavior increases with the concomitant use of SSRI and 5-HT₃ drugs. Three case reports observed PONV in patients on SSRIs treated with 5-HT₃ antagonist drugs. From these observational and animal studies it is recommended that 5-HT₃ drugs be used cautiously with patients who are taking SSSRA drugs. Human RCTs are needed for conclusive evidence on the concomitant use of SSRI and 5HT₃ antagonist drugs.

Consciousness Monitoring for Anesthesia Practice: A Review of the Latest Research

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Introduction: Consciousness monitoring devices were introduced into anesthesia practice beginning in the early 1990s. Extensive research has been performed on these products throughout their inception, but the opinions of anesthesia providers still remains widely variable concerning the accuracy, usefulness, and effectiveness of this technology. This variation in anesthesia providers' adaptation prompted this continuing education module, which will discuss the history and science behind the most commonly used consciousness monitoring devices and delve into the most current research regarding this topic.

Literature Review: Research articles and product manufacturer information from 1994 to the present were used for the history and technology sections, while only scientific, peer-reviewed articles published after 2009 were utilized for the latest research sections of the article. The outcome-based articles were then summarized and divided into 2 categories: those demonstrating benefits of utilizing consciousness monitoring or those demonstrating either no benefit or inconclusive results.

Results: Consciousness monitoring devices are continuing to be studied in order to determine their effectiveness for a variety of surgical circumstances. Some studies show that the benefits include decreased amount of anesthetic pharmacologic usage, shortened recovery times, reduced postoperative complications, and accurate determination of appropriate intubation readiness. Other studies conclude that these monitors do not result in a reduction of intraoperative cost, risk of surgical awareness, and accurate determination of anesthetic depth.

Conclusions: For as many studies that demonstrate positive outcomes, there are equally as many studies showing no difference in outcomes or even negative outcomes regarding the use of BIS and Entropy. Providers need to be familiar with the latest research in order to utilize these monitors for the appropriate patient in the setting that benefits have been demonstrated. Therefore, the utilization of these monitors should be as an adjunct to other anesthesia monitors.

Deliberate Hypothermia in the Neurosurgical Patient

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Introduction: Milano, Antibas and Prado purport that intraoperative hypothermia may be used by anesthesia providers with the objective of improving clinical outcomes. Mild hypothermia (1-4°C below normothermia) has been proven to provide dramatic protection against focal and global ischemia; therefore, it is frequently indicated during neurosurgery. The purpose of this paper is to describe the evidence related to the effectiveness of mild intraoperative hypothermia compared with normothermia on postoperative mortality and neurological outcomes in the neurosurgical patient. The PICOT (population, intervention, comparison, outcome, time) format was used to search the literature.

Literature Review: The following PICOT statement was used to conduct a review of the literature: In the adult neurosurgical patient (P) are neurological outcome and mortality rates improved (O) with intraoperative deliberate hypothermia (I) compared with neurosurgical patients who are maintained normothermic intraoperatively (C)? The databases PubMed/MEDLINE, Ovid/MEDLINE, PsycINFO, CINAHL, and the Cochrane Database of Systematic Reviews were searched for evidence to answer the PICOT question. The keywords used included neurosurgery, anesthesia, hypothermia and deliberate hypothermia.

Results: A search of 5 literature databases and critical appraisal resulted in 3 randomized controlled studies (Level II) and 2 systematic reviews (Level I) that addressed the topic. Hindman et al (1999) found that there were no statistically significant differences between the hypothermic and normothermic patients as measured by neurologic outcome and mortality. Todd et al (2002) showed that there was no significant difference in mortality (6% in both groups) or neurological outcome as measured by the Glasgow outcome score (GOS) (66% versus 63% for the hypothermic and normothermic groups, respectively). Milani, Anibas and Prado (2011) conducted a systematic review and found the results were statistically insignificant for mortality ($p=0.47$) and neurological outcome ($p=0.09$). A systematic review performed by Zhao, Wu, and He (2012) found that mild hypothermia does not improve mortality rates (pooled OR 0.98; 95% CI 0.60-1.58; $p=0.47$) or neurological outcome (pooled OR 1.26; 95% CI 0.91-1.74; $p=0.09$) in neurosurgical patients.

Conclusions: There is insufficient evidence to support the routine practice of hypothermia for cerebral protection during brain surgery. The evidence supports the use of normothermia in providing optimal results as measured by mortality rates and neurological status. There are no identified risks or burdens involved with normothermic methods; whereas certain patient populations are at risk for exacerbation of their disease states with hypothermic measures.

Dexmedetomidine: A Potential Prophylactic Treatment Modality for Emergence Delirium Among Combat Veterans

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Introduction: Emergence delirium (ED) is a postoperative phenomenon that puts patients at risk of both physical and psychological harm. Combat veterans have emerged as a vulnerable population, as the incidence of ED is 20% following general anesthesia. Dexmedetomidine, an α -2 agonist, has been successfully used to attenuate ED in the pediatric population. The purpose of this in-depth literature review was to describe ED as it occurs among combat veterans and to identify the associated risk factors. In addition, the goal was to discover the plausibility of perioperative dexmedetomidine use as a potential prophylactic treatment for ED in the combat veteran population.

Literature Review: A literature review was conducted using Cumulative Index to Nursing and Allied Health Literature (CINAHL) and PubMed databases. The search was confined to the last 10 years with the terms dexmedetomidine and anxiety. The medical subject headings (MeSH) terms used were: delirium, anesthesia, recovery, postoperative complications, anesthesia surgical patients, combat veteran, and opioids. Boolean connectors were used to assist in searching the topic within each database, emergence AND delirium AND dexmedetomidine AND opioids AND combat veterans.

Results: Past research of ED has primarily focused on the pediatric and geriatric populations. Little was found using combat veterans as the population of interest. Combat veterans are being diagnosed with psychological disorders at a higher rate than the general adult population. Risk factors such as preoperative anxiety, depression, and posttraumatic stress disorder (PTSD) increase the risk of ED among combat veterans. Similar risk factors in the pediatric/geriatric populations were found and have created a parallel set of risk factors between groups. Dexmedetomidine decreases the incidence of ED in children but has not been well studied in adults, specifically combat veterans.

Conclusions: Given the fact that military members are returning from war and are being diagnosed with psychological disorders at an alarming rate, it is probable that the incidence of ED in this population will continue to rise. Research has identified a role for dexmedetomidine in the prevention of ED among children. These studies provide the scientific basis for the pursuit to discover if dexmedetomidine is a safe and effective prophylactic treatment for ED in the adult combat veteran population. A prospective, experimentally designed research study is required in order to investigate the knowledge gap. Future research should also aim to develop a reliable diagnostic instrument for ED to be used in the adult population.

Doing It Right: Alveolar Recruitment Maneuvers--A Proposed Continuing Education Study Module

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Introduction: Atelectasis is associated with many postoperative complications. Perioperative atelectasis can be minimized or reversed by performing alveolar recruitment maneuvers (ARMs). Knowledge deficits among anesthesia providers may limit the use of ARMs thereby limiting the therapeutic effects of this intervention. An improved understanding of the pathophysiology of atelectasis and the ability to mitigate these changes through ARMs and other adjunctive interventions will enable anesthesia providers to help prevent the complications associated with perioperative atelectasis.

Literature Review: A systematic review regarding the postoperative effects of atelectasis, factors that lead to higher risk of perioperative atelectasis, interventions that may prevent perioperative atelectasis, and benefits of different methods of performing ARMs was completed. The efficacy of different techniques for performing ARMs was contrasted based on a variety of parameters.

Results: Appropriate use of ARMs has been shown to decrease intraoperative atelectasis. ARMs performed immediately after induction with the addition of PEEP can reverse the atelectasis produced during the induction process. Repeating ARMs intraoperatively may be indicated to treat atelectasis caused by changes in positioning, ventilatory modes, and ventilation. Although the relationship between atelectasis and postoperative complications has been established, there was no conclusive evidence showing that reducing atelectasis intraoperatively has lasting postoperative benefits.

Conclusions: The literature supports the effects of ARMs on reducing intraoperative atelectasis; however, inconsistencies in ARM technique, PACU care, and respiratory care through the hospital stay may skew existing data regarding the efficacy of intraoperative ARMs in reducing postoperative pulmonary complications. Knowing the pathophysiologic sequelae of atelectasis and understanding the higher risks of atelectasis in specific surgical populations gives anesthesia providers the opportunity to attenuate its effects and positively impact patient outcomes through the timely performance of ARMs.

Evidence on the Effectiveness of Intraoperative Transfusion During Spinal Surgery

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Introduction: Spinal surgeries are associated with large intraoperative blood loss during the perioperative period. The standard practice has been to maintain a blood hemoglobin (Hgb) level greater than 10 g/dL with an emphasis on intraoperative transfusion. However, emerging guidelines suggest transfusions begin at lower Hgb levels of 7 g/dL. It is unclear whether maintaining higher intraoperative Hgb levels with intraoperative transfusion is more effective in preventing adverse outcomes such as surgical site infections (SSI), late ambulation and increased hospital length of stay (LOS) in spinal surgery patients compared with postoperative transfusion.

Literature Review: The purpose of this work is to describe the evidence on the effectiveness of early intraoperative blood transfusion on patient outcomes postoperatively. Keywords from the following PICO statement were used to search 5 literature databases: Do spinal surgery patients with a hemoglobin less than 10 g/dL (P) who are transfused intraoperatively (I) compared with patients transfused postoperatively (C) have better outcomes as measured by SSI, ambulation, and LOS (O)?

Results: Two studies found that postoperative transfusions lead to increased SSI, increased hospital LOS, and delayed ambulation. There was no statistically significant difference in mortality between early and late transfusions. One randomized prospective study of 57 spinal surgery patients found that patients transfused intraoperatively had earlier ambulation. There was no statistically significant difference in SSI, LOS, patient satisfaction, and nutritional status between groups. A retrospective study of 300 consecutive spinal surgery patients with more than 2 units of blood loss found that postoperative Hgb less than 8 g/dL were 6 times more likely to develop SSI and had increased LOS.

Conclusions: These studies found that late postoperative transfusions rather than intraoperative transfusions in this patient population lead to an increased risk of SSI, increased hospital LOS, and delayed ambulation. From these studies it is recommended that spinal surgery patients with Hgb < 8 g/dL be transfused intraoperatively to prevent SSIs and to allow for earlier hospital discharge.

Front-Loading an Integrated Nurse Anesthesia Program

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Introduction: The University of Michigan-Flint/Hurley Medical Center Anesthesia Program has successfully educated students in a fully integrated curriculum since 1982 and at the master's level since 1991. Over the years, however, increasing production pressure in the operating room has made entry into clinical areas increasingly challenging. To address this challenge, educators and students were surveyed to identify areas for change. Input from anesthesia professionals in a variety of settings was sought to identify suggestions to ease the transition.

Literature Review: While the Council on Accreditation of Nurse Anesthesia Educational Programs sets minimum admission requirements for nurse anesthesia programs, it does not dictate program structure. The available information shows no significant difference in mean passing rates on the National Certification Examination based on front-loaded versus integrated program structure. The NBCRNA reports no statistical difference in student performance on the Self-Evaluation Examination based on program structure.

Results: Anecdotal evidence suggests that students from front-loaded programs might have an advantage upon entry into the clinical area. Because of production pressure in the operating rooms, students and faculty desired students to have increased knowledge and better technical skills upon clinical entry. In fall 2012, UMF/HMC introduced a 4-week, preclinical period of intensive simulation and pharmacology training for new students. First-year students entered the clinical arena with significantly improved knowledge and technical skills. This experience led to the development of a preparatory website designed to harness the enthusiasm of incoming students and enhance their readiness for transition into the program and the clinical area.

Conclusions: The 4-week period of intensive simulation and pharmacology instruction had a positive effect on clinical entry for students and clinical faculty. Students reported less anxiety upon entering clinical areas, and clinical faculty noted a marked improvement in first-year student preparation, knowledge, and clinical performance compared with students in previous cohorts. The same student cohort endorsed the implementation of a preparatory website designed to reinforce foundational math and science levels of future students during the interim months between program acceptance and the program's start date.

Hyperoxemia and the Incidence of Surgical Site Infections in Patients Undergoing Colorectal Surgery

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Introduction: The purpose of this inquiry is to examine the benefits that higher perioperative fraction of inspired oxygen (FiO₂) levels have on the incidence of surgical site infections (SSIs) in patients undergoing colorectal surgery. Colorectal surgery is a “clean-contaminated” procedure in which a surgical wound is exposed to a significant bacterial load. The leukocyte killing rate can be substantially impaired when leukocytes are placed in a low oxygen environment, such as that often found in wound tissue, where the local microvascular supply is disrupted by surgical trauma, thrombosis, or edema. Clearly, oxygen plays a major role in surgical site healing, as well as the infectious process. Therefore, anesthesia providers play an important role in surgical outcomes, as they influence the administration of oxygen during the perioperative period.

Literature Review: An electronic keyword search of the terms: colorectal, surgical, infection, oxygen, and anesthesia were performed using MEDLINE, PubMed, and CINAHL. The search yielded several studies comparing the incidences of surgical site infections in patients undergoing colorectal surgery, receiving either 0.3 FiO₂, or 0.8 FiO₂; 6 were included. ASEPSIS, a seminal scoring tool created in 1986 for assessing surgical site infections, was included because it was referenced in 4 of the 6 included studies; corroborating that SSIs have been a long-standing clinical query.

Results: Three RCTs researched the outcomes of either 30% FiO₂, or 80% FiO₂ and concluded that the use of 80% FiO₂ during the perioperative period for patients undergoing general anesthesia for colorectal surgery is efficacious. These studies revealed secondary benefits of higher perioperative FiO₂, including faster return of bowel function, ability to tolerate solid foods sooner, ambulation sooner, suture removal sooner, and a shorter duration of hospitalization. A meta-analysis that investigated several types of general surgeries did not find an overall benefit for the use of higher FiO₂; however, it did conclude that there is a benefit for the use of higher FiO₂ for colorectal surgery. Finally, an RCT that measured subcutaneous tissue oxygen partial pressure (StO₂) with an invasive monitor, near-infrared spectrometry, found that patients with higher postoperative StO₂ levels had lower incidences of surgical site infections.

Conclusions: The strongest research suggests that hyperoxemic colorectal surgical patients had a significant reduction in the incidence of SSIs. Several studies found an increased incidence of surgical site infections in hyperoxemic patients. One such study, a double blind RCT, suggests that “hyperoxemia has predominately deleterious effect” and recommends that cardiopulmonary physiology be the principal determinant of the amount of oxygen that the patient receives perioperatively. A 2008 study that compared 3 RCTs found similar results. A recommendation of perioperative hyperoxemia for patients undergoing colorectal surgery is in its preliminary phases, and more research must be done to devise clear guidelines and practice recommendations.

I-gel® Supraglottic Airway Associated With Transient Lingual Nerve Neuropraxia: Two Case Reports

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Introduction: Lingual nerve neuropraxia (LNN) is a rare complication associated with the use of artificial airways (Foley, 2009). Over a 1-year span, the outpatient facility at MD Anderson Cancer Center recorded 2 instances (N=2,641) where LNN was associated with use of the I-gel® airway. The tube section of the I-gel® (the part that rests between the hard palate and tongue) incorporates a buccal cavity stabilizer and bite block. These elements add girth to the tube section, create an opportunity for displacement of the tongue, and increase the possibility of lingual nerve compression and neuropraxia.

Literature Review: Case 1: A 66-kg female underwent CVC placement. She was intubated for 1 hour and 26 minutes with a #4 I-gel®. Case 2: A 66-kg female presented for breast implants. Her #4 I-gel® remained in situ for 3 hours and 59 minutes. Both patients complained of unilateral tongue numbness and ageusia on the anterior tongue. Unilateral tongue numbness and ageusia on the anterior tongue are the characteristic symptoms of LNN (Foley, 2010). Conditions resolved in 4 weeks. The I-gel® devices were utilized according to the manufacturer's user guide and easily inserted on the first attempts.

Results: Supraglottic airway use can result in neuropraxias of the hypoglossal and/or laryngeal nerves. Malposition of the "cuff" has been linked to motor deficits of the tongue (Umopathy, 2001). This report examines sensory deficits. The tube section of the I-gel® occupies nearly twice the volume as that of the Classic LMA™. This section may cause pressure injury of the lingual nerve (Renes, 2011). Its girth displaces the tongue and results in ischemia of the lingual and chordae tympani nerves by impinging them between itself and the medial aspect of the mandible. In our center, there was a 0.40 % (N=502) incidence of LNN observed with I-gel® use. As a comparison, there was no (N=2,139) occurrence of LNN associated with use of the Classic LMA™.

Conclusions: These cases of LNN are likely associated with use of the I-gel®. In part, this association may be attributable to the girth and relative stiffness of the device's tube section and the buccal cavity stabilizer, which resulted in significantly more pressure being exerted on the lingual nerve than encountered with the Classic LMA™. Patients with LNN have a favorable prognosis, and symptoms are usually resolved in 4 to 6 weeks (Inacio, 2010).

Impact of IV Lidocaine on Return of Bowel Function and Hospital Length of Stay

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Introduction: Postoperative ileus (POI) occurs in approximately 50% of all patients undergoing abdominal surgery and results in substantial patient discomfort and a prolongation in overall patient recovery and hospital length of stay. Practitioners are constantly investigating methods to decrease POI, and recently some studies have indicated that using a lidocaine infusion before, during and after the surgical procedure may be beneficial in reducing overall POI and patients' length of stay (LOS). Therefore, the purpose of this evidenced-based review was to determine if there was enough evidence in the literature to support these suppositions.

Literature Review: An extensive literature search was performed using MEDLINE, Cochrane, and Google Scholar. Key search items included the following: postoperative ileus, lidocaine, lidocaine infusion, gastrointestinal motility, and abdominal surgery. The search was limited to randomized clinical trials between January 1985 and January 2013. The trials that analyzed the incidence of POI and LOS in patients that were receiving either a lidocaine or placebo infusion during an abdominal surgical procedure were included for final analysis.

Results: A total of 130 adult patients in 3 RCTs were included. All 3 studies were double blinded, randomized, controlled clinical trials that compared the effects of lidocaine infusion or placebo on the outcome variables of interest. Two of the 3 RCTs reported a decrease in the total hospital stay and a faster return of bowel function. One study reported inconclusive evidence to support the outcome variables.

Conclusions: Based on the limited evidence from this evidenced-based review, it appears that the inclusion of a lidocaine infusion as part of the anesthesia regimen in patients undergoing abdominal surgical procedures is beneficial in reducing POI and LOS and should be considered in all patients undergoing major abdominal surgical procedures.

Implementation of a Pediatric Surgical Checklist for Children Presenting for Ambulatory Surgery

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Introduction: In 2009, researchers confirmed a significant reduction in mortality and other postoperative complications when the World Health Organization (WHO) surgical safety checklist was utilized. It ensures that at 3 specific points during the operative phase, communication occurs between the participants in a patient's care. Whenever possible, the patient is directly involved, as such participation has proven to be error preventative. The procedures and policies developed for adult patients have limited applicability to the pediatric population. The literature suggests that many medical errors can be avoided by conducting preoperative conferences with the surgical team and parents of the patient. Moreover, parental satisfaction may improve by being involved in the surgical plan. From an administrative point of view, patient and parental satisfaction are highly likely to be tied to institutional reimbursement, making tools such as this economically viable.

Literature Review: A pediatric surgical checklist was created and utilized with pediatric patients in the ambulatory surgical setting at Golisano Children's Hospital of Southwest Florida. Parents underwent conventional surgical preparation with the addition of the pediatric surgical checklist. The checklist, completed in the presence of the parents and surgical team, was conducted in the parents' primary language, either English or Spanish. The principal outcome was the evaluation of parental satisfaction.

Results: Both qualitative and quantitative analyses were used to evaluate the data. Preliminary results indicated high patient satisfaction scores regarding ease of checklist process, provision of reassurance in the teamwork used in providing child's care, and parental agreement that incorporation of the checklist is useful in aiding surgical error prevention. Culturally, the availability of a translator or provider, fluent in Spanish, to discuss the checklist and answer questions was positively rated.

Conclusions: Utilization of such checklists allows participation of the child and/or parents in the preoperative setting, encourages collaboration among surgical staff and physicians, ensures organization of patient safety measures, and prepares for possible complications. Future directions and implications for practice are explored.

In Obese Adult Patients Does Videolaryngoscopy Provide a Shorter Time to Intubation Than Direct Laryngoscopy? An Evidenced-Based Narrative Review

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Introduction: The obese patient is identified as someone with a body mass index (BMI) >30, and it has been noted that these patients are predisposed to prolonged time to intubation. Delayed intubation can result in significant hypoxemia and all of the morbidities associated with this anesthesia emergency, therefore it is important to identify methods to shorten this time to intubation. Some practitioners advocate using videolaryngoscopy (VL) to facilitate intubation in the obese patient. Therefore, the purpose of this evidenced-based narrative review is to determine if the use of VL results in a shorter time to intubation in the obese patient compared with the use of conventional laryngoscopy (CL).

Literature Review: An evidenced-based review was completed using MEDLINE with a search of articles published between 2000 and 2013. The terms obesity and difficult intubation were linked with videolaryngoscopy and conventional laryngoscopy and scored for research quality. Only those randomized controlled trials (RCTs) that had a direct comparison between VL and CL were included in final analysis.

Results: A total of 736 subjects in 5 RCTs were identified as relevant and included in final analysis. Four of the RCTs (636 subjects) reported that the relative time to intubation using VL was significantly shorter compared with conventional laryngoscopy, whereas one RCT (100 subjects) reported no differences between the VL 32 seconds in the conventional laryngoscopy group.

Conclusions: Based on this review, VL is associated with a faster time to intubation in the obese patient and should be considered as a possible first-line intubation device to use in the obese population. However, more research is indicated.

Intraoperative Lung Protective Ventilation Strategies in Acute Lung Injury: A Case Report

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Introduction: Annually, 190,600 patients are diagnosed with acute lung injury (ALI) and adult respiratory distress syndrome (ARDS) in the United States. Mortality rates from ALI/ARDS remain high, ranging from 35% to 60%. Lung protective ventilation strategies (LPVS) have shown a reduction in the morbidity and mortality in these patients for more than a decade. Despite the beneficial outcomes, the utilization of LPVS remains low. It is essential that anesthetists have a good understanding of LPVS and the pathological process in ALI to avoid ventilation-induced lung injury.

Literature Review: An integrative literature review, using MEDLINE and CINHL search engines, was conducted to locate studies involving LPVS using the keywords: acute lung injury, adult respiratory distress syndrome, lung protective ventilation strategies, anesthesia and intraoperative management. Sixty-seven articles were reviewed to evaluate current recommendations and barriers in the utilization of LPVS. Results of the literature review were compared with a case study of a 56-year-old male who suffered blunt chest trauma and bilateral pulmonary contusions resulting in ALI and in which LPVS were utilized.

Results: The literature validated that long-term survival in patients with ALI/ARDS is improved with LPVS. The strategies documented in the literature include VT of 6 to 8 mL/kg predicted body weight (PBW), plateau pressure <30 cm H₂O, minimum PEEP of 5 cm H₂O, and the lowest FiO₂ to maintain SpO₂ (88% to 95%). Barriers to use LPVS include the use of actual body weight (ABW) instead of PBW in determining VT, reluctance to use high levels of PEEP, the use of high FiO₂ in the treatment of hypoxia, and a knowledge deficit in the understanding of plateau pressure. LPVS utilized in our patient with ALI included maintenance of plateau pressure <30 cm H₂O, 10 cm H₂O PEEP, and FiO₂ (0.4-0.8). Deviating from LPVS, VT was calculated using ABW.

Conclusions: The VT in our patient was calculated using ABW resulting in slightly excessive volumes, but all other LPVS were utilized. The patient recovered and was discharged with a good prognosis. Despite current recommendations to maintain low PaO₂/FiO₂ ratios in patients with ALI/ARDS using low VT, plateau pressure, FiO₂, and high PEEP, anesthetists still treat hypoxia in these patients with high VT, plateau pressure, FiO₂, and low PEEP. The utilization of LPVS has shown a reduction in morbidity and mortality in ALI/ARDS; therefore, the perioperative use of these strategies is vital.

Low-Dose Intraoperative Ketamine for Prevention of Postanesthetic Shivering: A Systematic Review

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Introduction: Postanesthetic shivering (PAS) is a common complication following general and regional anesthesia. PAS can be distressing to the patient and has been cited as one of the primary causes of discomfort during the postoperative period. In addition, PAS is associated with physiological consequences and interference with patient monitoring. A systematic review was undertaken to synthesize the best available evidence on the effectiveness of intraoperative administration of low-dose ketamine (less than 0.75 mg/kg) on prevention of PAS in adult patients undergoing general or regional anesthesia.

Literature Review: A thorough literature search was conducted in order to identify randomized controlled trials meeting the predetermined inclusion and exclusion criteria. All applicable studies were retrieved and assessed for quality. Studies meeting the quality criteria were included in this systematic review.

Results: Each of the studies included in this review demonstrated that ketamine is more effective than placebo for prevention of PAS. The results of this review reveal that ketamine is as effective as meperidine, clonidine, tramadol, and hydrocortisone, and more effective than midazolam and granisetron.

Conclusions: Prophylactic use of low-dose ketamine significantly reduces the incidence of PAS. Low-dose ketamine is a safe, effective alternative to other drugs for prevention of PAS. Based on the results of this review, it is recommended that anesthesia providers consider intravenous ketamine, less than 0.75 mg/kg, as an alternative to current pharmacological interventions used for prevention of PAS in adult patients.

Methodology of a Retrospective Inquiry of Perioperative Glycemic Control in Vascular Surgery Patients

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Introduction: The purpose of this project was to develop an instrument that provides the necessary information regarding perioperative glycemic control. The goal of this analysis was to confirm the need for standardized perioperative glucose management. At our institution, blood glucose levels have historically been monitored for patients who present with a blood glucose of 200 mg/dL or greater. After obtaining IRB approval, a descriptive, retrospective review of 100 vascular surgical patients will be analyzed. An instrument has been developed by our research team to evaluate perioperative glycemic control.

Literature Review: Evidence-based research suggested that improved intraoperative glycemic control will result in improved patient outcomes. Current research suggested that hyperglycemia is directly related to surgical site infections, increased length of stay, stroke, renal insufficiency, and increased mortality. It is estimated that 15% to 20% of surgical patients in the United States are diabetics. Studies have reported that glycemic control in coronary artery bypass patients improves mortality and morbidity. Evidence-based data on glycemic control is needed in all surgical populations.

Results: The instrument that was developed included: age, gender, body mass index, admitting diagnosis, surgical procedure, type of anesthesia, and comorbidities. Data collection included the following: preoperative glucose levels, frequency of glucose monitoring, treatment of blood glucose levels, hypertension, high cholesterol, diabetes, obesity, smoking, coronary artery disease, peripheral vascular disease, Hgb A1C, renal failure, and previous vascular surgery. An Excel spreadsheet was developed for data analysis. Documentation of open vascular surgery and one or more blood glucose measurements during the perioperative period was the criteria for inclusion. Patients that have exceeded 5 years since surgery were excluded.

Conclusions: The overall purpose of this project is to describe perioperative blood glucose monitoring and treatment as a basis for evaluation of current practices in a community hospital setting. Development of an instrument that includes all the necessary factors is key to identifying issues with glycemic control. The instrument is the first step in establishing which factors contribute to glycemic control. Once guidelines are established, consistent monitoring and treatment can be implemented as a quality improvement initiative.

Pediatric Anesthetic Neurotoxicity

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Introduction: Numerous animal studies have demonstrated that commonly used anesthetic agents lead to apoptotic neuronal degeneration and decreased performance on cognitive tasks when given during the delicate period of synaptogenesis.

Literature Review: Available human studies were reviewed to determine whether a similar effect exists and if findings are strong enough to recommend a practice change. After obtaining approval from the institutional review board, a literature review was conducted using Medline/EBSCOHost and CINAHL. This resulted in 10 retrospective cohort studies, 1 Bayesian meta-analysis, and 2 ongoing studies including 1 randomized controlled trial.

Results: Most reviewed studies suggest that there is a relationship between surgery at a young age and decreased performance on cognitive tasks, and the meta-analysis suggests a strong probability that surgery/anesthesia and cognitive problems are related, and that future studies will demonstrate a similar relationship. Two monozygotic concordant-discordant twin studies, however, propose that this may be due to genetic factors unrelated to the anesthetic that also increase the risk of having surgery.

Conclusions: Due to the correlational nature of the current research and the possible confounds, a practice change cannot be recommended at this time.

Postanesthetic Handoff Communication

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Introduction: Communication errors, according to the Joint Commission and Institute of Medicine (IOM), are a major cause of adverse events, and a large majority of those errors occur in the handoff process. The Joint Commission, as of 2010, requires that all accredited organizations standardize handoff communication. The American Association of Nurse Anesthetists (AANA), as part of its safe surgery and anesthesia position statement, defined the best practice elements of anesthesia handoff to include: open nonhierarchical communication, an environment free of distractions and interruptions, face-to-face 2-way verbal exchange, and development of and adherence to a facility policy defining professional accountability and handoff expectations.

Literature Review: The Iowa Model of Evidence-Based Practice to Promote Quality Care guided the systematic review of literature. The databases searched included the Cochrane Library, EBSCOhost, CINAHL, PubMed, EMBASE, and OvidSP. Practice guidelines were found at the Joint Commission Center for Transforming Healthcare and the American Association of Nurse Anesthetists websites. Search terms included: postanesthetic, postoperative, handoff, handover, anesthesia, protocol, communication, perceived efficacy, standardize, and structured.

Results: The literature on postanesthetic handoff shows that handoff communication is brief, unstructured, informal information that is often incomplete, incorrect, or omitted. Receiving nurses perceive the quality of handoff as good in only 42% of handoffs. Pretest and posttest observational data on structured handoff protocols show that implementation of a handoff protocol improves information transfer and reduces technical errors with no significant increase in handoff duration. Care provider questionnaires show that a standardized handoff protocol is preferred and improves the perception of information transferred.

Conclusions: All studies included in the synthesis of literature recommend standardization of postanesthetic handoff. The majority of studies suggest using a combined verbal and written protocol. In order to improve the perceived efficacy of postanesthetic handoff communication, and thus potentially reduce adverse events and serious medical errors, a structured verbal and written postanesthetic handoff protocol is recommended.

Postoperative Vision Loss in Steep Trendelenburg

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Introduction: Postoperative vision loss (POVL) is not new to anesthesia and has been reported in the literature for over a decade. The highest incidences occur in spine (0.03%) and cardiac (0.08%) surgical procedures.

Traditionally, the prone position has been the only position associated with the complication of POVL. Steep Trendelenburg (ST) positioning for lengthy surgeries, such as laparoscopic robotic surgeries, is emerging as a new source for increasing POVL risk. This evidence-based literature review sought to evaluate POVL in relation to ST and to explore a novel intervention to decrease POVL risk.

Literature Review: A review of literature was performed. Search terms included robotic surgery, steep Trendelenburg, POVL, and intraocular pressure. The Rosswurm and Larrabee 6-step model for change to evidence-based practice was used to guide the process.

Results: POVL following ST positioning has been documented in 2 cases after lengthy procedures, 6.5 hours and 9 hours in duration. As a result, interventions to change practice is emerging in the literature. The level supine intervention (LSI) of 5 minutes after ST duration of an hour decreases IOP and facilitates an earlier return to baseline after being returned to a level position at the conclusion of ST. The use of tonometry to measure intraocular pressure in combination with an observation scale may predict the probability of a patient reaching a critical IOP.

Conclusions: An LSI of 5 minutes after 1 hour of ST is an effective way to decrease the risk of POVL while undergoing a surgical procedure in the ST position. It would be prudent to perform an LSI prior to 6 hours of ST. Further research is needed to identify the most optimal time and frequency to perform an LSI for cases of a duration greater than 120 minutes.

Predictors of Use of Remifentanyl, Fentanyl, or the Combination in Surgical Procedures in the United States

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Introduction: Remifentanyl, a mu-opioid agonist, is indicated as an analgesic during induction and maintenance of general anesthesia; into the immediate postoperative period; and as a component of monitored anesthesia in conscious independently breathing patients. It has a rapid onset, short duration, predictable pharmacokinetics (inclusive of patients with renal and hepatic dysfunction) and does not accumulate with repeated or prolonged administration. This study assessed predictors of use of remifentanyl, fentanyl, or the combination in US surgical procedures.

Literature Review: Data were abstracted from managed care (MarketScan® Hospital Drug 2010) and Medicaid (2010) databases, including surgical procedure via ICD-9-CM or CPT-4 code (cardiac, general, gynecology, orthopedic, otolaryngology, neurology, thoracic, vascular), age, gender, hepatic or renal disease, comorbidity, pharmacotherapy, and facility characteristics. Hierarchical mixed-effects logistic regression analysis was used to discern factors predictive of receipt of remifentanyl, fentanyl, or the combination. The a priori significance level was $p < 0.05$. Analyses were conducted using SAS® and STATA®.

Results: Multivariate modeling ($n=946,948$) showed increased remifentanyl, or combined remifentanyl and fentanyl, vs fentanyl alone probability in females (OR=1.05, 95% CI=1.02-1.09; $p < 0.05$), >50 years of age (OR=1.04, 95% CI=1.01-1.08; $p < 0.05$), with diabetes (OR=1.12, 95% CI=1.04-1.16; $p < 0.05$), hypertension (OR=1.07, 95% CI=1.02-1.13; $p < 0.05$), hepatic disease (OR=1.17, 95% CI=1.03-1.24; $p < 0.05$), or renal disease (OR=1.11, 95% CI=1.05-1.19; $p < 0.05$). Epidural anesthesia was associated with decreased probability of receipt (OR=0.41, 95% CI=0.33-0.72; $p < 0.05$). Relative to cardiovascular surgery, the probability of remifentanyl or combination of remifentanyl and fentanyl use was greater in gynecologic, orthopedic, otolaryngologic, and neurologic surgeries ($p < 0.05$).

Conclusions: The selection of analgesic pharmacotherapy should be predicated on a patient's clinical presentation (eg, hepatic or renal disease), the pharmacokinetic and metabolic profile of an agent, and provider experience. The study results indicate that remifentanyl, either alone or in combination with fentanyl, is more likely to be used during surgical procedures for patients with specific underlying diseases and in specific surgical classifications. These conclusions are limited by the retrospective nature of the inquiry. Further prospective research is warranted to confirm these findings.

Preoperative Pharmacologic Methods of Preventing Sore Throat Due to Tracheal Intubation

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Introduction: Sore throat is one of the most undesirable outcomes in the postoperative period influencing patient satisfaction and the patient's activities after discharge from the hospital. Patients expect to not have a sore throat after general anesthesia with the use of an endotracheal tube. The authors examined preoperative pharmacological methods for decreasing the incidence of postoperative sore throat in adult surgical patients undergoing general endotracheal anesthesia.

Literature Review: A search for evidence was conducted using PubMed, CINAHL, and the Cochrane Databases of Systemic Reviews (1990-2012). Search terms used alone and in combination included intubation, sore throat, prevention, and postoperative. Inclusion criteria were full text English language sources published in peer reviewed journals. Sources excluded were studies involving multiple drug combinations, supraglottic airways, neck or upper airway surgery, and pediatric patients. Sources were appraised and levelled using the method proposed by Melnyk and Fineout-Overholt (2011).

Results: Nineteen potential evidence sources were found with 7 randomized controlled trials meeting inclusion criteria. The studies examined gargling with sodium azulene sulfonate or ketamine, the inhalation of fluticasone prior to intubation, intravenous dexamethasone prior to intubation, and the use of amyl-m-cresol or magnesium lozenges prior to intubation. All of these agents decreased the incidence of postoperative sore throat to varying degrees. An absolute risk reduction of postoperative sore throat ranged from 28% to 45% at 0 hours, 34% to 50% at 2 hours, and 13% to 45% at 24 hours after arrival into the postanesthesia care unit. The number needed to treat was the lowest for subjects using ketamine and sodium azulene sulfonate gargle. No significant side effects were reported.

Conclusions: The results were promising, but no drug produced an absolute risk reduction in postoperative sore throat of over 50% at any assessment time. This off-label use of these agents should be pursued cautiously. The agents should be further studied as adjunct to decrease the incidence of postoperative sore throat in adults after general endotracheal anesthesia. Future large multicenter randomized controlled trials should be conducted examining these agents alone and in combination with varying doses and includes the use of a placebo. Future studies should also further explore potential side effects.

Presenting Postoperative Desaturation in Patients With Obstructive Sleep Apnea

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Introduction: Perioperative complications associated with obstructive sleep apnea (OSA) include upper airway collapse, hypoxemia, hypercapnia, cardiac arrhythmias, ischemia, difficult airway management, and increased rate of postoperative infections. The authors propose a new standard of care including preoperative OSA screening in all patients utilizing the STOP-Bang assessment, as well as preemptive placement of a nasopharyngeal airway prior to extubation in high-risk patients.

Literature Review: In an informal observation of practices at Wake Forest Baptist Health, the researchers noted approximately 80% of obese patients desaturate below 85%, while only 5% were treated with nasopharyngeal airways in the postanesthesia care unit (PACU). A literature review was completed to identify perioperative implications of OSA, assessment tools used in diagnosis of OSA, and current guidelines for management.

Results: At present, consensus guidelines for perioperative management of surgical patients with OSA are lacking, and prospective data are needed to further guide therapy; last published guidelines were released in 2006. Due to the overwhelming amount of data compiled, the authors propose the use of nasopharyngeal airways in all patients whose STOP-bang preassessment score is 3 or greater unless otherwise contraindicated.

Conclusions: Research shows preoperative assessment utilizing the STOP-Bang tool is preferable as it is easy to use, concise, and has the highest sensitivity in correlation with apnea-hypopnea index scores. The authors propose preemptive insertion of a nasopharyngeal airway prior to extubation will reduce postoperative hypoxemia and PACU length of stay and improve patient care and safety. Further studies are needed to validate the effectiveness of the proposed standard.

Preventing Perioperative OSA-Related Morbidity and Mortality

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Introduction: Obstructive sleep apnea is present in 24% to 41% of the adult surgical patient population. Anesthesia providers must identify, recognize risk factors for, and create a plan to care for these patients.

Literature Review: A systematic literature search strategy was employed producing 4 sources including 2 systematic reviews and 2 studies. Screening tools for obstructive sleep apnea were compared by 3 sources, which statistically validated several instruments. Risk factors for obstructive sleep apnea and incidence of perioperative complications were addressed by the 2 systematic reviews. Recommendations for perioperative care were given, some supported by evidence and some based on expert opinion.

Results: Studies' recommendations of screening tools, identification of risk factors and perioperative treatments are alike. 2008 systematic review detailed opioid-sparing anesthetics, while the 2012 systematic review focused on positive pressure airway devices. Both recommended the expert-opinion based American Society of Anesthesiologists clinical practice guideline. Studies frequently found perioperative complications: hypoxemia (7), pneumonia (5), arrhythmia (5), reintubation (4), atelectasis (3), ventilation required (3), pulmonary embolism (3), myocardial infarction (3), atrial fibrillation (3), delirium/confusion (3), bronchospasm (2), pulmonary edema (2), hypercapnia (2). One hospital decreased respiratory events/unexplained deaths via chart labeling, heightened awareness, and automatic respiratory therapist postoperative alerts.

Conclusions: STOP-Bang tool is the most sensitive method to predict OSA as diagnosed by polysomnography. Opioid-sparing techniques include the use of nonsteroidal analgesics such as ketoprofen, transcranial magnetic stimulation, clonidine and dexmedetomidine. PPADs users should continue use postoperatively. Institution of PPADs should be considered for at-risk patients not using these devices. Evidence suggests PPADs are effective in reducing OSA-related complications.

Preventing Postextubation Respiratory Complications in Morbidly Obese Patients Through Non-invasive Ventilation

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Introduction: Morbidly obese patients, defined as having a body mass index (BMI) greater than 35, present with serious considerations for anesthesia providers, including complications related to intubation, ventilation and extubation. The combination of morbid obesity and general anesthesia leads to a higher risk of complications throughout the surgical process, especially postextubation complications. The purpose of this project is to determine if the use of noninvasive ventilation in the immediate postextubation will decrease respiratory complications for morbidly obese patients.

Literature Review: A synthesis of relevant literature reveals that noninvasive ventilation (NIV), with continuous positive airway pressure (CPAP) or bilevel positive airway pressure (Bi-PAP), is an effective method to improve the respiratory status of morbidly obese patients postextubation.

Results: Patients with a BMI greater than 35 should receive NIV (CPAP 10 cm H₂O or BiPAP inspiratory pressure 12 cm H₂O, expiratory pressure 4 cm H₂O) immediately after extubation, and support should be continued throughout the first 12 to 24 hours after surgery.

Conclusions: Current literature supports that patients with a BMI greater than 35 should receive NIV (CPAP 10 cm H₂O or BiPAP inspiratory pressure 12 cm H₂O, expiratory pressure 4 cm H₂O) immediately after extubation, and support should be continued throughout the first 12 to 24 hours after surgery. NIV should be worn for 2 out of every 3 hours during the designated postextubation time frame. Future recommendations include education for nurse anesthetists and anesthesiologists, post-anesthesia care registered nurses, intensive care nurses, and patients and their family members. Recommendations also include protocol development and implementation, as well as continued research on this topic.

Remifentanil Compared With Dexmedetomidine in Patients Undergoing Carotid Endarterectomy Under Regional

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Introduction: Carotid endarterectomy (CEA) surgery attempts to reverse or relieve symptoms or consequences of carotid atherosclerosis, which can progress to a transient ischemic attack or stroke. The anesthetic goal for this surgery is to provide optimum hemodynamic stability and allow for prompt neurologic evaluation. The question remains as to which anesthetic combined with regional anesthesia results in a prompt neurologic evaluation. The purpose of this work is to describe the evidence from the literature on the effectiveness of dexmedetomidine compared with other intravenous (IV) anesthetic drugs used with regional anesthesia in this patient population.

Literature Review: A literature search was conducted using the PubMed, CINAHL and Cochrane literature databases from 2000 to 2012. Keywords from the following PICOT statement were used for the search: Does the use of dexmedetomidine (I) compared with other IV anesthetic drugs (C) in adult patients with regional anesthesia for CEA surgery (P) allow for a more timely neurologic assessment (O) perioperatively (T). Three randomized clinical trials (RCTs) were identified and critically appraised.

Results: Three RCTs found that dexmedetomidine was more effective than other IV anesthetic drugs including remifentanil and fentanyl with Versed for prompt neurological evaluation with stable hemodynamics during CEA performed under regional anesthesia. One RCT found adverse effects were significantly greater in the remifentanil group due to respiratory depression.

Conclusions: In conclusion, dexmedetomidine was found to provide reliable anesthesia in adult patients undergoing CEA under regional anesthesia that does not impede neurological evaluation or hemodynamic stability.

Student Nurse Anesthetists and Hand Hygiene Compliance

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Introduction: Nurses are taught fundamental handwashing skills as a foundation of best practice. In pursuing graduate level education, the goal is to build upon the foundations that are developed. Current research indicates, however, that hand hygiene compliance rates of Certified Registered Nurse Anesthetists (CRNAs) are significantly lower than the compliance rates of their critical care nursing colleagues (De Wandel; Maes; Labeau; Vereecken and Blot, 2010; Biddle and Shah, 2012). The purpose of this study is to identify whether there is a relationship between hand hygiene practices of student registered nurse anesthetists (SRNAs) in their previous practice as critical care nurses, as well as identification of the top barriers to implementation in the clinical setting for nurse anesthetists.

Literature Review: A survey was distributed to a convenience sample of SRNAs (n=18) at a small, private Midwestern University in the spring of 2013. Inquiries were made about handwashing practices of SRNAs during their previous experience as a critical care nurse, as well as their current practice in the clinical arena. The tool was a closed-ended, 33-question survey using Likert, dichotomous, and ranked scales to examine the relationship between variables, as well as establish internal consistency among constructs. The Health Belief Model (Rosenstock, 1966) served as the theoretical basis for survey design.

Results: Cronbach's alphas for the previous nursing practice handwashing subscale ($\alpha=.854$) and the SRNA handwashing subscale ($\alpha=.803$) show strong internal consistency between questions. A significant relationship exists between previous handwashing as a critical care nurse and current handwashing as an SRNA before contact with a patient ($r=.417, p<.05$). Moreover, nurses who previously completed hand hygiene as a critical care nurse after removing sterile gloves were significantly more likely to complete hand hygiene as an SRNA after removing sterile gloves ($r=.719, p<.001$). The top 4 identified barriers to completing hand hygiene were: lack of a well-placed sink, soap, waterless alcohol dispenser, and/or alcohol wipes (n=10); patient care is distracting (n=7); lack of hand hygiene in anesthesia practice is culturally acceptable (n=7); and production pressure (n=6).

Conclusions: The results of this study indicate that nurses who previously practiced good hand hygiene prior to nurse anesthesia school are more likely to continue practicing good hand hygiene during clinical. As common barriers to hand hygiene have been identified, it is imperative to further assess why hand hygiene is not more prevalent in anesthesia care. More research is needed to generalize these results to a larger population. IRB approval is currently pending for further investigation of SRNAs nationwide with collaboration from the American Association of Nurse Anesthetists.

The Clinical Significance of a Single Dose Administration of Etomidate and Adrenal Dysfunction in Critically Ill Adults

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Introduction: Etomidate is an intravenous anesthetic agent commonly used to induce general anesthesia and facilitate endotracheal intubation in the critically ill. Its favorable profile of rapid onset, rapid recovery, and minimal cardiovascular depressant effects makes it an agent of choice when preservation of optimal blood pressure is critical (White and Eng, 2009). The controversy remains whether the adrenal insufficiency caused by the use of etomidate as a single dose is clinically significant in regard to patient outcomes (Albert, Ariyan and Rather, 2011). The purpose of this critical review of literature is to understand whether adrenal insufficiency from the use of a single administered dose of etomidate is clinically significant in terms of patient outcomes.

Literature Review: The literature review methodology included a literature search to determine the primary research available on the use of etomidate and associated adrenal insufficiency and the clinical significance of adrenal insufficiency following single dose administration of etomidate in the critically ill population. The following databases were searched: PubMed, CINAHL and MEDLINE.

Results: After reviewing current literature regarding the clinical significance of single dose etomidate use and its associated effects of adrenal insufficiency in the critically ill, its safety and clinical utility cannot be fully rejected or fully supported.

Conclusions: Despite etomidate's favorable pharmacological properties, which include a rapid onset, rapid recovery, and the preservation of hemodynamic stability, etomidate causes adrenal insufficiency by inhibiting cortisol synthesis. The current literature reveals that there are inconsistencies in the clinical significance of etomidate-associated adrenal insufficiency. There are numerous research studies opposing the belief that a single dose of etomidate increases morbidity and mortality and leads to adverse clinical outcomes in the critically ill. On the other hand, several research studies suggest the administration of a single dose of etomidate leads to adverse clinical effects and recommend its use be avoided in the critically ill population. Further research is needed to explore the use of etomidate regarding its safety and clinical utility. A possible solution to etomidate-associated adrenal insufficiency is the development of MOC-etomidate, an analogue of etomidate, which possesses the same favorable pharmacological properties but demonstrates very minimal effects on the adrenocortical system. Eliminating the associated adrenal insufficiency could make MOC-etomidate a more useful induction agent and have a significant impact on clinical practice and patient outcomes.

The Effectiveness of Aminocaproic Acid at Minimizing Surgical Blood Loss in Pediatric Scoliosis Surgery

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Introduction: Spinal fusion surgery to correct scoliosis, an abnormal curvature of the spine, is associated with significant intraoperative blood loss due to muscle dissection from the spine. Aminocaproic acid (Amicar) is an antifibrinolytic drug that has been used in orthopedic and cardiac surgeries to decrease intraoperative blood loss and transfusions. The purpose of this poster is to describe the evidence from the literature of the effectiveness of intraoperative Amicar in decreasing intraoperative blood loss in pediatric patients during spinal fusion surgery.

Literature Review: Five literature databases, CINAHL, PubMed, the Cochrane library, Ovid, and Dynamed, were searched using the following keywords: aminocaproic acid, Amicar, scoliosis, pediatric spinal fusion surgery, and surgical blood loss. Four randomized controlled trials (RCTs) and 1 systematic review (SR) were selected using Melnyck's Critical Appraisal Tools.

Results: The results of 3 RCTs found a statistically significant decrease in perioperative blood loss with Amicar during pediatric spinal fusion surgery. The results of 1 RCT and SR with adult patients found no decrease in intraoperative blood loss with Amicar. This discrepancy in results could be due to the use of adult patients rather than pediatric patients in the RCTs. The results of the 3 randomized control trials that analyzed pediatric patients all support the use of Amicar during spinal fusion surgery for scoliosis. All of the control studies showed that Amicar significantly decreased the perioperative blood loss. Though Amicar proved to be a good antifibrinolytic in the pediatric population, other studies show that it may not be the antifibrinolytic of choice for adults who are receiving spinal fusion surgery. It is unclear why there is this discrepancy between the perioperative blood loss in pediatric and adult patients. More research needs to be performed to clarify this discrepancy.

Conclusions: The evidence from these clinical studies indicates that Amicar is effective in decreasing intraoperative blood loss during pediatric spinal fusion surgery. In addition, Amicar is a less expensive antifibrinolytic drug with fewer complications compared with other antifibrinolytic drugs.

The Effectiveness of the Bispectral Index Scale Monitor at Reducing Intraoperative Awareness and Postoperative Nausea and Vomiting

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Introduction: Intraoperative awareness is estimated to occur in 0.15% of general anesthetics administered resulting in adverse outcomes such as posttraumatic stress disorder (PTSD). Excessive use of volatile anesthetics has been found to increase the incidence of postoperative nausea and vomiting (PONV) and prolong anesthesia emergence and postanesthesia recovery times. It has been stated that the Bispectral Index Scale (BIS) monitor may reduce the incidence of intra-operative awareness. It is unclear if the use of BIS monitor is effective in reducing intraoperative awareness and PONV. The purpose of this paper is to evaluate the effectiveness of a targeted BIS of 40 to 60 (t-BIS 40-60) when compared with no BIS monitoring in reducing the incidence of intraoperative awareness, PONV, anesthesia emergence, and recovery time in patients receiving general anesthesia for surgery.

Literature Review: A literature search was performed via PubMed, CINAHL, and Cochran databases using the following PICOT statement: Does the titration of anesthetic agents to a target BIS between 40 and 60 versus no BIS monitoring reduce the incidence of intraoperative awareness, PONV, anesthesia emergence, and recovery time in patients receiving general anesthesia for surgery? From this literature search, 8 randomized controlled trials (RCTs) were chosen to critically appraise.

Results: Six of the RCTs found no statistically significant difference between anesthetics titrated to a t-BIS of 40 to 60 compared with no BIS monitor for the incidence of intraoperative awareness. One RCT found a higher incidence of awareness in the BIS monitored group compared with the control group. Six of the studies found no significant differences in anesthesia recovery time and PONV between the BIS monitored group and control group, whereas 2 RCTs suggested the efficacy of BIS monitoring in decreasing emergence time, extubation duration, and inhalation agent consumption intraoperatively.

Conclusions: From the results of these studies it is recommended that anesthetic agents not be titrated based only on BIS values. BIS monitoring may be used as an adjunct monitor for high risk patients at the anesthesia provider's discretion.

The Preparation of Anesthesia Machines for the Malignant Hyperthermia Susceptible Patient

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Introduction: A Malignant Hyperthermia susceptible (MHS) individual is at risk for developing MH after exposure to inhalational agents. The minimum concentration of inhalational agents that is safe for MHS individuals is unknown, but 5 ppm of halothane did not trigger MH in MHS swine. Older anesthesia machines are flushed with oxygen at 10 L/min for 10 minutes to achieve 5 ppm. Newer anesthesia machines have components that absorb inhalational agents, so the required flush time is unknown. This poster presents the evidence regarding washout times of newer anesthesia machines in preparation for MHS patients.

Literature Review: The following PICOT statement was used to search the literature databases for evidence to answer this question: In newer anesthesia machines (P), what is the washout time needed (I) to render the machine safe for the MH susceptible patient as measured by an anesthetic concentration of 5 ppm (O)? The purpose is to identify the required washout time of newer anesthesia machines. The outcome is an anesthetic concentration of 5 ppm to ensure the safety of MHS patients. Four searches were done with each of the 5 databases: CINAHL, PubMed, Cochrane Library, OVID, Medline (in process).

Results: Shanahan et al evaluated the washout time of modern anesthesia machines; the Drager Fabius CE and the Drager Zeus achieved an anesthetic concentration of 5 ppm in 141 minutes and 85 minutes respectively. Gunter et al studied the Drager Narkomed and the Drager Fabius, which are newer machines; washout times to achieve a concentration of 5 ppm was 18 minutes and 104 minutes respectively. Prinzhausen et al evaluated washout times of the Drager Primus, a newer anesthesia machine, and the Ohmeda Excel 210, an older anesthesia machine; 5 ppm was achieved in 63.6 ± 5.1 minutes and 6.7 ± 0.5 minutes respectively. Whitty et al studied washout times of the Drager Fabius GS, a newer anesthesia machine, which reached 5 ppm in 151 ± 17 minutes.

Conclusions: Based on the findings of benchmark studies, a washout time of 1.5 to 3 hours is needed to achieve an anesthetic concentration of 5 ppm in newer anesthesia machines. The Malignant Hyperthermia Association of the United States recommends preparing newer machines for MHS patients based on manufacturer's recommendations or published studies due to varying flush times needed to render a newer machine safe. Specific guidelines for each anesthesia machine must be developed. Dissemination and adherence to these guidelines by anesthesia providers will promote safer anesthesia care for MHS patients.

The Utilization of Intravascular Fluid Management to Affect PONV Outcomes

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Introduction: PONV, also known as postoperative nausea and vomiting, continues to be a concern for patients undergoing general anesthesia with approximately 30% experiencing PONV. PONV prolongs recovery room stay, delays discharge, increases use of rescue antiemetics, increases healthcare costs, and decreases patient satisfaction. The CTZ (chemoreceptor trigger zone) is located next to the vomiting center and is sensitive to opioids, anesthetic agents, dopamine, and serotonin. When this area is triggered, PONV becomes a patient issue. Decreased volume status and/or intraoperative hypotensive episodes can cause intestinal ischemia release of serotonin which then stimulates the CTZ and results in nausea and vomiting. IV fluid replacement ranging from 15 to 40 mL/kg is recommended by American Society of Perianesthesia Nurses to high risk ASA I-III patients with no contraindications for increased IV fluid. A review of current literature will determine the effectiveness of IV fluid replacement to prevent PONV.

Literature Review: Two studies reviewed examined the outcome of PONV when using crystalloid vs colloid. It was not determined that crystalloid or colloid was more effective than the other in preventing PONV. Other studies consistently found patients that were administered larger volumes of IV fluid had decreased PONV. Limitations to the studies reviewed include: large variation in amount of fluid replacement utilized between studies; not all studies had rationales behind amount of fluid replacement administered; and most advantageous timing of fluid replacement is unclear.

Results: Aggressive fluid replacement was statistically significant to reduce PONV. Correction of preoperative dehydration whether administered intraoperatively or postoperatively can decrease PONV. There is a lack of generalized studies that follow a uniform calculation for IV fluid replacement and a standardized time for fluid replacement. Administration of IV fluid cannot be applied for all patient populations or to all surgical procedures: Large IV fluid replacement is contraindicated in extreme positioning, patients with severe comorbidities, and those at risk of airway complications. A change in practice is applicable to healthy patient populations at high risk for PONV.

Conclusions: PONV results from differing inputs to the vomiting center, making prevention of PONV difficult. Review of the literature found the technique of aggressive fluid replacement results in decreased incidence of PONV. Research of the literature found that the molecular weight of IV fluid did not influence the incidence of PONV. Anesthesia providers can incorporate this technique into their practice as an adjunct to reduce PONV. Intraoperative or preoperative fluid replacement was found to be an inexpensive, simple, and effective method to incorporate into a multimodal prevention of PONV.

The Writings of Ira P. Gunn, Past to Present: Relevant, Visionary, Legendary

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Introduction: Ira P. Gunn, CRNA, MLN, FAAN, is a well-known legend in the world of nurse anesthesia; however, many anesthetists may not be fully aware of her contributions to the profession. This poster aims to highlight the contributions of Gunn to nursing and nurse anesthesia in the greater context of healthcare in the United States.

Literature Review: A search was conducted using the search terms Gunn IP, Gunn, Ira Gunn, IP Gunn, and Gunn Ira utilizing the MedLine/PubMed, CINAHL, MedLine/Ovid, and Google scholar databases. Relevant articles spanned from 1964 to 2001.

Results: Thirty-nine articles were found. Gunn's works were featured in a variety of distinguished publications including *JAMA*, *Anesthesiology*, and *Advanced Practice Nursing Quarterly*. Gunn also authored the chapter on nurse anesthesia history in one of the foundational books of nurse anesthesia education.

Conclusions: Originally, the articles were divided and reviewed by decade; however, common themes were noted that spanned throughout time, and 8 themes were identified that best embodied Gunn's works. These themes included education, the importance of congruency with nursing, healthcare reform, rural healthcare, advocacy for CRNAs, CRNA-anesthesiologist relations, continuing competency and recertification, and the history of nurse anesthesia.

To Tranexamic Acid or Not?

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Introduction: Tranexamic acid (TXA) has been used to decrease intraoperative blood loss in total hip arthroplasty (THA) and total knee arthroplasty (TKA) surgical patients. Some studies have reported cases of thromboembolic events following the use of this drug. It is unclear whether there is an increase in postoperative thromboembolic events with the use of TXA in this patient population.

Literature Review: The purpose of this work is to describe the risk of thromboembolic events after intraoperative TXA administration to TKA and THA patients. Cochrane, PubMed, Medline, and Google Scholar databases were searched for evidence. Keywords from the following PICOT question were used to search the literature databases: In adult patients having total knee arthroplasty or hip arthroplasty (P) does intraoperative tranexamic acid (I) increase the risk of thromboembolic events (O) postoperatively (T) compared with patients who do not receive tranexamic acid intraoperatively (C)?

Results: Four randomized controlled trials (RCTs), 2 meta-analyses and 1 retrospective therapeutic study were critically appraised. The 4 RCTs found that intraoperative use of TXA does not increase the risk of thromboembolic events within a 3-month postoperative period in patients having TKA or THA surgery.

Conclusions: The evidence from these studies suggests that TXA be used cautiously in this surgical patient population.

Treatment of Spinal-Induced Hypotension in Adult and Parturient Patients

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Introduction: Thirty-three percent of adult patients undergoing spinal anesthesia experience hypotension, while hypotension incidence in parturients can be as high as 50% to 60%. Current standards of practice to prevent spinal-induced hypotension (SIH) include preloading the patient with colloids, crystalloid, and vasopressors. These modalities are not always effective in preventing SIH. 5-HT₃ receptor antagonist drugs have shown to block the postsynaptic neuronal stimulation of the vagus nerve and the Bezold-Jarisch reflex, which is associated with hypotension and bradycardia. It is unclear whether 5-HT₃ receptor antagonist drugs clinically decrease the incidence of SIH. This work describes the clinical effectiveness of 5-HT₃ antagonist drugs in preventing SIH.

Literature Review: The following PICO question was used to search 5 literature databases: Will adult patients, including parturients, pretreated with 5-HT₃ antagonists prior to receiving spinal anesthesia experience fewer episodes of hypotension compared with patients pretreated with crystalloid/colloid or vasopressors? The keywords SIH, 5-HT₃ antagonists drugs, and Bezold-Jarisch reflex were used. Two randomized clinical trials (RCTs) were critically analyzed.

Results: Both RCTs measured blood pressure and heart rate prior to, during, and up to 20 minutes following administration of spinal anesthesia. Systolic and mean blood pressure values obtained over a 20-minute observation period were significantly higher in the patients who received a 5-HT₃ antagonist drug. Both RCTs showed patients pretreated with a 5-HT₃ antagonist drug required statistically significant fewer vasopressor drugs and had a statistically significant lower incidence of nausea and vomiting.

Conclusions: Based on this analysis, 5-HT₃ antagonist drugs have shown to prevent SIH in patients undergoing spinal anesthesia.

Use of Sugammadex Versus Neostigmine to Reverse Nondepolarizing Neuromuscular Blockade--A Review of the Literature

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Introduction: Postoperative residual neuromuscular blockade and a number of critical respiratory adverse events have been associated with the use of nondepolarizing muscle relaxants (NDMR) during general anesthesia. Commonly used reversal agents to prevent such complications are neostigmine and glycopyrrolate. Administration of these medications is not without side effects. Sugammadex, a relatively new reversal agent, is a modified γ -cyclodextrin molecule that reverses neuromuscular blockade through direct binding to NDMRs. Clinical trials have demonstrated sugammadex reverses neuromuscular blockade more quickly than usual standard of care reversal agents. In 2008, the FDA rejected the use of sugammadex in the United States due to concerns regarding hypersensitivity. Since then, new clinical trials have been performed and the drug's application was recently resubmitted to the FDA, with a decision expected sometime in 2013. A systematic inquiry was performed on the following clinical question: in adult surgical patients receiving rocuronium or vecuronium-induced muscle relaxation, does the use of sugammadex provide greater efficacy and safety in reversing neuromuscular blockade as compared with usual standards of care?

Literature Review: A literature review was conducted on PubMed, CINAHL, and the Cochrane Library. Inclusion criteria incorporated publications within the last 6 years, randomized controlled trials (RCTs), adults ≥ 18 years old, and English language publications. Overall, 8 RCTs were obtained for this analysis. Three outcomes were analyzed: efficacy (i.e., recovery to a train-of-four ratio of >0.9), adverse events, and serious adverse events.

Results: Sugammadex reverses rocuronium and vecuronium-induced muscle relaxation and recovers patients to a TOFr > 0.9 at a significantly faster rate than standard of care reversal agents, including neostigmine/glycopyrrolate and edrophonium/atropine (2.5 min vs 25 min vs 5.5 min, respectively; $p < 0.0001$). Of the 354 patients who received sugammadex, 46 patients experienced an adverse event (AE) that was possibly related to the study drug, representing 13% of the total. Of the 370 patients who received a cholinesterase inhibitor and antimuscarinic agent, 67 patients experienced an AE deemed to be possibly related to the study drug, representing 18% of the total. The most frequently cited adverse events were procedural pain and nausea and vomiting. Patients in the sugammadex arm did not experience serious adverse events (SAEs) related to the study drug. However, thirteen patients in the neostigmine arm experienced SAEs, of which 2 were believed to be related to neostigmine.

Conclusions: Sugammadex is more efficacious at reversing rocuronium and vecuronium-induced muscle relaxation and recovering patients to a TOFr > 0.9 than usual standard of care reversal agents. Furthermore, the safety profile of sugammadex is well tolerated. This review found sufficient evidence supporting the use of sugammadex in the United States.

Utilizing Anesthesia Information Management Systems in the Study and Management of the Triple Low

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Introduction: The “triple low” is an anesthetic phenomenon involving the triad of low anesthetic concentration (MAC < 0.7), low Bispectral Index Scale (BIS) values (< 45), and low mean arterial pressure (MAP < 75 mm Hg). While each has been shown to be an independent risk factor for postoperative mortality, recent evidence suggests that a combination of these factors may be associated with increased long-term postoperative morbidity and mortality. It is unknown whether this phenomenon is merely a marker of comorbidity or whether intraoperative management of these risk factors influences long-term patient outcomes.

Literature Review: A 2012 study found the incidence of the triple low (TL) was 6% and was associated with a prolonged length of stay and 4-fold increase in 30-day mortality. Duration of low BIS and intraoperative hypotension may be independent risk factors for increased 1-year mortality. There is a 31% increase in mortality in those TL patients who go untreated, compared with a 7% to 20% increase in those who experienced a TL but whose hypotension was treated, suggesting vasopressors may reduce the duration and mortality associated with the TL. These findings suggest anesthetic management may be a significant factor in long-term patient mortality.

Results: A 2012 study found a 6% incidence of the TL, which was associated with a prolonged length of stay and an increase in 30-day mortality. Duration of low BIS and intraoperative hypotension may be independent risk factors for increased 1-year mortality. There is a 31% increase in mortality in untreated TL patients, compared with a 7% to 20% increase in those who experience a TL but whose hypotension is treated, suggesting vasopressors may reduce the duration and mortality associated with the TL. Anesthesia Information Management Systems (AIMS) allow the automatic collection, storage, and display of perioperative data. Many AIMS contain decision support features that generate real-time notifications to more effectively accomplish tasks.

Conclusions: Due to the inherent difficulties in studying this issue, a conservative approach using the best available evidence suggests keeping MAP > 70 mm Hg during surgery. Anesthesia Information Management Systems (AIMS) contain “decision support” features to help users more effectively accomplish a particular task by generating real-time notifications and reminders. AIMS could play a critical role in identifying and treating patient conditions, including the triple low, as well as increase CRNA adherence to a protocol to maintain a MAP > 70 mm Hg. AIMS can be used to implement and maintain the proposed protocol, as well as to study the outcomes on CRNA behavior and patient mortality.