

# STATE OF THE SCIENCE ORAL AND POSTER SESSIONS: PART 1

The AANA Foundation extended an invitation to participate in the State of the Science Oral and Poster Session at the AANA Annual Meeting in Washington, DC. This type of forum offers unique opportunities to talk directly to researchers about their research findings. The interaction among colleagues in a less formal setting set the stage for invigorating discussions and exploration of the research findings.

Each year, Poster Session candidates are selected by the AANA Foundation Board to present their research for the poster presentation. This year, many

of the abstracts from the State of the Science Oral and Poster Sessions were submitted for potential publication in the *AANA Journal*, and 47 abstracts were selected. Approximately half of the abstracts are published in this issue and the remainder are scheduled for publication in the December 2005 *AANA Journal*. For further detail and reference citations concerning individual abstracts, please contact the authors.

**Lorraine M. Jordan, CRNA, PhD**

*AANA Director of Research and AANA Foundation*

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## A1

### **Can anesthesia providers accurately predict their patient's preoperative anxiety?**

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**Introduction:** Anxiety is defined as a state of intense, often disabling apprehension, uncertainty, and fear caused by the anticipation of something threatening. All patients admitted for surgery experience varying degrees of anxiety. It is within the anesthesia provider's scope of practice to properly assess and treat the anxiety in which to alleviate the patient's worries, as well as avert negative outcomes associated with high anxiety levels. The goal of this study is to assess the anesthesia provider's ability to predict the patient's preoperative anxiety level as well as to determine the correlation between the Visual Analog Scale (VAS) and the Amsterdam Preoperative Anxiety and Information Scale (APAIS).

**Methods:** A convenience sample of 110 patients and the corresponding anesthesia providers will be used. Each anesthesia provider will be given a brief questionnaire (containing 6 questions from the APAIS and 1 from the VAS) prior to assessing the patient's preoperative level of anxiety. The patient will complete the same questionnaire prior to receiving any anxiolytics. Both descriptive and inferential statistics will be utilized to analyze the data obtained. The resulting information gathered will aid anesthesia providers when predicting preoperative anxiety. Also, the two tools used in anxiety assessment in this study, the APAIS

and VAS, will have a strong correlation with each other, further validating their effectiveness.

**Results:** The degree of association between the patient's anxiety scores and the trainee's and staff's predictions was assessed using a Kendall's correlation coefficient. Significance was noted between patient's actual recorded level of anxiety concerning anesthesia and surgery and that predicted by trainees and staff ( $p < 0.05$ ). Differences were also noted in overall combined anxiety scores between those tested. Trainees and staff reported similar scores in evaluation.

**Conclusions:** The effects of preoperative anxiety testing and the information collected will aid the anesthesia provider when predicting preoperative anxiety levels. This research will create awareness in the community as to the detriment of anxiety.

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## A2

### **Regional anesthesia website proposal**

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**Introduction:** The specific aim of this project was to develop a website to provide anesthesia care providers timely access to information regarding peri-operative care of a patient. The interest in developing a regional anesthesia website as a research project arose from learners' requests for a readily accessible resource that would ensure knowledgeable care for patients receiving a regional anesthetic. While many have a working knowledge of regional techniques, exposure to specific techniques may be limited or inconsistent because of clinical assignments.

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Research shows that adults prefer self-directed and self-designed learning projects to instructor-based learning environments. This website is a way that learners can take the initiative to learn about regional anesthesia whenever the need arises and at their own pace.

**Methods:** A review and comprehensive literature search of the principles of regional anesthesia management and techniques and adult and web-based learning was completed. Information was obtained from textbooks, research journals, and consultation with expert clinicians. Assistance with the creation of the website was obtained from the Internet/Website Development Department at Mayo.

**Results:** The information is available on the Mayo Anesthesia website. An outline format, consisting of broad subject headings, was utilized. Major headings include neuraxial blocks, peripheral nerve blocks, basic pharmacology, basic anatomy, and pre/intra/post-operative considerations. Subheadings provide additional information about subjects such as common procedures, room set-up, positioning, and anesthetic considerations/complications. Links throughout these subheadings include information presented in various multimedia formats.

**Conclusions:** The website provides easily accessible information to providers during the peri-operative period for patients undergoing regional anesthesia.

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### A3

#### **Locating the epidural space: A multidimensional approach to teaching**

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**Introduction:** The learning of manual skills required for the administration of anesthesia has been studied. For example, with general anesthesia it has been reported that it takes 47-57 attempts at laryngoscopic intubation to achieve a 90% success rate. The number of procedures required before achieving adequate technical skill (90 % success rate) in administering lumbar epidurals (LE) was studied by Kopatz who reported that for consistent correct spinal and epidural needle placement it requires 45 and 60 attempts respectively. Others report it takes 78 attempts at placement of LE to achieve a 98% success rate. We describe a process of teaching manual skills associated with insertion of epidural needles, followed by a report of success rates with accurate needle placement.

**Methods:** Students in the nurse anesthesia program received the following sequential instruction in

epidural needle placement: (1) anatomy of the back and central nervous system that includes a cadaver lab, (2) concurrent clinical correlation companion course, (3) dedicated didactic instruction in epidural needle/catheter placement, (4) simulated epidural placement using a training mannequin, and (5) tactile instruction allowing students to feel "loss of resistance" while observing needle advancement into the epidural space via fluoroscopy. Students then began an obstetrical rotation that included clinical insertion LE for relief of labor pain.

**Results:** Ten students who completed the described instruction administered a mean of 9.6 (range 4-19) epidural catheter placements for labor pain. Correct needle placement into the epidural space occurred with the first attempt in 94% of the cases. There was one puncture of the dura (wet tap), leaving the incidence at slightly less than 1%.

**Conclusion:** Teaching epidural placement using multidimensional approaches may result in steeper learning curves for the students and decrease the number needed to achieve consistent performance.

#### **References**

1. Mulcaster JT, et al. Laryngoscopic intubation: Learning and performance. *Anesthesiology*. 2003;98:23-27.
2. Konrad C, et al. Learning Manual skills in anesthesiology: Is there a recommended number of cases for anesthetic procedures? *Anesth Analg*. 1998;86:635-639.
3. Kopacz, DJ, et al. The regional anesthesia learning curve. *Regional Anesthesia*. 1996;21:182-190.

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### A4

#### **The laryngeal mask airway: Comparison of two insertion techniques related to waste anesthetic gas leakage**

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**Introduction:** Qualifying and quantifying amounts of waste anesthetic gas (WAG) exposure in the operating room is an ongoing safety concern for both providers and regulatory agencies. Currently there are no studies reported in the literature comparing the amounts of WAG with different insertion techniques of the laryngeal mask airway (LMA). Therefore, the purpose of this study is to compare the standard Brain technique with the Partially Inflated technique for the amount of nitrous oxide gas leakage in spontaneously ventilating Physical Status (PS) I or II subjects under general anesthesia.

**Methods:** In this randomized two group design, gen-

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eral anesthesia is induced with propofol and maintained with sevoflurane with a 70% nitrous oxide/30% oxygen mixture. Spontaneous ventilation is maintained to an end-tidal carbon dioxide level of less than 60 mm Hg. End tidal nitrous oxide concentration is measured by the Bacharach 3010 nitrous oxide monitor attached to the LMA at the level of the central incisors. Nitrous oxide in parts per million (ppm), LMA cuff pressures, and any assisted ventilation are measured at four consecutive fifteen-minute time intervals. **Results:** To date, 76 out of 128 subjects have been recruited for and completed this study. The mean WAG calculated for the Brain technique is 2317 ppm and 1664 ppm for the Partially Inflated technique.

**Conclusions:** The first phase of this study demonstrates a trend toward no significant difference in amount of WAG leakage between the two insertion techniques, cuff pressures, and periods of assisted ventilation. Final statistical analysis is pending completion of data collection, which is anticipated for fall 2005.

#### A5

##### **Efficacy of ketorolac: Preoperative versus intraoperative administration**

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**Introduction:** Uncontrolled postoperative pain is a common cause of prolonged recovery time. If narcotics are administered to control postoperative pain, this may also contribute to an increase in length of hospitalization. Non-steroidal anti-inflammatory drugs (NSAIDs) have demonstrated the ability to reduce pain and use of narcotics. The optimal point in surgery to administer these drugs has not been demonstrated. The purpose of this study is to evaluate time of administration of NSAIDs and the correlation between postoperative pain and narcotic usage in the recovery phase.

**Methods:** A convenience sample of seventy-four females scheduled for laparoscopic gynecological surgery were randomized into two groups. The first group received ketorolac, 30 mg, IV prior to leaving preoperative holding. The second group received ketorolac, 30 mg, intraoperatively upon instrument removal. In the recovery room, pain assessment with the visual analog scale (VAS) was completed upon arrival, thirty minutes postoperatively, and upon discharge. The results (pain scores and time in recovery) were compared for significance.

**Results:** The participants in both groups demonstrated similar demographics. An analysis of the data using the nonparametric Mann-Whitney U test revealed that patients receiving ketorolac preoperatively had significantly lower mean VAS scores 2.9 vs 4.2 ( $p < .05$ ) on

arrival to PACU. The VAS scores at 30 minutes and at discharge were not significantly different. The group receiving ketorolac intraoperatively had a longer length of stay in the recovery room (126 vs 106 minutes), but this difference was not significant.

**Conclusion:** This research demonstrated that the group receiving ketorolac preoperatively had less pain on arrival to PACU compared with the intraoperative administration group. Preoperative ketorolac may also offer an advantage of decreased recovery room length of stay. Future research may evaluate if re-dosing the ketorolac at the end of surgery or immediately on arrival to PACU would result in superior pain control.

#### A6

##### **A description of the indices of heart rate variability in chronic orofacial pain patients**

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**Introduction:** Heart rate variability (HRV) has emerged as an index of central nervous system (CNS) capacity. HRV is a measure of the beat-to-beat interval changes regulated by the dynamics of both sympathetic and parasympathetic drive. Low HRV is associated with a number of chronic disease states. Specifically, low HRV is present in patients with co-morbid conditions also found in chronic pain patients. The purpose of this investigation is to compare the indices of heart rate variability in chronic orofacial pain patients with that of normal controls, and to determine if anticipated alterations in the indices of heart rate variability improve with a standard behavioral therapy over time.

**Methods:** A descriptive prospective investigation was performed comparing the indices of HRV in chronic orofacial pain patients with that of normal controls. Fourteen male/female pain patients were recruited from the Orofacial Pain Center at the Naval Postgraduate Dental School, National Naval Medical Center Bethesda, Md. Fourteen male/female matched control subject volunteers were recruited through advertisements placed throughout the Naval Postgraduate Dental School, National Naval Dental Center, Bethesda, Md.

**Results:** No significant differences were noted between control and orofacial pain patient groups on the demographic variables measured. A significant difference

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was found between groups for the HRV variables of RFA ( $p=.006$ ) LF/HF ( $p=.006$ ), LF nu ( $p=.041$ ), and HF nu ( $p=.045$ ). The orofacial pain patients demonstrated a significant improvement in HRV variables from the pre-test to the post-test, RFA ( $p=.003$ ), LF/HF ( $p=.005$ ), LF nu ( $p=.008$ ), HF nu ( $p=.008$ ). In addition, orofacial pain patients demonstrated a significant change in VAS ( $p=.008$ ), MPI Interference ( $p=.027$ ) and MPI severity ( $p=.068$ ) from the pre-test to the post-test.

**Conclusions:** The ability to demonstrate an improvement in pain outcomes with an objective physiologic variable in a diverse multifaceted population represents a significant advancement in understanding the pathophysiology of pain disorders. In addition, the measurement of HRV may assist in the evaluation of current and future treatment strategies for chronic pain.

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## A7

### **A snapshot of the military CRNA in 2004**

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**Introduction:** The purpose of this study was to examine the demographical information to include experience level, primary practice positions and settings, and the clinical anesthesia practice of Army CRNAs as compared with the general membership of the AANA (American Association of Nurse Anesthetists) members.

**Methods:** This descriptive study used a secondary analysis of a 2004 Army CRNA Retention Survey, which was developed by expert Army Nurse Corps clinicians. The survey was emailed to all active duty Army CRNAs ( $n = 178$ ), and 135 responded.

**Results:** These data were compared to the 2003 AANA Practice Profile survey results. Eighty percent of Army respondents were 45 years old or less, while 69% of AANA members surveyed were 45 years old and above. Sixty-nine percent of Army CRNAs were male, while 49% of AANA members who work full-time were male. Forty-six percent of Army CRNAs had less than five years of experience while only 22% of AANA members had less than 5 years of experience. Respondents of the AANA survey had more years of clinical experience than the ones in the Army study. Eighty-three percent of Army CRNAs practice in a setting with anesthesiologists, while 25% of AANA members administer anesthetics without anesthesiologists. Demographics specific to the Army study included information about rank, years on active duty, and

deployment. Forty-five percent of Army CRNAs are at the rank of Captain. Forty-three percent have between 16 and 20 years on active duty. Seventy-seven percent were deployed within the last year.

**Conclusions:** The demographic data describes the current inventory of Army CRNAs as compared with AANA members. The Army CRNA is younger, less experienced, and required to perform a demanding wartime mission. These differences challenge Army leadership as they develop strategies to improve Army CRNA recruitment and retention.

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## A8

### **Variability of the ACT with different activator concentrations and blood components**

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**Introduction:** The activated coagulation time (ACT) is currently the most commonly used test to assess adequacy of anticoagulation during cardiopulmonary bypass (CPB). It is also used for evaluating the neutralization of heparin with protamine. A study by Goldstein suggested reducing the amount of Celite activator in the ACT might improve the correlation of the ACT with the platelet count allowing the ACT to be incorporated into a new device to improve the diagnoses of perioperative coagulopathy with cardiac surgery. The aim of this current study was to determine, in vitro, if a modified ACT was more sensitive to platelet count and clotting factor levels than a conventional ACT.

**Methods:** Initial testing was performed to determine the appropriate calcium chloride concentration needed for recalcification of the blood. Six units of whole blood randomly obtained from the blood bank were fractionated and reconstituted in small aliquots. Measured amounts of plasma and platelets were added to achieve specific percentages of platelet counts and factor levels. To measure the impact the ACT activator, Celite, had on ACT results, four concentrations of Celite were added to the tubes containing specified plasma and platelet levels.

**Results:** Although the platelet-ACT relationship was stronger than the plasma-ACT relationship, both had statistically significant correlations ( $p$ -values  $< 0.05$ ). With regard to platelets, the correlation did not depend on the Celite level. The ACT was able to equally detect thrombocytopenia with 1.5, 3, 6, or 12 mg Celite.

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Plasma levels indicated the correlation was definitely worse with 12 mg Celite, although the correlations were very close with 1.5, 3, and 6 mg of Celite.

**Conclusions:** ACT is a reliable test for patients with thrombocytopenia. Reducing the amount of Celite activator did not result in improved statistically significant correlations. The ACT did not correlate well with plasma concentration.

**References:**

1. Goldstein SJ, Grosfsik, et al. The correlation between platelet count and ACT in blood from healthy volunteers is improved by decreasing Celite content. *ASA*. 1997.
2. Henderson N, Key NS, Christie B, Kisiel W, Foster D, Nelsestuen GL. Response of factor VIII and IX-deficient blood to wild type and high membrane affinity mutant factor VIIa in an in vitro whole blood clotting assay: possible correlation to clinical outcome. *Thrombosis & Haemostasis*. 2002;88(1): 98-103.

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**A9**

**Cricoid pressure-improving performance through education and training**

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**Introduction:** Passive regurgitation of abdominal contents during endotracheal intubation is of significant concern in the operating room. Pulmonary aspiration of gastric contents can trigger a sequence of events that may result in injury to the patient. An effective means of reducing this risk is cricoid pressure. Often, the circulating nurse is responsible for the application. Unfortunately, studies reveal a knowledge deficit regarding correct application among operating room personnel. The purpose of this investigation was to determine if an educational intervention improved performance and retention of information.

**Methods:** The study used a pretest-posttest design secondary to data collection prior to the educational intervention. A convenience group of 14 perioperative nurses served as the sample. After obtaining consent, subjects completed an open-ended questionnaire regarding appropriate force. Participants simulated cricoid pressure on a laryngotracheal model, and then received individual instruction, practice session, and retesting. At the two-month follow-up participants tested without remediation.

**Results:** Only 14% correctly answered the amount of pressure applied prior to the educational intervention. At baseline data collection, 50% held the correct amount of pressure at the start point. Only 35% utilized the appropriate pressure at the 60-second finish point. After an educational intervention and practice period, 50% of participants simulated appropriate cricoid pressure. At 60 seconds, 21% still held correct pressure. At the two-month follow-up, 90% correctly answered the amount of pressure and 70% applied an appropriate amount of pressure to start. At 60 seconds, 60% still held an appropriate pressure. During the course of the trials no comparisons were significant with  $p > .05$ .

**Conclusion:** This study suggests positive retention and concurs with prior research. While the trend globally suggests learning and retention, the results were not significant, likely due to the small sample size and low power.

**References:**

1. Owen H, Follows V, Reynolds KJ, Burgess G, Plummer J. Learning to apply effective cricoid pressure using a part task trainer. *Anaesthesia*. 2002;57:1098-1101.
2. Sellick BA. Cricoid pressure to control regurgitation of stomach contents during induction of anaesthesia. *Lancet*. 1961;2:404-405.

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**A10**

**Clinical educator styles – Survey**

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**Introduction:** Clinical teaching responsibilities are often an integral part of a Certified Registered Nurse Anesthetist's job. The challenge for the clinical facility/leadership of the nurse anesthesia program is to try and develop clinical educators who will contribute to students' learning and growth. The interactions between the clinical educator and the student nurse anesthetists extend beyond education. These relationships contribute to students' perception of that department for potential future job employment opportunities. This survey research was intended to identify differences in educating styles/methods among CRNAs involving six clinical sites. The goal of this research is to identify if significant differences in teaching styles exist between the different clinical affiliations.

**Methods:** Following attainment of IRB approval, a survey was distributed to 130 CRNAs in six anesthesia departments. The survey was developed to capture comprehensive information related to all aspects of the clinical instructors. Content validity and scorer reliability were determined a priority.

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**Results:** Sixty-seven percent (N=95) of the surveys were returned. Demographic data was obtained, and nonparametric procedures were applied to the dependent variables. The two factors found to be significantly correlated with the instructor's enjoyment of precepting and their willingness to seek out teaching experiences for the student were: the anesthesia program they graduated from and their current place of employment. This research found significant differences between the six clinical affiliations regarding instructors' perceptions of the rewards and difficulties associated with working with students.

**Conclusions:** This data indicated that overall the CRNAs surveyed enjoy being an integral part of the student's learning experience. The results of this research demonstrated that the program an instructor graduates from and the place of employment has an impact on their precepting styles. This study revealed a significant correlation between instructors' attitudes regarding the benefits of participating in education with the number of available CRNA vacancies at that clinical site. Future research may evaluate the significance of this relationship.

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## A11

### **Ondanestron versus granisetron: Prevention of postoperative nausea and vomiting in patients undergoing cesarean section**

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**Introduction:** As hospitals continue to battle the increased costs incurred when patients experience postoperative nausea and vomiting (PONV), research is necessary to determine the most cost-effective ways to prevent and treat this costly condition. Certain patient populations are at an increased risk for experiencing PONV including: women, non-smokers, and patients undergoing major abdominal, obstetric, gynecologic, plastic, and laparoscopic surgical procedures. The study's purpose was to determine if granisetron, 0.1 mg, was as effective as ondansetron, 4 mg, in preventing PONV in female patients who have undergone cesarean section.

**Methods:** Following IRB approval, a double-blinded pre-test/post-test control design study was conducted to compare the efficacy of granisetron and ondansetron in preventing PONV in females undergoing cesarean section. The patients were randomly assigned to receive

granisetron, 0.1 mg, or ondansetron, 4 mg, intravenously after the delivery of the fetus. Nausea scores were recorded preoperatively and postoperatively at 6, 12, and 24-hour intervals after administration using a 4-point verbal scale. Any incidences of vomiting or retching were recorded. Statistical significance was reported as a p-value of less than 0.05.

**Results:** Total patient population consisted of 38 patients with 19 in each group. One patient from each group was excluded in data analysis due to incomplete data collection. Results showed no statistically significant difference in PONV between ondansetron, 4 mg, and granisetron, 0.1 mg. Lack of vomiting and retching was similar between the groups. P-values for 6, 12, and 24-hour intervals were  $p=1.0$ ,  $p=0.337$ , and  $p=0.331$  respectively, showing each group was equally effective in the prevention of PONV.

**Conclusion:** This study has shown that low dose granisetron can be used as a cost saving alternative for the prevention of PONV in women undergoing cesarean section. Further research will be needed to determine if the use of low dose granisetron will benefit other high risk patient populations. Patient satisfaction and cost consciousness continues to be a major concern of anesthesia providers. The results of this study will assist in determining which of these antiemetics will provide the more efficient and cost-effective regimen in preventing PONV in patients undergoing cesarean section.

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## A12

### **Comparison of inhalation of isopropyl alcohol (IPA) versus promethazine in the treatment of postoperative nausea and vomiting (PONV) in patients identified as at high risk for developing PONV**

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**Introduction:** Postoperative nausea and vomiting (PONV) persevere as common complaints among higher risk patients, including female gender, non-smoker, motion sickness history, previous PONV history, and general anesthesia. These patients are often treated prophylactically with ondansetron and symptomatically with promethazine. However, promethazine, while effective for PONV treatment, is associated with the side effects of sedation, dry mouth, and occasionally hypotension. Studies indicate that inhalation of 70% isopropyl alcohol (IPA) is as effective

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tive as conventional antiemetic therapy (with no related side effects) for PONV treatment, but has not been investigated in a high risk population who have been treated prophylactically with ondansetron.

**Methods:** In this prospective, randomized study, 96 ASA I and II subjects screened for 3 of 5 known PONV risk factors were randomly assigned to the experimental or control group. Severity of PONV was measured using a 0-10 verbal numeric scale (VNRS). Other measured variables included demographic data, PONV incidence, and total antiemetic requirements.

**Results:** Except for patient age, no significant difference in demographic variables, surgical or anesthesia time, or analgesic requirements were noted between groups. Noted no significant differences in VNRS scores in PACU between IPA and promethazine groups except at 5 minutes following treatment ( $1.29 \pm 1.24$  versus  $3.45 \pm 2.77$  respectively) ( $p=0.027$ ). VNRS scores in SDSU and following discharge to home were also similar. When time to 50% resolution of symptoms were analyzed, noted time differences between the IPA and promethazine groups in the SDSU ( $9.74 \pm 6.96$  versus  $23.33 \pm 18.87$  minutes, respectively) ( $p=0.008$ ) and following discharge to home ( $17.25 \pm 7.34$  versus  $26.67 \pm 12.5$  minutes, respectively) ( $p=0.017$ ).

**Conclusion:** Administration of 70% isopropyl alcohol as rescue treatment for PONV resulted in lower time in minutes to 50% reduction in VNRS scores in the SDSU and home environments compared to promethazine.

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### A13

#### **Certified Registered Nurse Anesthetists (CRNAs) attitudes toward and knowledge base regarding the treatment of hyperglycemia in the patient undergoing coronary artery bypass grafting and/or cardiac valve procedures**

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**Introduction:** Recent research has demonstrated the importance of blood sugar control during the intra-operative period in patients undergoing open heart surgery. Aggressive treatment and significant control of blood sugar levels have been shown to result in positive patient outcomes. Despite these findings, there seems to be hesitancy among CRNAs to treat hyperglycemia intra-operatively in this patient population. The purpose of this study was to determine the attitudes and knowledge base of CRNAs regarding insulin therapy for the treatment of hyperglycemia during the intra-operative period.

**Methods:** Following attainment of IRB approval a self-

administered questionnaire was distributed to a convenience sample of CRNAs employed within the Detroit Medical Center and their affiliated sites.

**Results:** The survey data were analyzed using descriptive statistics. This study found consensus between all respondents that intra-operative control of hyperglycemia promotes positive outcomes. Hyperglycemia was defined as blood sugars in excess of 120 g/dL by 96.4% (N=27) of the participants. The threshold for treating hyperglycemia varied with only 17.9% (N=5) of respondents agreeing that they would treat the blood sugar at serum levels of 120 g/dL. Protocols for the treatment of hyperglycemia did not increase the uniformity of treatment, as only 35.7% (N=10) followed the departmental recommendations. Autonomy in the treatment of hyperglycemia was shared by the majority of respondents.

**Conclusion:** Although all respondents felt that control of hyperglycemia promotes positive patient outcomes, definitions of hyperglycemia and methods of treatment varied among CRNAs. Continuing education regarding treatment and control of hyperglycemia may be useful among CRNAs who provide anesthesia for patients undergoing open heart surgery.

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### A14

#### **The accuracy of the minimal leak technique and pilot balloon palpation in assessing endotracheal tube cuff pressure during intubation**

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**Introduction:** The most common airway management technique used for adults undergoing general anesthesia is intubation with a cuffed endotracheal tube. Improper inflation of these cuffs can potentially cause injury. Under-inflation increases the potential for aspiration, and over-inflation can potentially cause tracheal damage. Most anesthesia providers utilize methods of cuff inflation that employ estimations rather than exact pressure determinations. The purpose of this study was to collect data regarding cuff inflation practices and compare direct pressure measurements with estimation techniques.

**Methods:** Following IRB approval a convenience sample of 80 anesthesia providers were enrolled in the study. Demographic data were collected and each participant was observed during the induction of general anesthesia and endotracheal intubation. The participants were asked to employ their usual technique of cuff inflation. Immediately following inflation, cuff

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pressures were measured using a standard manometer. **Results:** This research found that 84% (N=67) of the participants utilize the palpation technique. The mean cuff pressure using this technique was 53 torr with a range of 16-120 mm Hg. The arbitrary air injection technique was utilized by 14% of the respondents (N = 11). The mean pressure for this technique was 45 torr with a range of 45-110 mm Hg. This technique was utilized significantly more by individuals with >21-25 years of experience. The minimal leak technique was only utilized by 2 % (N=2) of participants. The mean pressure with this method was 26 torr with a range of 18-35 mm Hg.

**Conclusions:** The data obtained in this study found <20% of anesthesia providers inflated the cuff within the ideal range. The two most commonly used techniques of inflation were associated with a wide range of cuff pressures. This data indicates that estimation techniques may lead to endotracheal cuff pressures that are potentially unsafe and demonstrate the benefits of direct cuff pressure measurement.

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## A15

### **Comparison of hypothermia prevention strategies in a critically ill animal model exposed to aeromedical evacuation environmental conditions**

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The US Army Graduate Program in Anesthesia Nursing **Introduction:** Medical care during military operations is often conducted in cold environmental conditions. Hypothermia has been shown to increase mortality. The purpose of this study was to determine the efficacy of two hypothermia prevention strategies that are applicable to military aeromedical evacuation. Specifically, this study compared the ChillBuster warming blanket (Chillbuster group); the ChillBuster in conjunction with a reflective blanket (Chillbuster/Reflective Blanket group); and two standard military wool blankets (Blanket group).

**Methods:** Twenty Yorkshire swine weighing between 55 and 65 kg were used in a quasi-experimental study and were assigned to one of three groups. Each pig was exsanguinated until the mean arterial pressure (MAP) of 30 mm Hg was achieved and then Hextend (500 ml) plus replacement blood was administered. The subjects were then exposed to 50°F with an air flow 1 + 0.5 m/second over a six hour period. This

represents a typical in-flight aeromedical duration and conditions. The temperature of each pig was monitored with a pulmonary artery catheter.

**Results:** A one-way analysis of variance (ANOVA) revealed a statistically significant difference between groups ( $p < 0.01$ ). A posthoc Bonferroni analysis was calculated. There was no statistical significant difference between the Blanket only group and Chillbuster groups ( $p > 0.05$ ). However, there was a statistically significant difference in the ChillBuster/Reflective group when compared to the other groups ( $p < 0.05$ ). After six hours of cold exposure, the subjects in the Blanket only group lost an average temperature of 2.9°C; the Chillbuster only group lost an average temperature of 2.7°C. The ChillBuster/Reflective Blanket group had an average temperature gain of 1.8°C suggesting that this combination is an effective warming device.

**Discussion:** The ChillBuster or blankets when used alone do not prevent hypothermia in a treated hypovolemic model. However, when the Chillbuster is used in combination with the reflective blanket, the method is effective in maintaining temperature and preventing hypothermia.

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## A16

### **Anaphylaxis secondary to the administration of rocuronium?**

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**Introduction:** Reports of anaphylactic reactions to rocuronium, a monoquarternary aminosteroid neuromuscular blocking drug, have recently been cited in the literature. This is probably due to increased rocuronium administration by anesthesia care providers. Muscle relaxants have accounted for 69% of most cases of anaphylaxis during anesthesia. Criteria for anaphylaxis include a life-threatening event and two or more of the classic signs: hypotension, bronchospasm, dermatologic manifestations, angioedema or cardiovascular symptoms.

**Case report:** In our case review, a 77-year-old ASA III male presented with a renal mass for a robotic laparoscopic partial nephrectomy. After an uneventful RSI with succinylcholine and return of neuromuscular function, an initial dose of rocuronium was administered. Within three to five minutes after dosing, he exhibited classic signs of anaphylaxis including bronchospasm, hypotension, and dysrhythmias. Appropriate intervention was initiated, although bilateral wheezing persisted. After subsequent dosing of

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rocuronium, the patient developed hypotension and slight tachycardia despite his preexisting beta blockade. The procedure was canceled, and the patient was transferred to PACU for further cardiopulmonary evaluation and treatment. An echocardiogram performed in the PACU demonstrated signs of a possible non-Q wave myocardial infarction, pulmonary hypertension, and an ejection fraction of 55%. The correlation of anaphylactic symptoms occurring with each dose of rocuronium in this patient warrants further allergy testing because it is imperative to identify the incriminating agent of anaphylaxis.

**Conclusion:** Ideally, when an allergic reaction is suspected and the signs and symptoms of anaphylaxis occur, serum should be obtained within 30 to 60 minutes for a tryptase level, and urine should be collected for 24 hours. Serum and urine levels of tryptase are indicative of an immune-mediated response and reflect its release from mast cells and basophils during an anaphylactic reaction. This type of testing is the initial step in confirming anaphylaxis in a patient under general anesthesia.

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#### A17

**Evaluation of the anxiolytic effects of chrysin, a passiflora incarnata extract, in the laboratory rat**  
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**Introduction:** It is estimated that 19 million adults in the United States suffer from some type of anxiety disorder. Anxiety activates the stress response, resulting in increased neuroendocrine mediators (elevated catecholamines and cortisol), which may be deleterious to the patient. Most prescribed and marketed drugs for anxiolysis have undesirable side effects such as hypotension, sedation, and an increased potential for addiction and abuse. Many Americans are using herbal supplements in lieu of pharmaceuticals. Research suggests chrysin, a passiflora incarnate extract, may be

beneficial in decreasing anxiety. However, few studies definitively describe the pharmacodynamic site that produces the mechanism of action of chrysin and its resultant behavioral and physiologic effects.

**Methods:** Forty-four male Sprague-Dawley rats were randomized in a double blind, placebo controlled, between subjects experimental design. Each animal received an intraperitoneal injection of either: (1) vehicle (DMSO 4%), (2) chrysin 2 mg/kg, (3) midazolam 1.5 mg/kg, or (4) flumazenil 3 mg/kg and chrysin 2 mg/kg. The elevated plus-maze apparatus was used to evaluate the behavioral component of anxiolysis, and catecholamine and corticosterone assays were examined to measure the neurohormonal effects of anxiety.

**Results:** Only the midazolam group demonstrated a statistically significant difference in decreasing anxiety ( $p < 0.05$ ) in the rodent model when compared to the control and flumazenil and chrysin groups; however, there was no statistical difference found between the midazolam and chrysin groups. No statistical difference was found among the groups regarding the catecholamine and corticosterone levels.

**Conclusion:** Midazolam, as expected, significantly decreased anxiety compared to the control and flumazenil and chrysin groups; however, did not reach significance when compared to the chrysin group. These findings suggest that chrysin may have anxiolytic properties similar to midazolam, but to a lesser magnitude at the 2-mg/kg dose used in this study.

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#### A18

**Effect of continuous infusions vs intermittent boluses on maternal temperature during labor epidural analgesia**

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**Introduction:** Increase in temperature has been associated with the use of labor epidural analgesia (LEA). Temperature increases  $> 2^{\circ}\text{C}$  above baseline are associated with decreased uterine blood flow and significant fetal compromise. The mechanism of temperature rise during LEA remains unclear. We hypothesized that temperature rise may result from inhibition of sweating due to sympathetic blockade with subsequent reduction of heat loss. The purpose of this study was to compare maternal temperatures at pre-specified time increments in subjects receiving continuous LEA with those receiving intermittent LEA.

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**Methods:** After IRB approval and consent, 41 healthy primiparas were randomized to receive continuous (n=20) or intermittent (n=21) epidural injections. Temperatures were obtained with a calibrated tympanic thermometer at baseline, at 4 hours, at 8 hours, and at delivery. Demographic data were compared using a Student t-test. ANOVA was used to compare mean temperatures between groups. A Student t-test was used to compare mean temperatures within groups compared to baseline and between groups at each time increment.

**Results:** Demographic characteristics were comparable at baseline with the exception of weight, which was significantly higher in the intermittent LEA group (p=0.045). Temperature rise within groups was significant relative to the baseline temperature at every time increment (p<0.05). No difference in temperature was found between groups at any measurement interval.

**Conclusions:** Our data indicate that parturients experience significant temperature rise relative to baseline during both continuous and intermittent LEA. We conclude that temperature rise during LEA is not affected by delivery technique (continuous vs intermittent). Etiology of temperature elevation during LEA remains elusive and warrants further study.

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## A19

### **Anesthesia manpower survey for Michigan counties with populations greater than 250,000**

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**Introduction:** The purpose of this cross-sectional study was to determine the current and projected Certified Registered Nurse Anesthetist (CRNA) manpower staffing needs for urban Michigan counties. The anticipated population growth within Michigan is 1.34% annually. With CRNAs providing nearly 2/3 of all anesthetics in the United States, combined with the current national shortage of CRNAs, it is predicted that Michigan will also continue to experience a shortage of nurse anesthesia providers. This study attempted to quantify the current, 1 year, and 3-5 year anticipated CRNA manpower need for Michigan counties with populations >250,000.

**Methods:** Upon approval for IRB exemption, surveys were mailed to the chief CRNA at each of the 60 hospitals that met inclusion criteria of having a population >250,000. Exclusion criteria included those

counties with populations <250,000 people, those hospitals that do not employ CRNAs, and non-hospital-based health care settings. Of the 83 counties in Michigan, 7 had populations >250,000 as identified from a list obtained from the Michigan Hospital Association website. Survey results were then analyzed using SPSS version 10.0 to project the current and future CRNA manpower need.

**Results:** Preliminary data of the returned surveys demonstrate the existence of a current and future CRNA manpower shortage. Based on a 26% return rate, there are currently 2.3 vacant FTE positions per hospital. Additionally, there is an anticipated 1 and 3-5 year need of 2.6 and 2.4 FTE vacancies per hospital, respectively.

**Conclusion:** The results demonstrate a projected 15% increase in demand for CRNAs over the next year, with 3-5 year predictions estimating an increased CRNA need of 14%. These results predict that an additional 140 CRNAs will be needed in all of Michigan's hospitals located in counties with populations >250,000 during the next 5 years.

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## A20

### **A description of carbon dioxide recovery times in orofacial pain patients**

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**Introduction:** Orofacial pain refers to the differential diagnoses and management of pain and dysfunction affecting the motor and sensory functions of the trigeminal nervous system. Pain, panic, and anxiety are all activators of the autonomic nervous system. Increases in sympathetic nervous system activity with reductions in carbon dioxide levels and activation of the accessory muscles of respiration have been associated with enhancement of ectopic nerve impulses from the trigeminal nervous system. The purpose of this investigation was to measure carbon dioxide levels and muscle activity before, during, and after exposure to a stressor in a chronic pain patient population.

**Methods:** A descriptive, prospective investigation was performed and measured carbon dioxide recovery times to baseline after exposure to a cold pressor test in chronic orofacial pain patients. In addition, electromyographic recordings of the sternocleidomastoid, trapezius, and chest wall muscles were performed before, during, and after exposure to the same cold pressor test.

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**Results:** Five female chronic pain patients were recruited from the Orofacial Pain Center at the Naval Postgraduate Dental School, National Naval Dental Center, Bethesda, MD. The mean time to recovery of carbon dioxide levels to baseline was 6.8 minutes [SD  $\pm$  10.2]. The mean time to recovery for the sternocleidomastoid muscle was 3.2 minutes [SD  $\pm$  2.7]. The mean time to recovery for the trapezius muscle was 3.2 minutes [SD  $\pm$  2.16]. The mean time to baseline recovery for the chest wall was 1.2 minutes [SD  $\pm$  0.84].

**Conclusion:** The ability to demonstrate a measurable physiologic variable in a diverse multifaceted population may represent a significant advancement in understanding the pathophysiology of pain and in the efficacy of current/future treatment strategies.

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## A21

### **Analysis of the difference in CO<sub>2</sub> absorbent duration between observed and predicted values using the Magellan 2200 and the METI HPS**

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**Introduction:** This study was designed to determine the duration of carbon dioxide removal for four different patient weights using the Medical Education Technology Incorporated, Human Patient Simulator (METI HPS).

**Methods:** In a descriptive study, the METI HPS was used to produce and sustain an accurate and reliable rate of carbon dioxide to mimic that of a human patient for four different patient weights. The gram weight of each carbon dioxide canister was standardized at 400 grams of soda lime, a temperature probe was placed in the CO<sub>2</sub> canister, a machine check was performed, and the METI HPS was set to spontaneously ventilate for a given patient weight. The METI HPS was connected to the Magellan 2200 via an ET tube and a circle system with a 2 L fresh gas flow rate and the end tidal CO<sub>2</sub> (ETCO<sub>2</sub>) and temperature were measured by the Propaq Encore with side stream sampling. ETCO<sub>2</sub> and temperature were recorded every ten minutes until completion as determined by an inspired carbon dioxide level greater than 2 mm Hg.

**Results:** Using a spontaneously ventilating METI HPS, the time for each experiment was recorded. The duration for the 86 kg was 400, 410, 510 minutes. The duration for the 76 kg was 330, 390, and 430 minutes. The duration for the 67 kg was 390, 410, and 510 minutes. The duration for the 57 kg was 380, 390, and 520 minutes.

**Conclusion:** The average time to exhaustions of the

400 grams of soda lime was 422 minutes for a spontaneously ventilating patient. There was a wide range for the individual times 330 to 520 minutes.

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## A22

### **The effect of pre-admission drug screening on substance abuse rates among CRNA students**

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**Introduction:** The prevalence of chemical dependency among nurse anesthesia providers has been variably reported at 10-15%. Preliminary drug screening of nurse anesthesia program applicants has been proposed by some as a preventive measure to reduce substance abuse rates. The purpose of the study was to obtain information from nurse anesthesia programs about their reported incidence of student substance abuse, and if pre-admission drug screening methods are utilized by the program.

**Methods:** A survey questionnaire was developed and distributed to ninety-two nurse anesthesia program directors in the United States. The purpose of the research, along with background information, was detailed in a cover letter accompanying the survey. Questions were designed to determine substance abuse rates, types of substances abused, drug screening methods, and demographic data. Included were several open-ended questions to assess attitudes about drug screening.

**Results:** The survey response rate was 70% (N= 64) programs. Drug screening at admission is done by 23.4% of the programs. At least one incident of substance abuse among students was reported by 57.8% of programs, and 34.4% had more than one incident. No significant difference in the rate of substance abuse was found between programs that drug test versus those that do not. Fifty-two percent of the respondents do not believe preliminary drug testing is an effective tool in reducing substance abuse rates.

**Conclusion:** This research found that substance abuse among students occurs at significant rates. The use of a pre-admission drug test does not appear to be an effective deterrent. The likelihood that drug testing will be implemented by more programs appears doubtful due to an expressed lack of confidence from many program directors that it is an efficacious intervention. Suggestions for future research include evaluating the impact of computerized narcotic control programs and random drug testing on substance abuse occurrence rates among anesthesia providers.

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