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DOLASETRON FOR PREVENTION OF PERIOPERATIVE NAUSEA AND VOMITING DURING CESAREAN SECTION UNDER REGIONAL ANESTHESIA

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Introduction: Regional anesthesia is commonplace worldwide for elective and emergent cesarean section. However, the incidence of intraoperative nausea and vomiting can be quite high, is always distressing to the patient, and often interferes with the performance of surgery. Peritoneal stretching and uterine replacement after closure of the uterine incision have been implicated as significant causes of nausea and vomiting. The present study was undertaken to investigate the efficacy of dolasetron, a relatively new serotonin antagonist, as a prophylactic antiemetic for patients undergoing cesarean section with regional anesthetic.

Methods: Ninety-eight ASA II-III pregnant females were enrolled in the study. Premedication included 30 ml of sodium citrate orally plus 10 ml of metoclopramide intravenously, and prehydration was achieved with 1,000 ml lactated ringer solution prior to induction of anesthesia. All women received either spinal anesthesia (12 mg of 0.75% bupivacaine with 25 mcg fentanyl) or epidural anesthesia (15-20 ml of 2% lidocaine with 1:200,000 epinephrine and 1:10 ml sodium bicarbonate), to achieve a bilateral cephalad dermatomal level of T4. Patients were then randomized into two groups. Group A (n=48) received dolasetron (12.5 mg IV) prophylactically immediately after clamping of the umbilical cord; Group B (n=50) received no prophylactic antiemetic and were only given rescue medication (droperidol or dolasetron) if emesis occurred. Patients were observed for nausea and vomiting; for the purpose of this study, retching was equated with vomiting. All patients were followed up to one hour in the postanesthesia care unit for any evidence of nausea and vomiting.

Results: Compared to the control group, the incidence of nausea and vomiting was found to be markedly lower in patients treated prophylactically with dolasetron. Only two of the 48 patients (4%) in Group A complained of intra- or postoperative nausea, and neither progressed to retching or vomiting. In Group B, 12 of 50 patients (24%) experienced nausea, retching or vomiting. Using the chi-square test for analysis of the data, we found this difference to be statistically significant ($p<0.05$).

Discussion: Perioperative nausea and vomiting frequently occurs and is troublesome during cesarean section under regional anesthesia. In this study, we focused on prophylactic dolasetron for prevention of nausea and vomiting during spinal or epidural anesthesia. We administered the antiemetic drug after clamping of the umbilical cord, since the effects of dolasetron on the fetus and the neonate is unknown. In conclusion, this study clearly demonstrates the beneficial role of intravenous dolasetron for prophylaxis of nausea and vomiting in pregnant patients undergoing cesarean section with regional anesthesia.

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DOES USMLE STEP 1 EXAMINATION PREDICT PERFORMANCE ON IN-TRAINING EXAMINATION IN ANESTHESIOLOGY RESIDENTS?

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Introduction: In reviewing applications for residency, the only standardized test available to compare applicants from different medical schools is The United States Medical Licensing Examination (USMLE) Step 1 score. Generally, USMLE Step 2 is not available at the time the resident applicant is evaluated. Unfortunately, it is not clear whether the USMLE Step 1 score is predictive of Future Anesthesiology Specialty Examination (in-training examination and written board) scores for the applicant. Therefore, we undertook this study to determine whether in-training scores on written examinations can be predicted by the USMLE Step 1 score.

Methods: The USMLE Step 1 scores were collected for all residents entering anesthesiology residency at one medical school from 1994 to 2001. Anesthesiology In-Training Examinations and Written Board Examinations are given in July of each year. The categorization is based on the years of training completed at the time of the examination. In-training scores for the first years of training (PGY-0, CB, CA1, and

CA2) and written board examination (CA3) scores were collected, if available, for the same residents. Pearson's correlation was performed on USMLE Step 1 scores and each level of the In-Training Examination and Written Board Examination. Because of levels of residency, completion differed among residents (i.e., a resident beginning in 2001 would have only have taken the PGY-0 examination. A resident beginning in 2000 would have only taken the PGY-0 and CB examinations. And a resident beginning in 1999 would have only taken the PGY-0), CB, and CA1 examinations), the number of PGY-0 scores are more than CA-3 scores.

Results: From 1994-2001, there were 91 residents for whom USMLE Step 1 scores were available. In-Training scores were available in 60 PGY-0, 74 CB, 59 CA 1, 49 CA 2, and 33 CA3 residents. The USMLE Step 1 score correlated least with PGY-0 scores (R=0.30) and most with CA 3 scores (R=0.44; see Figure). If USMLE Step 1 scores less than 180 or greater than 200 (greater than 1 standard deviation from national mean of 200) are excluded, then scores between 180 and 220 did not correlate at all with CA-3 scores (R=0.14).

Discussion: USMLE Step 1 scores did not correlate with any of the In-Training written examinations for anesthesiology. Because of the low numbers for those residents who scored high (>220) or low (<180) on USMLE Step 1, it is not clear if these very high or low scores correlate with Written Board (CA 3) examinations.

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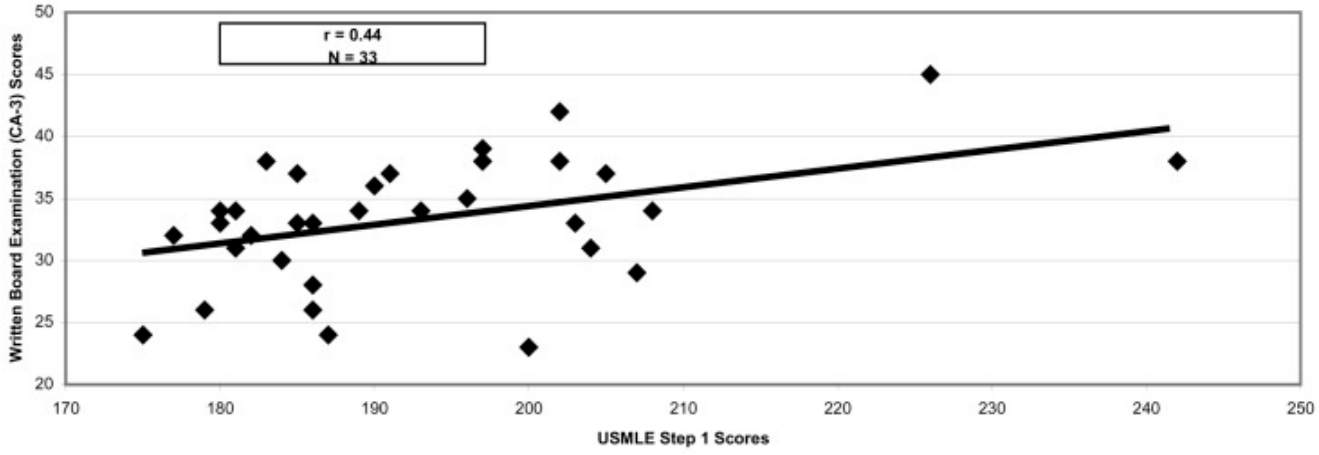
Figures and Tables

Figure:



USMLE Step 1 Scores and Written Board Examination (CA-3) Scores

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PRACTICE MANAGEMENT CURRICULUM FOR ANESTHESIOLOGY RESIDENTS

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Introduction: The Accreditation Council for Graduate Medical Education (ACGME) requires all anesthesiology residencies to address business and practice management in their didactic educational programs.1 In addition, formal understanding of Medicare compliance requirements is essential.2 We formalized and implemented a business curriculum for anesthesiology residents in 1996-1998.3 Recently, the ASA published a monograph focused on practice management information for senior residents.4 In response, we revised our curriculum to utilize this monograph as the textbook for the educational block. In this study, we describe the resulting practice management block.

Methods: The current business curriculum was evaluated4 and compared to the information in the ASA Practice Management monograph.3 The 2002-2004 curriculum was revised to be more consistent with the monograph. In this way, the monograph can be used as a textbook for the block.

Results: The topics, format, contact hours, and target audience for the 2002-2004 Practice Management Educational Block is shown in the Table. Topics covered include billing, revenue, compensation plans, productivity, job search, contracts, risk liability, managed care, governmental rules/regulations, and economic decision-making. Format and contact hours for the two-year curriculum is 16 hours for departmental presentations to all residents, 0.75 hours for introductory presentations to new residents, and 10 hours to new residents in university-wide seminars. Speakers include members of the department and invited non-physician experts.

Discussion: The ASA monograph as a resource for information and topics has been useful in developing and revising the practice management curriculum for anesthesiology residents.

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Figures and Tables

Table 1.

New	Category	Topic	Residents	Hrs	Comment
	Orientation	Documentation and The Anesthesia Record	New	0.75	
	PM	Risk Liability Seminar	New	5.0	University-Wide
	PM	Managed Care Seminar	New	5.0	University-Wide
New	PM	Anesthesia Reimbursement, Billing, Payment, and Compensation Plans	All	2.0	
New	PM	Case Conference: Billing and Revenue	All	0.5	
	PM	Job Search, Contracts	All	2.0	
New	PM	Credentialing - Hospital and Insurance	All	0.5	
New	PM	Getting Your Medical License	All	0.5	Resident Panel
New	PM	Mock Deposition	All	2.0	
New	PM	Risk Liability - What not to do!	All	1.0	
	PM	ASA and TSA Updates	All	1.0	
	Economics	Economic Selection of Anesthesia Technique	All	0.5	
	Personal Finance	Taxes and Retirement	All	2.0	
	Medicare	HIPPA, Fraud, False Claims, and Compliance	All	3.0	
	Economics	Costs: A Primer	All	0.5	
	PM	Types of Business Organizations	All	0.5	

PM = Practice Management, Hours = Contract Hours

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COMPARISON OF RESIDENT SELF-EVALUATION VS. FACULTY EVALUATION AS A MEASURE OF RESIDENT PERFORMANCE

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Introduction: The resident who is not performing well is usually identified early in his or her training. The institution of corrective measures as soon as possible is desirable. Identification of the resident who will not progress adequately through residency despite remediation is beneficial. We conducted a retrospective study to determine if resident self-evaluation or faculty resident evaluation is a better predictor of future performance as well as which resident may benefit from remedial measures.

Methods: The residents were asked to complete an evaluation form to assess their performance similar to the one used by the faculty. The evaluation form was distributed to residents of all levels within the program at the end of the third quarter of the academic year. A total of 10 residents completed and returned the self-evaluation form. We compared the residents' self-evaluation scores with those provided by the faculty. The evaluation form rated residence performance on a three-part scale, below average as 1, average as 2, excellent as 3. The criteria evaluated were (a) preanesthesia assessment, (b) selection, preparation and use of equipment and supplies, (c) formulation of an anesthesia care plan, (d) management of induction of anesthesia, (e) maintenance of anesthesia, (f) emergence from anesthesia, (g) postanesthesia patient assessment and management, (h) interpersonal relationships, and (i) record keeping. The score in each category was recorded and added up. The total was divided by the number of categories for an overall score of between 1 and 3. The faculty resident evaluations were scored the same.

Discussion: A resident self-evaluation score higher than the faculty appeared to be a predictor of poor performance. This was particularly evident when the faculty rated the resident as below average. Objective self-evaluation is a critical part of the learning process. The success of corrective measures is, in part, dependent on the resident's realization of a learning problem. Lack of insight appears to hinder that realization as evidenced by the discrepancy between faculty and resident evaluations. Without insight remediation will be difficult or unsuccessful. Thus we suggest that resident self-evaluation is a helpful tool in the resident evaluation process.

Figures and Tables

Table 1.

Results

	Faculty Evaluation	Resident Evaluation	
Resident #1	2.62	1.89	Every resident who rated him/herself higher than the faculty on their evaluations had difficulty during their residency, i.e., remediation or probation. Resident #5's assessment was deemed in line with the faculty assessment. Those residents who rated themselves higher than the faculty but were evaluated as performing below average (Resident #9 and Resident #10) did not complete the program. All the residents who rated themselves lower than the faculty on their evaluations finished
Resident #2	2.43	2.00	
Resident			

#3	2.35	2.00	the residency with distinction.
Resident #4	2.33	2.11	
Resident #5	1.97	2.00	
Resident #6	2.15	2 22	
Resident #7	2.03	2.22	
Resident #8	2.03	2.61	
Resident #9	1.85	2 22	
Resident #10	1.69	2.00	

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A WORKSHOP TO ILLUSTRATE TIME CONSTANTS, DIFFERENTIAL LUNG-UNIT VENTILATION, AND BASIC PRINCIPLES OF CAPNOGRAPHY

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Introduction: We have developed a two-station workshop, which uses the example of the sloping capnograph waveform seen during bronchoconstriction, to teach participants about time constants as they apply to lung physiology and differential lung-unit ventilation.

Methods: Physical simulation (part task trainer): We connected two anesthesia reservoir bags via endotracheal tubes (ETT) to a central y-connector. A thin tubing with a flow of CO_2 was distributed evenly between the reservoir bags. Stopcocks allowed sampling of CO_2 concentration at the y-connector, and at each reservoir bag (Fig. 1). When the time constant of one of the lung units was increased (endotracheal tube changed to a smaller diameter), and the bags were ventilated with specific parameters, a typical sloping capnogram tracing developed. Trainees observed the capnogram and the movement of the reservoir bags. They then adjusted the ventilator to create an inspiratory pause.

Full human simulator: The trainees were shown how to adjust the bronchial resistances on the METI (Medical Education Technologies, Inc., Sarasota, FL) simulator to create an up-sloping capnogram with an intubated, ventilated mannequin. They observed the (differential) chest wall rise and fall, and the capnogram, as an inspiratory pause, was created.

The trainees' observations at both stations were discussed in the context of time constants and their application to lung physiology.

Results: Trainees could actually see differential lung ventilation at both stations (i.e., simulated lungs moving out of phase). At the first station, the CO_2 concentration was initially higher in the bag attached to the smaller ETT. An inspiratory pause created visible redistribution of gasses between the reservoir bags. Capnograms sampling from the reservoir bags, after the inspiratory pause was created, also showed this redistribution of gas during the inspiratory pause (Fig. 2).

Discussion: We believe the demonstration of how time constants of lung units can be altered is important to trainees' full understanding of the concept. A physical model enabled visualization of dynamic changes in ventilation during simulated bronchospasm. Placing the concept in a clinical context with the simulator, and allowing hands-on participation, further enhances understanding and memory retention.

Figures and Tables

Fig. 2

The Effect of Revision on Remembering. From "Study Smarter Not Harder" Kevin Paul. Self Counsel Press 1996.

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MEASURING COMPETENCE IN ANESTHESIOLOGY RESIDENTS: USING

STANDARDIZED PATIENTS FOR PREOPERATIVE EVALUATION

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Introduction: Common performance evaluation tools in the field of resident education include written and oral examinations. Few, if any, specialties use patient-centered examinations except as reviews of case records or operative procedure lists. Hence, consistent measurement of day-to-day clinical performance is difficult to achieve and remains elusive in educational practice. And, in cases of close faculty supervision, resident physicians frequently demonstrate a "halo" effect, in that they usually perform better with an attending physician watching than he/she does when the attending physician is out of sight.

Satisfactory clinical performance and competence in anesthesiology is determined by more than operating room skills. Decision-making skills, interacting with patients in a healthy manner through adequate interpersonal skills, and communicating with patients are all important indicators of clinical competence. These skills are not independent of each other, having been previously demonstrated to be interdependent and related to the clinical context.[1]

The syndrome of clinical hypo competence among practicing physicians has been noted for many years.[2] Major issues include lack of therapeutic skills, inattention to patient symptoms, physician demonstrating a high control style, incomplete database which leads to omitting other active medical problems and omitting patient-centered data, and performing a thoughtless interview by not developing working hypotheses. Of these deficiencies, all but lack of therapeutic skills can be addressed by using a standardized patient evaluation tool. We describe a technique using standardized patients (SPs) as a tool to measure clinical competence, interpersonal skills, and physician-patient communication skills, thus improving our ability to measure and assure clinical competence.

Methods: First, a realistic clinical case is developed. The patient is a 26-year-old female who has been an insulin-dependent diabetic since childhood. Decision points in this scenario include having the patient be poorly compliant with her diabetes control, giving an equivocal answer when asked about the possibility of pregnancy, and being adamant that she have only an "attending" anesthesiologist.

We recruited and trained two female SPs for the role. While some of their answers may be spontaneous and unscripted, responses to questions about the decision points need to be answered in an identical manner regardless of which patient is playing the role at the time. After training, one faculty member who was familiar with the project and one faculty member who was blinded to the project interviewed each standardized patient. In both cases, the faculty members test the patient role for validity and reproducibility.

Resident encounters with the SPs occur in the preoperative clinic, where nurses and staff treat the SPs like any other patient. The patients' "surgeon" has also been notified of the date(s) that the standardized patient will be seen in clinic, in order to provide realistic feedback to any residents who choose to call him about this patient's particular medical problems in relation to the upcoming anesthetic.

Each encounter is tape recorded surreptitiously and used during the debriefing/think-aloud session with each of the residents. After each interview, the patient will also score each resident on a paper grading rubric, noting areas of perceived strengths and weaknesses. During the debriefing session, the resident is encouraged to use self-reflection and self-assessment. The faculty member debriefing the resident provides

specific and descriptive, nonjudgmental feedback. This feedback will be both positive and negative in nature, addressing areas of strength as well as areas needing improvement.

Results: Our presentation will include a description of setting up an SP program and preliminary results.

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ANESTHESIA KNOWLEDGE ACQUISITION AND MEASUREMENT: EXPECTATIONS, OUTCOMES, AND PROGRAM MODIFICATION USING AVAILABLE EVALUATION TOOLS

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Introduction: The ACGME Outcome Project offers programs three challenges: a shift of emphasis to educational outcomes rather than program structure, the development of methods of assessing the achievement of competency-based learning objectives, and the incorporation of outcome assessments into continuous program improvement. We have applied this evaluation structure to the assessment of resident knowledge using two universally available tools, the American Board of Anesthesiology In-Training Examination and the Anesthesia Knowledge Test. Setting specific expectations for resident performance provides clear competency-based objectives, while the combination of the tools provides frequent outcome assessment throughout the residency program. Finally, knowledge of resident performance at specific points in their education has enabled us to initiate program modifications based specifically on a core competency outcome.

Methods: All residents are required to take the American Board of Anesthesiology In-Training Examination (ITE) in July of their CA1, CA2 and CA3 years, providing assessment at the 0, 12, and 24-month points of the program. In addition, all residents complete the Anesthesia Knowledge Test (AKT) at the 0, 1, 6, and 18-month points. Combined, these standardized examinations provide valid, reliable measures of resident competence in the area of knowledge at frequent intervals throughout their training.

Expectations: All residents receive specific written expectations covering academic performance and departmental participation at the beginning of the residency. In the area of knowledge, all residents are expected to strive toward performance in the upper 10-20%. As a minimum, however, all residents are required to perform above the 25th percentile on each of the assessment tools noted above. Failure to meet that objective results in an “unsatisfactory” in the area of knowledge on the semiannual Clinical Competence Committee Report submitted to the ABA. Failure to perform above the 25th percentile on two consecutive examinations results in an overall unsatisfactory and placement on Academic Remediation.

Outcomes: The combination of these two knowledge assessment tools has enabled us to recognize and commend residents displaying outstanding performance or significant improvement. In addition, it has enabled us to identify residents who were struggling academically and place them into custom didactic programs designed to accommodate their learning styles. Our preliminary experience has been that these residents benefit significantly from early assessment and modification of their personal approach to learning.

Continuous Program Improvement: The results of these outcome assessment tools have enabled us to evaluate the effectiveness of specific components of our educational program. We have noted, for example, a small but consistent decrease in resident performance from the zero to one month AKT scores which we have attributed to the structure of our CA1 Core Curriculum. This observation has led us to modify the structure and content of the Core series. Future results will assess the impact of these changes and guide further program improvement.

Discussion: We have employed several universally available tools to formulate an approach to assessment of resident knowledge that meets the criteria of the ACGME Outcome Project. Objectives are clearly stated in the form of expectations, a reliable method of assessing competence is used, and the outcomes guide continuous improvement for both the individual resident and the program as a whole. We have been limited largely by the substantial delay between administration of the examinations and availability of the results. This has compromised our ability to integrate the measure of competence in knowledge with the ABA Clinical Competence deadlines, as well as delaying our intervention into the educational needs of specific residents.

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THE PERCEIVED VALUE OF A HUMAN SIMULATOR AND CRISIS RESOURCE MANAGEMENT (CRM) TRAINING IN THE THIRD WORLD

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Introduction: We believe that Crisis Resource Management (CRM) skills (e.g., understanding of roles, efficient communication, identifying when help is needed, avoiding fixation, and preparation for emergencies before they occur) are important in any adverse economic environment (First and Third World) where financial constraints limit the duration of clinical exposure of trainees.[1] Full human stimulation can be an important tool in the training of these skills.[2,3] We tested this hypothesis, specifically in the Third World, during the Annual Meeting of the 2001 South African Society of Anaesthetists in Durban, South Africa.

Methods: Groups of 20 congress attendees were offered a 2-hour CRM session consisting of an introduction to the METI simulator (Medical Education Technologies, Inc., Sarasota, FL), participation in a videotaped crisis event, a lecture on CRM principles, discussion of a simulated aircraft accident, and a debriefing of their own crisis. Two participants volunteered to be in the hot seat, while the rest of the group were observers. A comprehensive questionnaire explored the participants' perception of the value and applicability of such sessions in Africa and the Third World.

Results: There were 3 daily sessions attended by a total of 56 participants. All participants, except for one, strongly believed (8.7 ± 1.70 on a 10-point scale - average ± standard deviation) that training in, and application of, CRM principles would improve patient care in Africa.

Discussion: The hot seat volunteers were requested to act as residents. The actors prompted them when it seemed that they would fail to identify a clue (or vital sign) necessary for correct diagnosis and therapy. This avoided any embarrassment to the hot seat participants and enabled the discussion to focus on CRM principles rather than on medical issues. Based on the evaluations, the novel concepts of this project (CRM training for large observer groups, and use of a simulator based in the Third World, during a Congress held in the Third World) were enthusiastically received.

CM is Crisis Management (medical issues) and CRM is Crisis Resource Management (team and interpersonal issues).

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Figures and Tables

Table 1.

Perception of Value of CRM Sessions in the Third World

Question (10 point scale: 0 = not much, 10 = high degree)	Average	Std Dev	Minimum	Maximum
Familiarity with a full human simulator	2.6	3.4	0	10
Better understanding of the difference between CM and CRM	7.8	2.1	1	10
Improved your confidence for future crisis	7.6	1.6	3	10
Will CRM improve care in Africa?	8.7	1.7	0	10

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CAPNOGRAPHIC VARIATIONS PRODUCED BY LEAKS IN SIDE-STREAM SAMPLING TUBES: A STUDY USING THE METI™ SIMULATOR

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Introduction: Capnography is a sensitive, nonspecific indicator of physiological and mechanical maladies that occur in an intubated patient. Knowledge of the relationship between capnogram morphology, end tidal carbon dioxide ($ETCO_2$) values, and their correlation to a patient's condition is essential.

Tripathy and Pandey[1] discovered a “new” capnogram pattern when they unknowingly used a sampling tube that had been accidentally crushed. A subsequent perforation of the tube’s wall produced an abnormal pattern they named “tails up.”

We wanted to investigate changes that might occur in waveforms and $ETCO_2$ readings when using sampling tubes with leaks varying in size and location along the tube.

Footnotes

[1]Simulation Development and Cognitive Science Laboratory, Pennsylvania State University College of Medicine, Hershey, PA

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REGIONAL ANESTHESIA AND PAIN MEDICINE RESIDENCY TRAINING-THE YEAR 2000

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Introduction: Is resident exposure to regional anesthesia currently sufficient to provide adequate training? Anesthesiology residents used regional techniques in 21% of surgical cases during the 1979-1980 academic year. This percentage increased to 29.8% during the 1989-1990 academic year. Notably, during both of these periods there were large discrepancies in regional anesthesia experience between training programs (2.8% to 55.7% of total delivered anesthetics in 1979-1980). During the past decade, numerous educational changes have occurred in anesthesiology training, including the CA3 year, increased emphasis on pain management, and specific Residency Review Committee (RRC) requirements for anesthetic techniques. This report documents anesthesiology residents’ experience in regional anesthesia for the academic year 1999-2000.

Methods: Blinded cumulative data about regional anesthetic techniques performed by American anesthesiology residents were obtained from all annual training reports submitted in the year 2000 to the RRC for Anesthesiology/Accreditation Council for Graduate Medical Education (ACGME). Exposure to obstetric anesthesia, pain management, and a resident’s year-in-training were analyzed as independent factors expected to influence their use of regional anesthesia.

Results: Regional anesthesia was used in 30.2% of operative cases during the year 2000 (not significantly different from 1990 - Fig. 1). Previous training disparities between programs narrowed. The distribution of regional anesthetic techniques did not change (Fig. 2). Regional technique experience tends to increase with each level of residency training. At least 90% of residents meet or exceed the RRC minimal requirements for epidural and spinal anesthesia experience. Conversely, as many as 40% of residents fail to meet minimal requirements for peripheral nerve blocks.

Discussion: The average anesthesiology resident performs regional techniques for 30% of their total case load. This represents a stable experience compared to 1990 and holds the gains made from 1980. Furthermore, the teaching of regional techniques has become more consistent across residency training programs. However, the distribution of types of regional techniques has not changed over time, which

means that nearly half of the United States residents continue to receive inadequate exposure to peripheral nerve block.

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EVALUATION OF RESIDENT PERFORMANCE WITH A SURGICAL INFORMATION SYSTEM® DATABASE

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Introduction: Due to recent advances in computerized data collection, modern Operating Rooms are able to quickly and accurately collect large amounts of data. Our objective is to utilize these data to assess an individual resident's clinical capabilities and to compare the clinical efficiency of our resident group with our more experienced anesthetists (AAs and CRNAs).

Methods: Our Surgical Information System (SIS) contains data related to each surgical case, including information on procedures, start and stop times, and personnel involved. As we are a teaching institution, we utilize a team approach for the delivery of anesthesia services. However, since we wanted to assess each individual, we used only a subset of the data available in the system. By choosing only elective cases, beginning and ending between 07:30 and 15:30, Monday through Friday, we hoped to examine cases in which the same resident/anesthetist both started and finished the case. Our data subset consisted of 6,437 cases conducted during the first year in which the SIS was installed. Three time intervals (minutes) were calculated from the database: 1) The Anesthesia Release Time Interval (ARTI = Anesthesia Release Time - Anesthesia Start Time), 2) Surgical Start Time Interval (SSTI = Surgical Start Time - Anesthesia Start Time), 3) Exit Time Interval (ETI = Leave OR Time - Surgery End Time). These three time intervals were examined for obvious errors (e.g., negative time intervals). Presence of bias was assessed by means of histograms approximating the distribution of the three aforementioned time intervals. Analysis of variance and analysis of covariance were utilized to examine the effects of time/experience, surgical service (11 in all) and anesthesia provider (resident, AA, CRNA). Unequal distribution of individual caseloads across the different surgical services were corrected by calculation of least square means.

Results: Histograms of the ARTI demonstrated large, outlying peaks at the 5 and 10 minute cells, and a less but still prominent peak at 15 minutes. In contrast, the SSTI and ETI histograms were smooth without any apparent outlying peaks. Scatter plots and analysis of covariance models showed no consistent effect of time (for individuals or groups) with regard to either the SSTI or ETI data. Analysis of variance of the SSTI and ETI data showed that the effects of surgical service, type of anesthetist, and their interaction, were all statistically significant with p-values ranging from 0.0001 to 0.015. Calculation of least squared means and their confidence intervals are shown (partial results) in Table 1.

Comparison of the confidence intervals in Table 1 reveal that there are significant differences between residents and the other two anesthetist groups for both the Neurosurgery and Vascular services with the SSTI. For the ETI, the residents differ from the other two groups for both the Eye and Neurosurgical services. For all other comparisons by surgical service, no differences for the three anesthetist groups were found.

Discussion: Bias in the recording of data precluded the use of ARTI data in this study. No definitive effective time in training or experience could be determined from these data by means of an analysis of covariance. The training effect may be offset by the assignment of progressively more difficult cases as a resident progresses through the program. Only four comparisons (out of 22 total) demonstrated a clinically significant difference in time intervals for the three anesthetist groups. The largest difference occurred in the SSTI*Neuro comparison where the resident SSTI value was 5.7 min. longer than the AA value (SSTI = 47 min.). The evaluation of this discrepancy requires additional investigation.

Figures and Tables

Table 1.

Least Squared Means (95% Confidence Interval) - minutes

Time Interval	Surgical Service	AA	Resident	CRNA
SSTI	Eye	10.4(9.0, 11.8)	14.6(11.4, 17.8)	11.6(9.9, 13.4)
SSTI	Neuro	47.2 (45.2, 49.4)	52.9 (50.8, 55.1)	48.5 (46.4, 50.7)*
SSTI	Vascular	30.0 (27.8, 32.2)	37.0 (34.7, 39.4)	30.6 (27.9, 33.4)*
ETI	Eye	3.4 (2.7, 4.4)	6.4 (4.8, 7.9)	3.4 (2.5, 4.2)*
ETI	Neuro	11.4(10.4,12.4)	14.5 (13.5, 15.6)	11.5(10.5,12.6)*
ETI	Vascular	6.9 (5.8, 7.9)	7.7 (6.6, 8.8)	6.4(5.1,7.7)

*nonoverlapping confidence limits

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A RESIDENT EDUCATION-CENTERED APPROACH TO SOLVING QUALITY OF CARE ISSUES - AN OPPORTUNITY TO DEMONSTRATE RESIDENT COMPETENCIES AND TEACHER/CLINICIAN FACULTY SCHOLARSHIP

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Introduction: Many residency education programs currently use assessment tools that effectively demonstrate competency in patient care and medical knowledge among resident learners. Recent attention has focused on the need to develop reliable and effective means of demonstrating achievement in the other four general competencies (practice-based learning and improvement, interpersonal and communication skills, professionalism, and systems-based practice).[1,2] Additionally, there is an increasing need for reliable measures of educational scholarship of faculty seeking promotion in the clinician/educator track.[3] Finally, anesthesiology residency program requirements now require an academic project of all graduates.[1] A faculty-mentored, resident-centered approach to solving the systems and patient quality challenges

associated with the introduction of a new surgical procedure served as a model to demonstrate resident general competencies and to generate evidence of faculty educational scholarship.

Methods: In the fall of 2001, a surgeon introduced a procedure new to the institution. Initially, the Department of Anesthesia did not provide consistency in the anesthetic approach or personnel for the procedure. Within a month, a resident and a faculty mentor took on the responsibility of devising anesthetic guidelines. With close guidance from the faculty mentor, the resident devised a practice-based improvement strategy, including the following elements: researching the medical literature, devising preliminary guidelines, involvement as primary provider for most of the cases, collaboration with the surgeon and subspecialty nursing team, systematic method of review/reflection on outcomes, revision of guidelines, formulation of formal research chart review protocol, descriptive analysis of cases/data, preparation of formal departmental Grand Rounds presentation, preparation of scientific meeting abstract, preparation of a manuscript for publication, and creation of a departmental guidelines document.

Results: Since the project's beginning, the resident and faculty advisor have met regularly, and the advisor records contact time and content. The resident devised and implemented anesthetic guidelines based on review of related medical literature, implemented a method for systematically analyzing accumulating practice experience, and revised the guidelines based on analysis of clinical outcomes database. The surgeon has valued the attention the two dedicated physicians have given to assisting with the success in introducing this new procedure, has assisted in the anesthesia research project, and is assisting in preparation of the Grand Rounds presentation and publication manuscript.

Discussion: Patient quality care issues often trigger departmental consideration of best practices approaches to improving various aspects of anesthetic management. Involvement of a resident in the process of patient quality care issues provides an opportunity to demonstrate all six general competencies while satisfying the academic project requirement and participating in the solution to a real problem. The model described embodies the essence of practice-based learning and improvement (investigating patient care practice, appraising scientific evidence, and improvement of that practice; facilitating the learning of other health care professionals). The model also affords the opportunity to demonstrate competency in interpersonal and communication skills (information exchange; teaming with patients and professional associates), professionalism (confidentiality, informed consent, commitment to excellence and ongoing professional development), and systems-based practice (impact on larger context and system of health care; system resources; optimal value of care; partnering with other healthcare managers to assess, coordinate, and improve health care). For the faculty mentor, this model provides an opportunity to demonstrate evidence of educational scholarship of the quality required for promotion in the clinician/teacher educational track. This resident education-centered approach is a model that can be used to address many clinical quality care improvement issues, satisfying many resident education needs, providing a platform for faculty educational scholarship, and improving patient care.

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THE ROLE OF A PROFESSIONAL EDUCATOR IN MEDICAL STUDENT EDUCATION IN ANESTHESIOLOGY

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Introduction: The education of medical students in anesthesiology presents many challenges to the faculty of an academic medical center. We have been fortunate to maintain a two-week mandatory rotation in Anesthesiology and Perioperative Medicine as a component of our third year curriculum, and have previously presented our success with the program.[1] In an effort to continue to improve our educational efforts, we recruited an individual with extensive teaching experience and interest in adult education to serve as a full-time educational resource. This individual brings both knowledge and time that exceed the practical contributions of even the most motivated physicians. His early efforts, directed toward the student clerkship, have enhanced our "learner-centered" approach and provided a new level of continuity, evaluation, and timely feedback.

Methods: The knowledge and commitment of a professional educator in the Department of Anesthesiology have brought significant improvements to our medical student clerkship:

"Learner-Centered" Education: The goal of tailoring educational efforts to the needs of students began with brief daily meetings between the educator and students. These meetings familiarized the educator and students with each other and served as a forum for comments, suggestions, and complaints. Our educator developed an awareness of some of the challenges inherent to medical education, and the comments that arose in the sessions became the framework for improvement in the program.

Organization of Didactic Teaching Programs: The availability of one person to schedule and oversee the daily student didactics markedly improved our ability to provide these programs in a consistent and timely manner. Student educational experience and satisfaction have increased significantly.

Improvement of Teaching: Our professional educator serves as a resource to faculty looking to improve their teaching skill through the development of objectives, handouts, and effective presentations. In addition, his input has helped us ensure a mix of activities aimed at students with a variety of learning styles. Faculty and residents benefit from his monthly newsletter aimed at increasing awareness and effectiveness of our educational programs.

Consistent Availability: It has historically been difficult for busy clinical faculty to constantly meet the administrative demands of a rotation that incorporates 150 students each year. The presence of a professional educator provides students with a consistent resource within the Department.

Evaluation: Explicit criteria for clinical performance and timely feedback are desirable in any medical school rotation, and the presence of a professional educator has significantly improved our process in these areas. Students receive daily clinical evaluations completed by the faculty based on specific performance criteria. These evaluations are reviewed by the educator and provide an opportunity for formative evaluation at the halfway point of the rotation. We have also improved our multiple choice evaluation tool through analysis and revision of questions. The educator continually tracks examination performance, allowing faculty to focus their teaching efforts on areas of difficulty to students.

Outcomes: The addition of a professional educator has assisted us in remaining the top-rated rotation in the Medical School. Our scores on student experience surveys remain consistently high, with marked improvement in areas related to evaluation and feedback.

Discussion: Physicians, although very well trained in clinical medicine, seldom receive instruction in methods of education. In addition, growing clinical demands make it increasingly difficult to focus adequate attention on maintaining a strong presence of the Department of Anesthesiology in the Medical School curriculum. The addition of a professional educator to our staff has improved faculty teaching and the evaluation, feedback, and interaction with students. This continuous improvement has enabled the Anesthesiology and Perioperative Medicine rotation to remain the highest-rated in the medical school and has contributed to our ability to maintain Anesthesiology as a required component of the curriculum.

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TEACHING MEDICAL STUDENTS GENERAL MEDICAL PRINCIPLES DURING A REQUIRED ANESTHESIOLOGY ROTATION

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Fourth-year medical students at West Virginia University are required to successfully complete a 2-week rotation in the Department of Anesthesiology. This has traditionally been structured to teach anesthesiology principles. We found: 1) Most medical students do not become anesthesiologists, and 2) Two weeks is not long enough to learn anesthesiology. Based on these premises, we developed a program to teach students basic medical principles required for most specialties. We also incorporated several educational principles advanced by our medical school into our program: 1) Educate students to become competent professionals with integrity and compassion with the potential to become community leaders, innovative educators and creative researchers; 2) Promote life-long learning skills; 3) Stimulate interest in primary care fields.

Our program had formerly supplied a basic text to each student and assigned him or her to an operating room every day for two weeks. At the end of the rotation, all students took a written test that determined their grade for the course. We implemented the following changes (rationale in parentheses): 1) All students should understand the steps in a rapid sequence induction and intubation, and must demonstrate this procedure using a simulator. (Physicians use this technique in a variety of fields, particularly in emergency situations. We found that medical students were learning this from our emergency medicine colleagues who have a different approach and understanding of the method.) 2) Students must participate in a minimum number of hours with the anesthesiology team. (The students cannot gain any understanding of anesthesiology if they are not present. We allow students to arrange their schedule in any way they wish with the understanding that they must be present a minimal amount of time. They may put in their time on

nights, weekends, or during regular days, and their time must be documented by the staff to whom they are assigned.) 3) Students should gain an understanding of basic equipment. (Most specialties use blood pressure cuffs, pulse oximeters, IV catheters, and ambu-bags. We include teaching on these and other common devices, including questions on our written take-home exam.) 4) Students cannot learn everything they need to know, but they can locate and utilize good resources. (Our take-home exam gives the students something to work on during "down" time between cases, and includes a variety of questions that must be looked up to answer.) 5) Students should get formative feedback as part of their training. (We have the students ask the attending to comment on their performance on the attendance sheet they sign each day. This gives the student immediate feedback about their performance that day.)

Since its inception three years ago, we have had an overwhelmingly positive response from our medical students. Students can choose to have their rotation at our hospital or at another site. Due to the high number of students who wish to have their rotation here, we now have to limit the number of students that we accept in order to maintain a quality experience. Despite our more rigorous standards and demands, the students indicate that they have a better learning experience. In the past, many students would come on the first day and then "skip out" for the remainder of the rotation. This does not occur now. Despite our decreased emphasis on anesthesiology specifically, we find that the students have a greater interest in our specialty than ever. This is partly due to our timing, but the students also seem to realize that anesthesiologists have expertise that they need to obtain. Once they are interested in what we are teaching, they begin to understand what we do and then they can see themselves doing it. "Selling" the program too hard can also have negative consequences on recruitment, and we make it clear that anesthesiology is not for everyone. Pointing out the relevance of the material to the students is also essential. This is accomplished by finding out the specialty area of interest to the students and tailoring the teaching points to them.

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INTEGRATION OF TRANSESOPHAGEAL ECHOCARDIOGRAPHY ANESTHESIOLOGY RESIDENT EDUCATION AND FUTURE CREDENTIALING OF GRADUATED RESIDENTS

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Background: Anesthesiology Residency Graduates are seeking credentialing in transesophageal echocardiology. The University of Arizona Anesthesiology Residency Program offers two transesophageal echocardiography electives.

Methods: Objectives for the two-transesophageal echocardiography electives were derived from the basic competencies as described in the Practice Guidelines for Perioperative Transesophageal Echocardiography. A proficiency checklist was devised incorporating a performance-based assessment of the objectives for the elective. The resident must present the topic and/or show proficiency in a skill to an Echocardiography Anesthesiology Faculty Member who then signs and dates the report card when the task is completed. The proficiency checklist is put in the resident's file for future reference when the resident requires a letter of proficiency for credentialing.

Conclusion: The Anesthesiology Educator can incorporate teaching and future credentialing by organizing objectives, which can be related to a performance, based assessments of skills and knowledge. The document of proficiency can be used for future credentialing of Anesthesiology Residency Graduates, thus ensuring that the knowledgeable Anesthesiologists are using transesophageal echocardiography in their practice.

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A NEW APPROACH TO TESTING UNIDIRECTIONAL VALVES ON ANESTHESIA CIRCLE SYSTEMS

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Introduction: Safety has long been emphasized by anesthesiologists as paramount to good patient care and, as a result, anesthesia is much less dangerous for patients. However, as equipment still malfunctions, the FDA has provided guidelines for a standardized machine checkout. One aspect of the anesthesia machine inadequately interrogated by the current guideline is unidirectional valve function. Unidirectional valves are addressed only during the ventilator check by watching for movement without any check for leaks. A more thorough evaluation of unidirectional valves may be warranted given that valves malfunction in as many as 15% of all anesthesia machines.[1] Newer anesthesia machines now perform start-up self-tests but these machine self-tests may be inadequate to check unidirectional valve function. Through mastery of this new test of valve function, residents can develop a deeper understanding of the circle system, as well as normal and abnormal patterns of gas flow within that system.

Methods: This new approach to checking unidirectional valves requires only an extra reservoir ("breathing") bag and less than one minute. Starting with a standard circle system, which includes a reservoir bag (Bag A), the test details are as follows:

1. Remove the 22 mm breathing hose from the inspiratory limb and place an extra breathing bag (Bag B) on the inspiratory limb connection.
2. Turn the gas flows as low as the machine will allow. Close the adjustable pressure limiting (APL) valve and press the oxygen flush button to develop a circuit pressure of 30 cm H2O.
3. Both bags should be round and fully inflated (distended).
4. Observe the reservoir bag (Bag A) at least 5 seconds for any deflation.
5. Bag A deflation indicates a leaking expiratory valve.
6. Open the APL valve to decompress the breathing circuit. Evaluate Bag B on the inspiratory limb: if Bag B remains inflated for at least 15 seconds, then the inspiratory valve is not leaking.

Each machine was tested using 1 L and 3 L breathing bags. This same testing was then performed again after a specially fabricated incompetent valve was placed first in the inspiratory limb and then in the expiratory limb.

The Draeger Julien anesthesia machine start-up self-test was performed with the incompetent valve first in the inspiratory limb and then in the expiratory limb.

Results: A total of 18 anesthesia machines (Draeger and Ohmeda) were tested and no leaking inspiratory valves were identified, but one (6%) of the expiratory valves had significant leak. In every instance that a faulty valve was introduced into a machine, the leak of the incompetent valve was confirmed by the test.

Discussion: Identification of a leaking valve was both faster and more obvious using the smaller 1 L breathing bags. The Draeger Julien start-up self-test failed to detect a leaking valve in either the inspiratory or expiratory limb, while this new test identified the existence of valve leaks in both inspiratory and expiatory valves. Educating residents on how to perform this new test would provide a valuable new skill while promoting a deeper understanding of the flow dynamics within a circle system.

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A MEDICAL CENTER APPROACH TO PATIENT SIMULATION

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Due to their recognized value, the number of patient simulators has been increasing in the academic centers in the United States. Some are departmental-based and some are hospital-based. At the University of Louisville, we have built the world's largest academically-based simulation center. It is organized and advertised as a resource available to every department and faculty member in the medical center. The success during the six months the facility has been open has been astounding. There have been more than 1,300 medical student scenario encounters (representing more than 500 different students) during all four years of medical education. More than 100 residents have been trained in the center from many departments. Besides medical student and medical resident education, there have been conscious sedation classes for dental students and dental residents, ACLS for nurses and residents, ATLS courses, CME courses in bioterrorism. We have also given demonstrations to 111 visiting groups, totaling more than 1,250 people who have mostly been high school students. There are more than 50 instructors (mostly faculty) who have now been trained to teach on the simulator. The non-faculty instructors have been nurse educators from the main teaching hospital and the staff of a regional helicopter transport company. The growth during the first six months has been stead and is projected to continue as we add nursing students, other dental students, and allied health students as well as inviting the other area hospitals to use the facility for their educational purposes.

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