A Structured Educational Curriculum for Residents in the Anesthesia Preoperative Evaluation Clinic

B Jericho, P DeChristopher, D Schwartz

Citation

B Jericho, P DeChristopher, D Schwartz. *A Structured Educational Curriculum for Residents in the Anesthesia Preoperative Evaluation Clinic*. The Internet Journal of Anesthesiology. 2009 Volume 22 Number 2.

Abstract

Background: Less than 50% of anesthesia residency programs implement a structured educational curriculum in preanesthesia evaluation for residents. It is unclear whether residents' knowledge base increases after a structured educational curriculum. We hypothesized that residents' knowledge base in preanesthesia evaluation would increase after a structured educational curriculum in the Anesthesia Preoperative Evaluation Clinic (APEC). Description: To evaluate this, seventy-six anesthesia residents were assigned to a two-week rotation in APEC with a structured curriculum in preanesthesia evaluation. The anesthesia residents were tested before (pretest) and after (posttest) the APEC rotation. Residents completed a post-rotation questionnaire to evaluate the curriculum. Evaluation: Posttest mean scores were higher than those of the pretest ($p<0.05$) except for CXR interpretation. Residents evaluated the curriculum and gave a score of 4/5 for perceived achievement of curricular goals for increasing knowledge. Conclusions: A structured curriculum in preoperative evaluation increases anesthesia residents' knowledge base, except for CXR interpretation.

INTRODUCTION

A formally established educational curriculum in preanesthesia evaluation for residents is implemented in only 43% of anesthesia residency programs[1]. Structured curricula in other disciplines, such as internal medicine, have been shown to improve resident knowledge base in that particular discipline[2,3]. It is still not clear, however, whether structured educational curricula in preanesthesia evaluation can improve anesthesia residents' knowledge base. We hypothesize that residents' knowledge base in the preanesthesia evaluation of patients increases after a structured educational curriculum in the Anesthesia Preoperative Evaluation Clinic (APEC). To test our hypothesis, seventy-six anesthesia residents were assigned to a two-week APEC rotation with a structured curriculum and were tested before and after the completion of the rotation on preanesthesia evaluation knowledge base, transfusion medicine, as well as CXR and EKG interpretation. The structured curriculum was developed following a review of the literature and common topics utilized in the preanesthesia evaluation of patients. Since some patients receive preoperative blood transfusions, transfusion medicine is included in the curriculum. Anesthesia residents completed a post-rotation questionnaire evaluating their perceptions of the degree to which goals for knowledge change were achieved and their preferences for the various teaching methods that were utilized.

METHODS

The study protocol was reviewed and approved by the University of Illinois at Chicago (UIC) Institutional Review Board. Subjects included 76 anesthesia residents of the University of Illinois Medical Center at Chicago. Those residents eligible and those who agreed to participate in the study signed written consent forms. There were no residents who did not agree to participate in the study.

The pretests and posttests consisted of 25-item written examinations that were designed in collaboration with the Department of Medical Education at the UIC. The written examination was composed of multiple-choice questions and written interpretations by the residents of EKG tracings and chest x-rays. All examinations were assigned unique identifiers and were graded without knowledge of the identity of the resident. The answers were entered onto a computer spreadsheet for data analysis. The answers to the multiple-choice questions were compared to an answer key and computer graded. The written interpretations of EKG tracings and chest x-rays were graded by the principal

investigator from the spread sheet so there was no knowledge of the resident or group. The examination was scored by the number of correct answers in the entire test and in each domain (knowledge base [questions 1-19], transfusion medicine, CXR and EKG interpretation). The maximum score was 25 points (one for each correct answer) and the minimum score was 0. The multiple choice questions were 19/25 of the points and 6/25 of the points were the CXR and ECG interpretations. Chest x-ray interpretations included normal, left lower lobe infiltrate, right middle lobe infiltrate. EKG interpretations included complete heart block, right bundle branch block, and atrial fibrillation.

The residents were not given any feedback on test performance to protect the confidentiality of the examination content.

The intervention consisted of a structured curriculum incorporated in a two week rotation in APEC involving the preanesthesia evaluation of 25-30 patients per day. Anesthesia attendings were called upon on an as needed basis to discuss complicated cases. The structured curriculum included an APEC syllabus and mandatory once a week training in a) CXR interpretation in the Department of Radiology; b) EKG interpretation in the Department of Cardiology; c) one-on-one EKG interpretation with an attending anesthesiologist; d) lectures in the Department of Internal Medicine on such topics as preoperative pulmonary risk assessment; perioperative cardiac assessment and management; endocrine management of the surgical patient; perioperative anticoagulation; and perioperative management of common hematological disorders; and e)one-on-one tutorial of transfusion medicine. (applications of type and screens, type and crossmatching, transfusion indications, and transfusion reactions). The residents were given a written schedule of the location and time of these lectures and training sessions. The APEC syllabus was a bound collection of selected book chapters and peer-reviewed papers on preanesthesia evaluation. Selected topics included: risk of anesthesia; pulmonary function testing; anesthetic implications of concurrent diseases; malignant hyperthermia; specific genetic diseases at risk for complications during sedation/anesthesia; guidelines on transfusion medicine; regional anesthesia in the anticoagulated patient; interpretation of EKG; cardiac risk assessment for noncardiac surgery; cardiac rhythm management devices; and perioperative use of -blockers.

A post-rotation questionnaire was completed by the residents for curriculum evaluation. This survey was identified by examination number, not name. The residents were asked to rank on a scale of 1- 5 (1=did not address the purpose, 2=achieved the purpose 30%, 3=clearly achieved the purpose, 4=exceeded the achievement of the purpose>50%, 5=significantly achieved the purpose consistently) the following topics and purposes of the curriculum:

1. Syllabus purpose: To add to your knowledge base in the evaluation and optimization of patients preoperatively.

2. Chest x-ray reading purpose: To improve reading of chest x-rays.

3. EKG cardiology conference purpose: To improve EKG reading.

4.One-on-one EKG reading purpose: To improve EKG reading.

5. Internal Medicine lecture purpose: To discuss a variety of pathological processes and their impact in the preoperative evaluation and optimization of patients.

6. Transfusion Medicine lecture purpose: To learn about transfusion medicine and its involvement in the perioperative and intraoperative period.

7. How well did different clinical scenarios/seeing patients allow you to learn about the preoperative evaluation of patients and the optimization of patients prior to the operating room?

8. How well did discussing cases with attending anesthesiologists allow you to learn about the preoperative evaluation of patients and the optimization of patients prior to the operating room?

The data was consolidated in a computerized table by an independent party and analyzed. The residents also made qualitative comments on each of the above points.

STATISTICAL ANALYSIS

Statistical analysis was performed using SAS Statistical Software Series 9.1.3 (SAS Institute Inc. Cary, North Carolina, USA). Results were considered significant at $p<0.05$. Repeated measures ANOVA analysis was used to test the difference between pretest and posttest mean scores.

Normality assumption was checked for the total scores and the scores in each domain. Wilcoxon and McNemar tests were two different nonparametric statistic tests used to

analyze CXR and EKG interpretation because these questions were correlated binary data.

For the post-rotation questionnaire, a two-sample t-test .and two-sided Wilcoxon rank sum test were used.

RESULTS

Knowledge: Anesthesia residents' knowledge base in preanesthesia evaluation increased after a structured curriculum in preanesthesia evaluation, except for chest x-ray interpretation. We compared the pretest mean scores for the entire test and in each domain with the posttest mean scores. The posttest mean total score and the posttest mean scores of transfusion medicine, knowledge base, and EKG interpretation were higher than those of the pretest. (Table 1, $p < 0.05$). The CXR interpretation posttest mean scores, however, were not significantly higher than the pretest mean scores (Table 1, $p>0.05$).

Figure 1

Table 1: Comparison of Pretest and Posttest Mean Scores

Variable	Mean	Standard Deviation	P value
Pretest Total Score	9.8	2.8	<0.0001
Posttest Total Score	14.3	3.1	
Pretest Transfusion	2.6	1.2	<0.0001
Posttest Transfusion	4.3	1.5	
Pretest EKG	0.5	0.7	<0.0001
Posttest EKG	1.4	0.9	
Pretest CXR	1.2	0.7	0.1621
Posttest CXR	1.4	0.8	
Pretest Knowledge	8.1	2.4	<0.0001
Posttest Knowledge	11.5	2.7	

*repeated measure ANOVA analysis

Curriculum Evaluation: One-on-one EKG interpretation with an attending anesthesiologist, transfusion medicine tutorial, experiencing different clinical scenarios, and discussing cases with attending anesthesiologists were the interventions with the highest mean score of 4, i.e. exceeded the achievement of the purpose>50% (Table 2). Sixty percent of the responses were proportioned as the highest score of 5 for one-on-one EKG reading (Table 2). Also, this component of the evaluation received the highest percentages of the residents' responses as a score of 5 (Table 2). Lectures from outside departments received lower scores on the residents' evaluations. The residents' evaluation of the structured curriculum indicated that the syllabus was a good reference, but it contained too much material to cover in two weeks. Per the residents' comments, the curriculum enhanced their confidence in the preoperative evaluation of patients ("I feel more confident about the types of questions and management decisions than before doing the APEC rotation").

Figure 2

Table 2: Post Rotation Questionnaire Scoring Response Summaries of Syllabus, Chest x-ray Reading, EKG Cardiology Conference, One-on-One EKG Reading, Internal Medicine Lectures, Transfusion Medicine Lecture*

	Mini-mum	Median	Maxi-mum	Mean	Std	Score Proportion (%) 1	2	3	4	5
Syllabus	2	4	5	3.7	1.1	0	14.6	33.3	22.9	29.2
CXR Reading	1	3	5	3.0	1.1	12.2	19.5	34.2	26.8	7.3
EKG Cardiology Conference	1	3	5	3.0	1.5	23.1	18.0	18.0	20.5	20.5
One-on-One EKG Reading	2	5	5	4.3	0.9	0	4.3	17.4	19.6	58.7
Internal Medicine Lecture	1	3	5	2.8	1.4	25.8	19.4	19.4	22.6	12.9
Transfusion Medicine Lecture	2	4	5	4.1	1.0	0	6.4	21.3	29.8	42.6
Clinical Evaluation of Patients	2	4	5	4.0	0.9	0	4.2	25.0	33.3	37.5
Discuss Cases with Attending Anesthesiologist	2	4	5	4.0	1.0	0	6.3	27.1	25.0	41.7
Rotation Contributing to Knowledge	2	4	5	3.9	0.9	0	6.3	22.9	43.8	27.1

Scoring Responses
1=did not address the purpose
2=achieved the purpose 30%
3=clearly achieved the purpose
4=exceeded the achievement of the purpose>50%,
5=significantly achieved the purpose consistently
*two-sample t-test; two-sided Wilcoxon rank sum test

CONCLUSION

This study shows that a structured educational curriculum in preanesthesia evaluation increased anesthesia residents' knowledge base in preanesthesia evaluation except for CXR interpretation. Furthermore, the anesthesia residents' evaluation of this curriculum indicated that it was a useful tool to improve their knowledge base and that it enhanced their confidence in preanesthesia evaluation. The residents preferred one-on-one-teaching over lecture/group sessions.

The anesthesia resident's knowledge base in CXR reading did not improve. Factors that can explain this result include learning style, the content of the educational experience, the

frequency of the instruction, and resident effort.

The residents' evaluation of the curriculum indicated that the syllabus was a good reference, but it contained too much material to cover in two weeks. Potentially, the syllabus could be given to the resident several weeks prior to the APEC rotation or the content of the syllabus could be stream-lined, an approach we have since taken.

We believe that the beneficial effects of a structured educational curriculum are found not only in the specific content of the curriculum but also in the way the curriculum is structured to adapt to the diverse learning styles of the residents. It has been shown that individuals have different learning styles. Some prefer to learn by hearing the information and some prefer to visualize the information. Using different teaching methods helps overcome individual preferences for learning, helps maintain the students' interest, and helps reinforce the information[4]. This reinforcement of learning can enhance the depth of learning, promote the retention of information, and enhance the ability to apply what has been learned[4]. Our structured curriculum included methods of teaching involving group lectures (audible learning); a syllabus (independent study using written information); and one-on-one learning sessions, such as EKG interpretation (instructor-guided visual learning) and a transfusion medicine tutorial.

The tutorials in transfusion medicine and one-on-one lectures on EKG reading were well received by the anesthesia residents; however, group lectures from other departments received lower scores on the residents' evaluations secondary to administrative issues (no scheduled lecture, absence of faculty, etc.) and lack of consistency of the content of the lectures (not all lectures actually addressed preoperative evaluation). Further coordination and consistency in the curriculum with outside departments should be implemented in the future.

DISCUSSION

The residents expressed that discussing cases with an attending anesthesiologist contributed significantly to their knowledge base in the preanesthetic evaluation of patients prior to the operating room. Yet, the financial ability of a department to staff a full time anesthesiologist in preadmission testing, for one-on-one teaching of residents may not be feasible. Furthermore, the interest of available staff in preadmission testing clinics may not be present. Tsen and colleagues stated that about one third of surveyed anesthesia residency programs reported zero to 10% of their staff had any interest or proficiency in preadmission testing[1] . The University of Illinois has now staffed APEC with an attending anesthesiologist on a full-time basis.

In summary, this study shows that a structured educational curriculum in preanesthesia evaluation increased anesthesia residents' knowledge base, except in CXR interpretation. This increase in knowledge can contribute to the optimization of a patient's medical status prior to surgery and ultimately lead to achieving all of the benefits that derive from a thorough preanesthesia evaluation such as decreased surgical morbidity, decreased costs through minimization of expensive delays and cancellations on the day of surgery, and reduced patient anxiety[5].

We feel that this structured educational curriculum in preanesthesia evaluation is useful and should be adaptable for other programs. One of the limitations is that there will be a need to use validated outcome and assessment measures in the future. Another limitation is the small number of participants, which limits the ability to generalize results. However, because of the great impact of preanesthesia evaluation on the optimization of a patient's medical status prior to surgery and the subsequent impact on patient care, operating room efficiency and education, we feel that anesthesia residency programs can benefit from a structured educational curriculum in APEC.

ACKNOWLEDGEMENTS

Dr. PM Buttrick and the Department of Cardiology, University of Illinois at Chicago for providing instruction in EKG interpretation.

S Berlowitz , Drs. MF Mafee and P Talwar and the Department of Radiology, University of Illinois at Chicago for providing instruction in CXR interpretation.

Dr. Elizabeth Lincoln and the Department of Internal Medicine, University of Illinois at Chicago for providing preoperative internal medicine lectures.

Phil Bashook, EdD, and the Department of Medical Education, University of Illinois at Chicago for the review of the written APEC examination and assistance in entering data for analysis.

Suzann Campbell DeLapp, PhD, University of Illinois at Chicago for a critical review of the manuscript.

Waikua Gao, MS and Wei-Min Liang, MS, Quantitative Biomedical Sciences Program, School of Public Health,

University of Illinois for data analysis.

References

1. Tsen LC, Segal S, Pothier M, Bader A. Survey of residency training in preoperative evaluation. Anesthesiology 2000; 93(4):1134-37
2. Kollas CD, Frey CM. A medicolegal curriculum for internal medicine residents. J Gen Intern Med 1999;14:441-3
3. Alguire PC, Anderson WA, Henry RC. Teaching research skills: development and evaluation of a new research program for residents. Teaching and Learning in Medicine 1993;5(1):37-43
4. Kern DE, Thomas PA, Howard DM, Bass EB. Curriculum development for medical education: A six-step approach. Baltimore: The Johns Hopkins University Press, 1998. 39-40,71.
5. Fischer, SP. Cost-effective preoperative evaluation and testing. Chest 1999;115 (Supplement 2):965-1005.

Author Information

Barbara G. Jericho, MD
Departments of Anesthesiology, University of Illinois Medical Center at Chicago

Phillip J. DeChristopher, MD, PhD
Department of Pathology, Loyola University Medical Center

David E. Schwartz, MD, FCCP
Departments of Anesthesiology, University of Illinois Medical Center at Chicago