



Original Contribution

Comparison of the didactic lecture with the simulation/model approach for the teaching of a novel perioperative ultrasound curriculum to anesthesiology residents[☆]



Davinder Ramsingh MD (Assistant Professor)^{a,*},
Brenton Alexander BS (Medical Student II)^b, Khanhvan Le BA (Research Assistant)^a,
Wendell Williams MD (PGY-4 Resident)^a,
Cecilia Canales MPH (Director of Operations, Simulation Center)^a,
Maxime Cannesson MD, PhD (Professor of Anesthesiology)^a

^aDepartment of Anesthesiology, University of California at Irvine Medical Center, Orange, CA 92868, USA

^bUniversity of California at Irvine School of Medicine, Orange, CA 92868, USA

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Abstract

Study Objective To expose residents to two methods of education for point-of-care ultrasound, a traditional didactic lecture and a model/simulation-based lecture, which focus on concepts of cardiopulmonary function, volume status, and evaluation of severe thoracic/abdominal injuries; and to assess which method is more effective.

Design: Single-center, prospective, blinded trial.

Setting: University hospital.

Subjects: Anesthesiology residents who were assigned to an educational day during the two-month research study period.

Measurements: Residents were allocated to two groups to receive either a 90-minute, one-on-one didactic lecture or a 90-minute lecture in a simulation center, during which they practiced on a human model and simulation mannequin (normal pathology). Data points included a pre-lecture multiple-choice test, post-lecture multiple-choice test, and post-lecture, human model-based examination. Post-lecture tests were performed within three weeks of the lecture. An experienced sonographer who was blinded to the education modality graded the model-based skill assessment examinations. Participants completed a follow-up survey to assess the perceptions of the quality of their instruction between the two groups.

Main Results: 20 residents completed the study. No differences were noted between the two groups in pre-lecture test scores ($P = 0.97$), but significantly higher scores for the model/simulation group occurred on both the post-lecture multiple choice ($P = 0.038$) and post-lecture model ($P = 0.041$) examinations. Follow-up resident surveys showed significantly higher scores in the model/simulation group regarding overall interest in perioperative ultrasound ($P = 0.047$) as well understanding of the physiologic concepts ($P = 0.021$).

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* Correspondence: Davinder Ramsingh, MD, Department of Anesthesiology, University of California at Irvine Medical Center, 333 The City Blvd., Suite 2150, Orange, CA 92868, USA. Tel.: (714) 456–5501; fax: (714) 456–7702.

E-mail address: dramsing@uci.edu (D. Ramsingh).

Conclusions: A model/simulation-based based lecture series may be more effective in teaching the skills needed to perform a point-of-care ultrasound examination to anesthesiology residents.
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1. Introduction

Point-of-care ultrasonography may be defined as ultrasonography brought to the patient and performed by the provider [1]. Anesthesiologists commonly use this modality to aid regional anesthesia and central venous access. However, as point-of-care ultrasonography has advanced, further use of this technology has increased in the areas of hemodynamic monitoring and cardiopulmonary function [2].

For assessment of hemodynamic monitoring, numerous studies have shown the benefit of ultrasound for evaluation of intravascular volume status via inferior vena cava collapsibility and assessment of left ventricular end-diastolic area [3–7]. Point-of-care ultrasonography has also proven to be critical in the assessment of hemodynamic instability. The Focused Assessment with Sonography for Trauma (FAST) [8] examination is a highly effective tool in the detection of hemoperitoneum and hemopericardium [9–12]. In addition, examination of the cardiopulmonary system using bedside point-of-care ultrasound technology provides comparable reliability when compared with formal echocardiography [13,14]. The ability to train noncardiologists to perform and interpret this focused examination has been demonstrated [15,16]. Ultrasound assessment of pulmonary function and injury recently gained significant interest [17,18] and point-of-care sonography is the most sensitive tool in the detection of pneumothorax [19,20]. In addition, nonexperienced personnel have been trained efficiently to detect pneumothorax with point-of-care sonography [21]. It has now become a much more user-friendly technology, and may be more easily taught to physicians with no advanced ultrasound training.

Point-of-care ultrasound is capable of helping the perioperative physician with far more than central venous access and regional anesthesia. This point encourages the development of a point-of-care education curriculum for anesthesiologists. One is challenged to determine the best method of training point-of-care ultrasonography. Other studies of anesthesiology residents and practicing anesthesiologists showed that training on a simulator improves the acquisition and retention of knowledge in comparison to traditional lectures [22,23]. Specifically, simulation is beneficial in fiberoptic intubation skills [24] and unanticipated difficult airway [25]. Park and colleagues studied the efficacy of a simulation-based critical events curriculum for novice anesthesiology residents and showed accelerated acquisition of skills in the management of critical events involving hypoxemia and hypotension versus traditional methods of didactics and routine clinical operating room

(OR) care [26]. These studies support the concept of simulation for improved education for anesthesiologists, a point that has been encouraged by the ASA [27]. This study sought to assess the use of simulation training in improving the ability of anesthesiology residents to understand the concept of a perioperative ultrasound examination.

We hypothesized that implementation of a comprehensive ultrasound curriculum using a model/simulation-guided learning strategy would significantly improve resident post-training performance on a “hands-on” human model (normal pathology) and written multiple-choice examinations. Specifically, we assessed for a Kirkpatrick Level 2 outcome; we evaluated the use of a model/simulation teaching strategy in improving knowledge retention and ultrasound performance skills as determined by post-lecture multiple-choice tests and post-lecture human model ultrasound performance examinations.

2. Materials and methods

2.1. Study overview

This study was approved by the University of California Irvine Medical Center Institutional Review Board (HS #2010-7527). All anesthesia residents provided written informed consent prior to participating. This single-center, blinded, prospective trial analyzed the utility of a perioperative ultrasound examination for anesthesiology residents by comparing standard didactic lecture with a model/simulation-based curriculum. The perioperative ultrasound examination focused on basic interpretation of cardiopulmonary function, volume status, and evaluation for severe thoracic/abdominal injuries (Fig. 1). The specific objectives, which are listed in Fig. 2, include overall cardiac function, evidence of gross valvular abnormalities, fluid status, and existence of significant thoracoabdominal hemorrhage. Of note, the FAST examination was incorporated into this curriculum secondary to the potential utility of this examination to diagnose and quantify postoperative bleeding from abdominal/pelvic surgical procedures.

2.2. Study population

The study population consisted of 20 current anesthesiology residents at UCI Medical Center, which accounts for 65% of the clinical anesthesia (CA) CA1 to CA3 classes. Residents were separated between didactic and model/simulation methods of learning such that they were equally

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