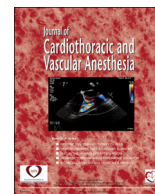


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Special Article

Anesthesia Residency Training in Cardiac Anesthesia: Development of a Model Curricula and Educational Resources: The Anesthesia Toolbox

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CURRENT RESIDENCY TRAINING in anesthesiology in the United States is composed of 3 years of supervised clinical experience with increasing independence, culminating in independent practice. In a heavily task-oriented specialty such as anesthesiology, the majority of resident experience is composed of intraoperative, clinically-oriented learning. Despite the movement in graduate medical education toward competency-based education, which calls for a greater degree of granularity in the knowledge, skills, and behaviors for which residents must demonstrate competency, there is little guidance for the development and implementation of curricula in cardiothoracic anesthesia education for anesthesia residency training.¹ Thus, there is wide variability in curriculum design and educational experiences for cardiothoracic anesthesia training among different residency programs. This problem is further compounded by a dependence on mentoring during clinical care as a primary means of education. The clinical environment is unpredictable, and it is inherently difficult to standardize educational experiences among trainees because exposure to patients and clinical scenarios is widely variable.²

This is a particularly important factor if the duration of clinical exposure is limited and a large clinical volume and variety are unavailable to ensure a consistent distribution of patient comorbidities, surgical procedures, and clinical situations for each trainee. Cardiothoracic anesthesia training during anesthesia residency often is only 2 to 3 months. To ensure more uniform educational exposure, all training programs supplement clinical experience with other educational experiences, ranging from lectures to simulation. Unfortunately, as mentioned, there is limited guidance on what specific educational experiences should be included in an overall cardiothoracic curriculum. With increasing work-hour regulations, lack of standardization of educational experiences, and movement toward competency-based assessment, programs must be efficient, effective, and creative in curriculum development and implementation. Because of the wide range of skill sets required, including invasive monitoring procedures and transesophageal echocardiography (TEE), cardiac anesthesia is particularly amenable to using video and blended e-learning approaches in teaching.

This qualitative review summarizes the available guidance on the creation of a cardiothoracic anesthesia curriculum from the anesthesia residency program requirements and the American Board of Anesthesiology (ABA) content outline and review-published resources that can inform curriculum development, including descriptions of cardiovascular fellow training and

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Table 1
Current State and Needs for Cardiothoracic Anesthesia Resident Training

What we know:

- Anesthesia training is transitioning toward a competency-based educational model.
- Cardiovascular anesthesia is becoming more complex.
- Duty hour restrictions limit resident training.
- Resident training is variable and depends on exposure to clinical cases and faculty.
- Training programs have increasingly limited resources.
- Online learning can supplement experiential learning

What we need:

- Standardized curricula for resident training in cardiac anesthesia
- Development of peer-reviewed resources to support self-guided learning
- Development of peer-reviewed resources to support faculty in conducting learning activities
- Shared training resources across programs
- Use of modern educational technology in residency training

TEE training. The review concludes with a description of the Anesthesia Toolbox—a recent effort to define curricula for resident cardiothoracic training that includes e-learning and faculty resources. Notably, all Toolbox materials are peer-reviewed and are shared with participating programs via an online learning platform (Table 1).

Accreditation and Certification Requirements

The primary source that guides American anesthesia residency training is the program requirements provided by the American College of Graduate Medical Education (ACGME). The ACGME provides an educational framework that delineates minimum requirements for accredited residency programs. For the subspecialty of cardiothoracic anesthesia, the ACGME specifies a minimum time-based requirement of two 1-month rotations. It further requires the care of 20 patients with cardiac disease, half of whom require the use of cardiopulmonary bypass (CPB).³ With regard to specific procedural skills, the ACGME program requirements specify that residents must care for patients requiring “specialized techniques including central venous catheters, pulmonary artery catheters, and the use of transesophageal echocardiography (TEE).” From a programmatic viewpoint, the ACGME specifies that formal teaching should occur in regularly scheduled didactic sessions with continuity in a logical sequence of topics for each level of learning. These guidelines provide a general structural framework for cardiothoracic training; however, they provide scant information from which to develop a curriculum for residency training in cardiothoracic anesthesia.

The ACGME has transitioned from a time-based service requirement to a competency-based assessment system with competency milestones. The objective underlying the milestone system is to identify core competencies and list the developmental stages of these competencies.⁴ In anesthesia, the 6 core competencies are patient care, medical knowledge, systems-based practice, practice-based learning and improvement, professionalism, and interpersonal and communication skills. Each core competency includes specific competency

milestones. Residents are rated on a scale of 1 to 5 for individual milestones and are expected to progress and demonstrate competency for each milestone at their own pace.

The ACGME materials contain several milestones that generally are applicable to cardiothoracic anesthesia training. For example, Patient Care 1: Pre-anesthetic Patient Evaluation, Assessment, and Preparation specifies that to reach level 3, the trainee must be able to demonstrate that he or she can “optimize(s) preparation of patients with complex problems or requiring subspecialty anesthesia care with direct supervision.”⁴ Table 2 lists those few ACGME milestones that have a direct tie to cardiothoracic training. As with the program requirements, each program is allowed the freedom to develop educational curricula tailored for its clinical environment and experiences. Unfortunately, this lack of detail provides insufficient guidance for programs in developing curricula, and the simultaneous development efforts at different programs lead to reinventing the wheel and a great deal of duplicated effort.

Guidance for Curriculum Content

The ABA publishes an outline of topics tested on certifying examinations. Table 3 lists the ABA content topics relevant to cardiothoracic anesthesia training. Another source of content for potential inclusion in a resident cardiac anesthesia curriculum is the ACGME program requirements for fellowship training in adult cardiothoracic anesthesia.⁶ These requirements are based on the ACGME competency domains previously outlined; however, they are much more detailed than those provided for residency training. For example, the fellowship document includes a requirement for knowledge of the embryologic development of cardiothoracic structures. Although directed at fellow-level training, the greater specificity of these requirements could be used to guide the development of a resident curriculum.

Published Curricula and Educational Resources for Cardiac Anesthesia Training

A comprehensive cardiothoracic anesthesiology resident curriculum should aim to teach residents the trifecta of clinical knowledge, procedural skills, and basic echocardiography. A

Table 2
ACGME Milestones Pertinent to Cardiac Anesthesia

Core Competency	Skills
Patient care	Patient evaluation, assessment, preparation Anesthetic plan and conduct Management of perianesthetic complications Crisis management Technical skills: use and interpretation of monitoring and equipment (includes arterial catheters, central venous catheters, and advanced techniques for assessing cardiac function, including pulmonary artery catheters and transesophageal echocardiography)

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