

Teaching Cardiac Anesthesia: The Challenge of Intraoperative Echocardiography

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Although echocardiography has been in clinical use for more than 20 years, it is still a relatively new technique in the practice environment of anesthesiologists. While the clinical benefits of perioperative echocardiography are well established, the problems surrounding training and certification are widespread. In some institutions, cardiothoracic anesthesiologists and cardiologists have jointly developed a structured educational program for education in perioperative echocardiography that includes full-time assignment to the echocardiography laboratory.¹ In many institutions, however, the demands of clinical practice preclude full-time assignment to the echocardiography laboratory and more flexible training pathways have been explored. Some experts such as Cahalan et al. have suggested that transesophageal echocardiography (TEE) can be safely and effectively learned "on the job" provided that an expert or "mentor" is available to ensure that essential information is not missed.² This apparent lack of consensus in an area that is deemed critical to the growth of anesthesiology as a profession has stimulated professional anesthesia organizations to study the issue and to suggest solutions.

The main goal of this presentation is to describe the involvement of the Society of Cardiovascular Anesthesiologist (SCA), in collaboration with the American Society of Anesthesiologists (ASA) and the American Society of Echocardiography (ASE), in the development of guidelines for training and certification in perioperative transesophageal echocardiography.

Training

Problems with education in echocardiography have been recognized since the earliest days of the technology. In an editorial in 1974, Harvey Feigenbaum described the growing demands from clinicians for echocardiographic information, yet deplored the paucity of adequately trained echocardiographers.³ A similar dilemma exists today for cardiothoracic anesthesiologists. Many cardiac surgeons and cardiac surgical programs rely on echocardiography for intraoperative decision-making. Cardiothoracic anesthesiologists are expected to be proficient in all aspects of intraoperative echocardiography, yet few have benefited from a formal education in the technique.

Over the years, professional organizations of many countries have published recommendations and guidelines concerning training in echocardiography.^{4,5,6,7,8} In the United States, the ASE has taken the lead in the development of training guidelines for echocardiography. In 1988, the ASE Committee for Physician Training in Echocardiography published Guidelines for Optimal Physician Training in Echocardiography.⁹ The principal themes of the recommendations were the following:

1) Physicians who take responsibility for the performance and interpretation of echocardiography should, have a clear understanding of the fundamental principles of, and practical experience with, all of the echocardiographic techniques.

2) Physicians who take responsibility for the performance and interpretation of echocardiography should have a broad background knowledge that spans the physical principles of echocardiography, echocardiographic instrumentation, the experience needed to recognize normal and abnormal information, and experience with other cardiac diagnostic techniques.

3) Physicians training in echocardiography ideally should spend a specified period of time in an active echocardiographic laboratory, working under the direction of an experienced echocardiographer who has achieved an advanced level of training; the levels of training were summarized in table format.

4) Techniques in echocardiography evolve rapidly and, therefore, physicians responsible for the performance and interpretation of echocardiographic examinations should maintain active and ongoing continuing education in the field.

In 1993, the ASA and the SCA established an Ad Hoc Task Force on Practice Parameters for Transesophageal Echocardiography to develop evidence-based guidelines on the proper indications for performing TEE in the operative setting. The task force divided its recommendations into 3 categories based on the strength of supporting evidence or expert opinion that the technology improves clinical outcomes.¹⁰ Although the primary goal of the task force was to develop recommendations on the indications and contraindications for TEE in the perioperative period, it was also specifically instructed to examine the issues of training and certification for anesthesiologists. The task force referred to two levels of training in perioperative TEE, basic and advanced. Both basic and advanced TEE training referred to specialized TEE training that extended beyond the minimum exposure to TEE that occurs during normal anesthesia residency training. Anesthesiologists with basic training were considered able to use TEE for

indications that lie within the customary practice of anesthesiology. Anesthesiologists with advanced training were considered, in addition to the above, to be able to utilize the full diagnostic potential of perioperative TEE.

The task force realized, however, that anesthesiologists with basic training would occasionally encounter unanticipated diagnostic issues that required the assistance of a physician with advanced TEE training. Anesthesiologists with basic training should, therefore, be able to recognize their limitations in this setting and request assistance in a timely manner from a physician with advanced training. The task force recognized that, once basic training had been completed, advanced training could occur along a continuum and in a gradual manner. Learning curves would vary from individual to individual, but were likely to be substantial for some of the TEE applications requiring advanced training. Because it is essential for many intraoperative applications to obtain a definitive interpretation of the TEE exam at the time of surgery, the task force strongly recommended that anesthesiologists actively pursue collaboration with surgeons, cardiologists or other physicians, involved in a patient's care.

Certification

In response to the concerns of its members, the leadership of SCA appointed a Task Force for Certification in Perioperative Transesophageal Echocardiography in 1996. The first assignment of the task force was to define the body of knowledge that would be tested in an examination. A content outline consisting of 23 knowledge categories was compiled by the task force and mailed to all active members of SCA. Subsequently, the task force compiled more than 250 multiple choice questions in the various categories of the content outline. It also developed multiple choice questions that were associated with 15 echocardiographic cases, recorded on videotape. On April 24, 1998, the first formal certification examination in perioperative transesophageal echocardiography was conducted in Seattle. The examination was open to all physicians and was administered by the NBME; 243 physicians participated in the exam. A total of 200 items were selected consisting of 159 non-video questions and 41 video questions. The exam began with a 50-minute videotape and was followed by the non-video questions. In early July 1998, the candidates received a pass/fail score and detailed results of their examination.

While the SCA Task Force on Perioperative Transesophageal Echocardiography was developing its examination, the leadership of SCA began discussions with ASE to create the **NATIONAL BOARD OF ECHOCARDIOGRAPHY (NBE)**. The leadership of the NBE consists of a Board of Directors with fixed representations from adult cardiology, pediatric cardiology, and anesthesiology. The NBE assumes responsibility for the certification of all physicians in echocardiography. At present, at least two examination pathways are available: one in general echocardiography and one in perioperative transesophageal echocardiography. In the future, additional examination pathways may be considered. The first certification examination in perioperative transesophageal echocardiography of the National Board of Echocardiography was conducted on April 28, 1999 in Chicago, IL.

¹ Savage R, Licina M, Koch C, et al. Educational program for intraoperative transesophageal echocardiography. *Anesthes Analg* 1995; 81: 399-403

² Cahalan M, Foster E. Training in transesophageal echocardiography: In the lab or on the job? *Anesthes Analg* 1995; 81: 217-218.

³ Feigenbaum H. Editorial: Educational problems in echocardiography. *Am J Cardiol* 1974; 34: 741-2

⁴ Recomendaciones sobre el entrenamiento en ecocardiografia. *Rev Esp Cardiol* 1990; 43: 135-6

⁵ Dumesnil JG, et al. Recommendations for physician training in Doppler echocardiography. *Can J Cardiol* 1991; 7: 281-6.

⁶ Training in echocardiography. Education and training subcommittee of the British Society of Echocardiography. *Br Heart J* 1994; 71: 2-5

⁷ Chan KL, Alvarez N, Cujec B, et al. Standards for adult echocardiography training. Canadian Cardiovascular Society Committee. *Can J Cardiol* 1996; 12: 473-6

⁸ Roudaut R, Touche T, Cohen A, et al. Recommendations de la Societe Francaise de Cardiologie concernant la formation des echocardiographistes et la realisation des echocardiogrammes. *Arch Mal Coeur Vaiss.* 1998; 1-Suppl: 7-14.

⁹ Pearlman AS, Gardin JM, Martin RP, et al. Guidelines for Optimal Physician Training in Echocardiography. *J Am Soc Echocardiogr.* 1988; 1: 278-284

¹⁰ Practice Guidelines for perioperative transesophageal echocardiography. A report by the American Society of Anesthesiologists and the Society of Cardiovascular Anesthesiologists Task Force on Transesophageal Echocardiography. *Anesthesiology* 1996; 84: 986-1006