

EDITORIAL

Perioperative Transesophageal Echocardiography: Advances and Challenges

Kathirvel Subramaniam, Balachundhar Subramaniam, Goverdhan Dutt Puri

How to cite this article: Subramaniam K, Subramaniam B, Puri GD. Perioperative Transesophageal Echocardiography: Advances and Challenges. *J Perioper Echocardiogr* 2013; 1(1):1-3.

Source of support: Nil

Conflict of interest: None declared

The history of perioperative transesophageal echocardiography (PTE) dates back to the 1980s when intraoperative transesophageal echocardiography (TEE) was found to be a preferable modality for evaluation of repaired or reconstructed mitral valve.^{1,2} It was also found to be an extremely useful tool to monitor for ischemia in high-risk cardiac and noncardiac surgery.³ The potential for diagnostic use of TEE during routine cardiac surgery was recognized soon after. Cardiac anesthesiologists (some of them trained cardiologists who became anesthesiologists) at major cardiovascular surgical institutions in North America promoted the practice and education in diagnostic intraoperative TEE for anesthesiologists in the early 1990s. The American Society of Anesthesiologists (ASA) and the Society for Cardiovascular Anesthesiologists (SCA) jointly published PTE guidelines in 1996; the SCA and the American Society for Echocardiography (ASE) have published several updates to the guidelines since then.^{4,5} Over the years, cardiologists and cardiac anesthesiologists have worked together tirelessly to standardize the practice of intraoperative TEE; the results are evident in the improved outcomes of cardiac surgical patients.

Advances in PTE education paralleled the advances in the practice of PTE among anesthesiologists. As the cardiologists ventured more into interventional procedures, research and advances in TEE was increasingly the anesthesiologist's domain. Development of the PTE examination, certification of physicians by the National Board of Echocardiography (NBE) to practice PTE, and the establishment of training requirements for fellows and practicing physicians are some of the key advances in PTE education. Several other countries (Canada, European countries, Australia, New Zealand, Japan, China and India) developed similar protocols for the education and practice of PTE. Since, there are well-established protocols and guidelines available for the practice of PTE by anesthesiologists, it is time to look further and fill in the gaps in perioperative echocardiography practice and education.

Development of new surgical techniques, such as minimally invasive cardiac surgery, robot-assisted cardiac surgery, catheter-based interventions, endovascular surgery and hybrid surgical procedures demand the more intense involvement of an intraoperative echocardiographer. A pre-bypass and another post-bypass examination are no longer sufficient to satisfy the needs of modern cardiac surgery. TEE has become a dynamic continuous monitor to assist in each and every step of the surgical procedure (cannulations, cardioplegia delivery, device deployment, etc.) and the success of the procedure heavily depends on echocardiography skills.

Further, new echocardiography modalities have been developed to improve the diagnosis of cardiac diseases and evaluate the hemodynamic significance of those diseases. Real-time three-dimensional echocardiography (RT3DE) has proven useful in the diagnosis and therapy of mitral valve diseases, evaluation of left ventricular function and guiding catheter-based interventions. Tissue Doppler and speckle tracking echocardiography are slowly finding their way into routine echocardiography practice, and RT3DE may also be a part of the standard PTE protocols in the near future. These modalities are also picking up in developing countries, which depend on literature from the western world to keep up with the latest advances. On the other side of the coin, the spectrum of cardiac disease in developing countries is markedly different from those in developed countries. For example, rheumatic and congenital heart diseases (CHD) are still common in developing countries. The practice of cardiology from these regions has the potential to enrich our knowledge and literature remarkably and deserves to be harnessed for propagation and discussion to the maximum.

Further, in the developing world, the cardiac anesthesiologists often need to care for the pediatric as well as adult cardiac surgical patients. Whether or not anesthesiologists should perform perioperative echocardiography for pediatric patients with CHD is also debated.^{6,7} The scenario differs significantly in the developing and the western world. Most centers in the west currently have cardiologists come to the operating room for intraoperative TEE. In the developing world, PTE has been the domain of the anesthesiologists or the surgeons, varying between centers. In this situation, there will be

significant benefit from the development of guidelines and protocols by pediatric cardiac anesthesiologists in collaboration with pediatric cardiologists.

However gradually, all over the world, echocardiography in general is transitioning to being a skillset developed in early years of cardiology training or among technicians. PTE is also in a state of flux, with the field of the anesthesiologist gradually expanding from only intraoperative TEE to pre- and postoperative assessment and monitoring. In some centers in the developing world, anesthesiologists in the critical care unit setting are using TEE for clinical evaluation and management in various stages of cardiac disease management.

It is also somewhat intuitive that the use of echocardiography techniques for evaluation of hemodynamic instability after cardiac surgery will establish the definitive etiology sooner than any other monitoring.⁸ Miniature echocardiography probes available on the market produce limited echocardiographic views for monitoring purposes and can be left in place for extended postoperative monitoring for 48 hours. Ultrasound for critical care is gaining momentum, as global organizations, such as the World Interactive Network Focused on Critical Ultrasound (WINFOCUS) promote ultrasound education for intensivists.⁹ However, formal guidelines for training anesthesiologists for TTE and focused PTE are still lacking.

Further, the usefulness of PTE monitoring in noncardiac surgery (i.e. vascular, thoracic, orthopedic and trauma surgery) has been addressed in several reports. Cardiac anesthesiologists may not be able to cover all surgical patients, especially during emergencies, such as trauma surgery. Hence, the time to teach basic echocardiography to noncardiac anesthesiologists has arrived, and the SCA is already moving in that direction in the West.

Until now, PTE education and practice primarily focused on cardiac anesthesiologists. Several barriers in implementing basic TEE training for general anesthesiologists should be noted.¹⁰ Training general anesthesiologists should not in any way compromise resident and fellow training, given the limited number of cardiac surgeries done nowadays, even in tertiary centers. The time and cost involved in teaching general anesthesiologists on the job could be significant. Since, this program is still in the pilot stages, continuous quality assessment of the training and practice is essential.

Methods for teaching echocardiography have evolved over the years. Initial teaching methods involved learning basic TTE skills with cardiologists in the echocardiography laboratory. As anesthesiologists' experience increased, it was felt that training and experience in optimal and resourceful use of PTE for guiding intraoperative surgical

interventions were best gained by being present in the operating room and learning to assist during the crucial stages of a surgical procedure. Web-based resources, continuing medical education conferences, journals and books with video resources have introduced different dimensions to perioperative echocardiography education. Simulation technology has also been utilized in echocardiography education; the role of simulation should be clearly defined based on outcome studies.

At this stage, it is useful to establish three different levels of PTE practice: Basic PTE for all interested practicing anesthesiologists and anesthesia trainees, advanced PTE for cardiac anesthesiologists, and few 'perioperative echocardiography superusers or consultants' with considerable expertise in both TTE and advanced TEE who can guide the basic and advanced users in practice, education and research.

Keeping in view, the significant advances in perioperative echocardiography and the challenges facing the scope of its practice and training, a journal dedicated to perioperative echocardiography is the need of the hour. There is a rising demand from cardiac surgeons for cardiac anesthesiologists who are trained in the more recent and advanced echocardiographic modalities, and an increasing demand for anesthesiologists trained in PTE. The Journal of Perioperative Echocardiography will serve as a mouthpiece as well as a resource, disseminating knowledge and helping to stimulate guidelines for the future. It aims to herald an era of more rapid and thorough development of the science of perioperative echocardiography.

REFERENCES

1. Mindich BP, Goldman ME, Fuster V, Burgess N, Litwak R. Improved intraoperative evaluation of mitral valve operations utilizing two-dimensional contrast echocardiography. *J Thorac Cardiovasc Surg* 1985;90(1):112-18.
2. Kneeshaw JD. Transoesophageal echocardiography (TOE) in the operating room. *Br J Anaesth* 2006;97(1):77-84.
3. Roizan MF, Beaupre PN, Alpert RA, et al. Monitoring with two dimensional transesophageal echocardiography: Comparison of myocardial function in patients undergoing supraceliac, suprarenal-infraceliac, or infrarenal aortic occlusion. *J Vasc Surg* 1984;1:300-05.
4. Practice guidelines for perioperative transesophageal echocardiography. An updated report by the American Society of Anesthesiologists and the Society of Cardiovascular Anesthesiologists Task Force on Transesophageal Echocardiography. *Anesthesiology* 2010;112:1-13.
5. Cahalan MK, Stewart W, Pearlman A, et al. American Society of Echocardiography and Society of Cardiovascular Anesthesiologists task force guidelines for training in perioperative echocardiography. *J Am Soc Echocardiogr* 2002;15:647-52.

6. Sangwan S, Au C, Mahajan A. Pro: Pediatric anesthesiologists should be the primary echocardiographers for pediatric patients undergoing cardiac surgical procedures. *J Cardiothorac Vasc Anesth* 2001;15:388-90.
7. Moran AM, Con GT. Pediatric anesthesiologists should not be the primary echocardiographers for pediatric patients undergoing cardiac surgical procedures. *J Cardiothorac Vasc Anesth* 2001;15:391-93.
8. Cowie BS. Focused transthoracic echocardiography in the perioperative period. *Anaesth Intensive Care* 2010;38:823-36.
9. Price S, Via G, Sloth E, Guarracino F, Breikreutz R, Catena E, Talmor D. World Interactive Network Focused on Critical UltraSound ECHO-ICU Group. Echocardiography practice, training and accreditation in the intensive care: Document for the World Interactive Network Focused on Critical Ultrasound (WINFOCUS). *Cardiovasc Ultrasound* 2008;6:49.
10. Green M, Heyer AS. Con: General anesthesiologists should not be trained and certified in basic transesophageal echocardiography. *J Cardiothorac Vasc Anesth* 2010;24:189-90.

ABOUT THE AUTHORS

Kathirvel Subramaniam

Clinical Associate Professor, Department of Anesthesia, University of Pittsburgh-Presbyterian Hospital, Pittsburgh, Pennsylvania, USA

Balachundhar Subramaniam

Associate Professor, Department of Anesthesia, Harvard Medical School; Staff Anesthesiologist, Director of Cardiac Anesthesia Research; Chair, Resident Research, Beth Israel Deaconess Medical Center, Boston, Massachusetts, USA

Goverdhan Dutt Puri

Professor, Department of Anesthesia and Intensive Care, Advanced Cardiac Center, Postgraduate Institute of Medical Education and Research, Chandigarh, India