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Editorial

An Unsentimental Education: How Should We Be Teaching Perioperative Echocardiography?

Perioperative transesophageal echocardiography has become a mainstay in the world of cardiac surgery as cardiac anesthesiologists have embraced their dual role as anesthesia providers and echocardiographers, working in concert with cardiac surgeons to deliver high-quality care, much of which is predicated upon transesophageal echocardiography (TEE) findings obtained during the perioperative period. Given the virtually universal adoption of intraoperative TEE during cardiac surgery and its role in patient care, there has been understandable interest in expanding the role of perioperative TEE in the noncardiac surgical area. Several studies have shown that the use of perioperative TEE for noncardiac surgery changes medical and surgical management, and these benefits also have been shown to extend into the realm of critical care.[1-6] With the expanding applications of TEE, the American Board of Anesthesiology (ABA) has included TEE-related questions in the advanced written, oral, and Objective Structured Clinical Examination board examinations, and, as a result, residency programs now must determine how best to prepare their trainees for these examinations and for a career in which echocardiography continues to gain prominence.

Although those entering a career in cardiac anesthesia require advanced training in TEE, all other anesthesiologists can elect to pursue basic TEE certification through the National Board of Echocardiography for use during various surgical cases and as a rescue modality when encountering intractable cardiopulmonary collapse or hypoxemia.[7] The requirements for certification include an examination that is offered every two years, as well as a clinical experience component that requires the review of at least 150 TEE examinations with a board-certified echocardiographer, of which at least 50 also must performed by the trainee. In most instances, these studies can be acquired during a trainee's core anesthesiology residency, given adequate clinical opportunities and support from program leadership. As such, residency programs across the country have developed their own curricula to prepare trainees for basic TEE certification, or at the very least provide them with the necessary training to perform well on the echocardiography sections of their board examinations. Despite the growing emphasis on TEE education by both individual residency programs and the ABA, there have been no studies by residency programs looking at the success of a TEE curriculum as measured by basic TEE certification rate.

In the current edition of the *Journal of Cardiothoracic and Vascular Anesthesia*, Subramaniam et al. published the outcomes of the TEE didactic curriculum at the University of Pittsburgh as measured by the rate at which participating residents obtained basic TEE certification and the percentage of graduates who continued to use TEE in their regular practice.[8] The study consisted of 67 CA-3 residents across six consecutive years who elected to participate in the two-month TEE curriculum (nine residents who pursued cardiac fellowship and advanced TEE certification eventually were excluded from the study cohort). Every rotation was preceded by online training modules focusing on areas such as basic TEE views and knobology and, after completing TEE simulation training on mannequins on day one, residents then performed and reviewed as many TEEs as time allowed during the two-month rotation, with a goal of achieving the 150 required examinations for basic certification. At the conclusion of the study, the authors determined the number of participants who had obtained either testamur status or certification in basic TEE from the National Board of Echocardiography.

The authors found that only 12 (21%) of the participating residents reached the primary outcome measure of basic TEE certification, whereas an additional 14 (25%) residents did achieve the secondary outcome measure of testamur status (ie, having passed the basic TEE examination but not [yet] pursued full certification). Of note, 100% of test takers passed the basic TEE examination, and all residents who submitted case logs met their clinical education goal of obtaining the requisite number of TEE examinations to apply for basic TEE certification. An anonymous survey was sent out to all participants to quantify the usage of TEE after graduation and to assess their impression of the two-month curriculum. To the authors' dismay, 63.4% of respondents indicated that they perform no TEE in their practice, but 78% of participants indicated that

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the two-month rotation was either very useful (41.5%) or somewhat useful (36.5%).

Although only 12 (21%) participating residents achieved the primary outcome measure, taking the basic TEE examination was not required, nor was seeking certification upon achievement of testamur status. With a modest survey response rate of 61%, the authors could have attempted to elucidate why the additional 14 (25%) participants who passed the basic TEE examination did not pursue certification despite no additional monetary cost associated with doing so. Future research into the efficacy of TEE curricula on achieving basic TEE certification could be designed with a compulsory component as it pertains to both taking the examination and pursuing certification after achievement of testamur status; this, of course, will have to be balanced against the high cost of the examination (currently $795). Despite a reported 100% pass rate among the 26 participants who took the basic TEE examination, the real pass rate could have been significantly lower given the number of nonresponders; again, this could be addressed with compulsory examination.

The work by Subramaniam et al. highlighted two important aspects of TEE education. First, a dedicated, hands-on TEE curriculum appears to have a significant impact on basic TEE examination preparedness, as indicated by both meeting the metrics required to sit for the examination and the 100% pass rate achieved by the participating residents (with a then 90% national pass rate). Second, despite a successful TEE curriculum, few residents progressed to full board certification in basic TEE and the vast majority of trainees used little-to-no TEE in postgraduate clinical practice. This has a few broad implications for both TEE training during residency as well as ultrasound education. Based on the findings of their study, the authors have altered the TEE elective at their institution to focus on residents who have an interest in organ transplantation, critical care, and trauma, who likely would have a practical use for TEE training in their future careers. They also have limited the TEE experience for those applying for cardiac anesthesia fellowship, as these individuals will receive more in-depth training during fellowship. Although there should be an emphasis on expanding the use of TEE during certain types of noncardiac surgery, the increasing importance of point-of-care ultrasound (POCUS) and transthoracic echocardiography (TTE) in the preoperative and postoperative areas also must be addressed by training programs.

Point-of-care ultrasound has established itself as a prominent diagnostic tool among emergency medicine and critical care practitioners due to its combination of high clinical impact paired with a low-cost, noninvasive nature and the relative speed at which it can be performed. Among anesthesiologists, POCUS also has gained increasing use, to the extent that the ASA has created a certification process for practicing anesthesiologists, the ABA has introduced focused ultrasound assessment into its applied clinical examination, and the ACGME now requires surface ultrasound education for residents.[9] Given the growing emphasis on POCUS education, the ASA assembled an expert panel to determine the scope within which anesthesiologists should practice ultrasound and the minimum required training one should receive to be deemed competent.[10] Additionally, the increasing availability and decreasing cost of portable ultrasound probes, like the Buttery or Philips Lumify (which can be connected to a smartphone or tablet), should help to remove many of the physical and equipment-related barriers to the development and implementation of POCUS curricula.[11,12]

Although cardiac anesthesiologists emphasize the use of TEE, there is a growing interest in the expansion of TTE education among anesthesia residents given its greater applicability by general anesthesiologists as a rescue modality and for use in the perioperative and postoperative areas as a noninvasive clinical tool that can help guide medical and surgical management. This growing interest has led to research in educating practitioners of varying levels, ranging from residents to attendings, and even members of other specialties.[13] Just as POCUS has found its way into board examinations and training requirements, TTE education also has been incorporated into ACGME requirements for anesthesia residents, with the expectation that ABA examination incorporation is soon to follow. Some programs have shown promise in applying TTE education as a longitudinal experience beginning early in residency, but further research into how to best educate trainees in both of these imaging modalities is needed, and is of critical importance as their use one day may become the standard of care.[14,15] In summary, training programs increasingly should think about their ultrasound education programs in a holistic manner, incorporating elements of POCUS, basic surface TTE, as well as the TEE imaging that cardiac anesthesiologists hold so dear.

Conflict of Interest

None.

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