ECHOCARDIOGRAPHIC GUIDANCE OF STRUCTURAL HEART DISEASE

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ABSTRACT

Transcatheter therapies for structural heart disease continue to grow at a rapid pace, and echocardiography is the primary imaging modality used to support such procedures. Transesophageal echocardiographic guidance of structural heart disease proceduresmust be performed by highly skilled echocardiographers who can provide rapid, accurate, and high-quality image acquisition and interpretation in real time. Training standards are needed to ensure that interventional echocardiographers have the necessary expertise to perform this complex task. This document provides guidance on all critical aspects of training for cardiology and anesthesiology trainees and postgraduate echocardiographers who plan to specialize in interventional echocardiography. Core competencies common to all transcatheter therapies are reviewed in addition to competencies for each specific transcatheter procedure. A core principle is that the length of interventional echocardiography training or achieved procedure volumes are less important than the demonstration of procedure-specific competencies within the milestone domains of knowledge, skill, and communication.

Keywords: Interventional echocardiography, Structural heart disease, Echocardiography training, chordiography, echo,

ANNOTATSIYA

Yurakning strukturaviy kasalliklari uchun transkateter terapiyasi tez sur’atlar bilan o‘sishda davom etmoqda va bunday protseduralarni qo‘llab-quvvatlash uchun ishlatiladigan asosiy tasvirlash usuli hisoblanadi. Strukturaviy yurak kasalliklari protseduralarining transezofagial kardiyografik ko‘rsatmasi Real vaqtda tasvirni tez, aniq va sifatli olish va talqin qilishni ta’minlaydigan yuqori malakali exokardiyograflar tomonidan amalga oshirilishi kerak. Interventsion exokardiyograflarning ushbu murakkab vazifani bajarish uchun zarur tajribaga ega bo‘lishini ta’minlash uchun o‘quv standartlari zarur. Ushbu hujjat interventsion exokardiyografiyada ixtisoslashishni rejalashtirgan kardiologiya va anesteziologiya tinglovchilari va aspirantura exokardiyograflari uchun o‘qitishning barcha muhim jihatlari bo‘yicha ko‘rsatmalar beradi. Barcha transkateter terapiyalari uchun umumiy bo‘lgan asosiy

vakolatlar har bir aniq transkateter protsedurasi uchun vakolatlarga qo‘shimcha ravishda ko‘rib chiqiladi. Asosiy printsip shundan iboratki, interventsion exokardiyografi bo‘yicha mashg‘ulotlarning davomiyligi yoki erishilgan protsedura hajmlari bilim, mahorat va muloqotning muhim sohalari doirasida protseduraga xos vakolatlarni namoyish qilishdan ko‘ra kamroq ahamiyatga ega.

Kalit so‘zlar: interventsion exokardiyografi, tizimli yurak kasalliklari, exokardiyografi mashg‘ulotlari, xordiografiya, echo,

АННОТАЦИЯ

Транскатетерная терапия структурных заболеваний сердца продолжает развиваться быстрыми темпами, и эхокардиография является основным методом визуализации, используемым для поддержки таких процедур. Чреспищеводная эхокардиография при структурных заболеваниях сердца должна выполняться высококвалифицированными эхокардиографами, которые могут обеспечить быстрое, точное и высококачественное получение изображений и их интерпретацию в режиме реального времени. Стандарты обучения необходимы для обеспечения того, чтобы интервенционные эхокардиографы обладали необходимыми знаниями для выполнения этой сложной задачи. Этот документ содержит рекомендации по всем важнейшим аспектам обучения для слушателей курсов кардиологии и анестезиологии и аспирантов-эхокардиографов, которые планируют специализироваться на интервенционной эхокардиографии. Рассматриваются основные компетенции, общие для всех транскатетерных методов лечения, в дополнение к компетенциям для каждой конкретной транскатетерной процедуры. Основной принцип заключается в том, что продолжительность обучения интервенционной эхокардиографии или достигнутый объем процедур менее важны, чем демонстрация специфических для процедуры компетенций в ключевых областях знаний, умений и коммуникации.

Ключевые слова: Интервенционная эхокардиография, структурные заболевания сердца, обучение эхокардиографии, хордография, эхо,

INTRODUCTION

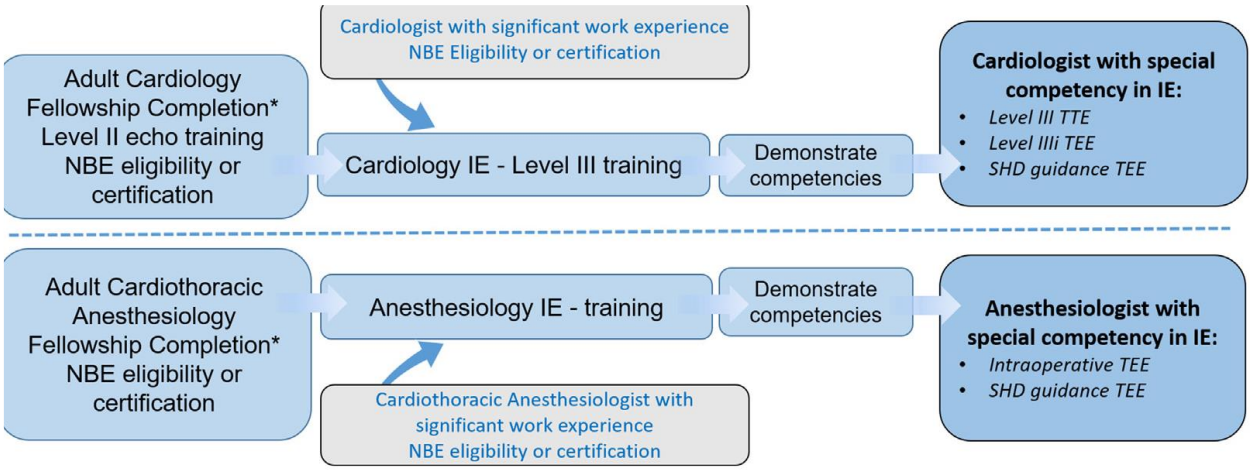
The introduction to echocardiography is usually achieved within a formal training program in adult cardiology, pediatric cardiology, or anesthesiology. The Accreditation Council for Graduate Medical Education (ACGME) is the primary regulatory body for such programs. In collaboration with the American College of Cardiology (ACC), specific learning goals have been developed as Core Cardiovascular Training Statements (COCATS) for adult cardiovascular disease

training programs.1 Such documents define the learning objectives, time commitment, and case volume generally required to achieve competency as an echo-cardiographer. COCATS 4 (Task Force 5) is an important document that explicitly addresses training in echocardiography within core cardiovascular training programs and defines required competencies as follows: level I (introductory experience), level II (independent interpretation of transthoracic studies), and level III (perform and interpret complex studies, lead a research program, train others in advanced echocardiography).2 In addition, Advanced Training Statements (ATS) have also been developed by the ACC, American Heart Association (AHA), and the American Society of Echocardiography (ASE) to describe skills and expected competencies in defined subspecialty areas of cardiology. The most recent ATS on echocardiography identified specific competencies for level III echocardiography training that go beyond what is expected of core cardiology trainees.3 If a trainee was able to devote all available elective time to echocardiography and gain the needed experience within the 3-year core fellowship, there was an avenue to achieve such advanced echocardiography training within the core fellowship. Additional dedicated training was required for most individuals seeking to acquire specialized procedural skills.

Although the competencies defined by COCATS do not directly apply to the ACGME's expectations for training in perioperative chocardiography, a graduate from an adult cardiothoracic anesthesiology fellowship program will have reached level II competency in the independent interpretation of perioperative transesophageal echocardiographic studies. In fact, the ACGME expects trainees in adult cardiothoracic anesthesiology to meet the requirements of certificationby the National Board of Echocardiography (NBE) for special competence in advanced perioperative transesophageal echocardiography. Because the field of IE has evolved so rapidly, additional efforts have been made to further refine the level III competencies and training elements required for those individuals undergoing training to become interventional echocardiographers. Recognizing that IE is not yet performed at all echocardiography training institutions, an expert consensus group proposed a collection of SHD competencies within the level III training framework as an aid to both laboratory directors and physicians seeking advanced training in the performance of IE.5 Importantly, the nomenclature of level III IE was adopted to denote demonstrated special competency in specific SHD procedures.

The purpose of this new document is to supplement the ATS on echocardiography with recommendations for general and procedure-specific competencies within the domains of medical knowledge, procedure skills, and communication skills as a guide to both trainees and trainers in the emerging field of IE. For the trainee interested in this subspecialty, the level III IE training pathway could diverge from the traditional

pathway after level II training is achieved. Level III IE minimum procedural numbers do not differ significantly from those of the traditional level III; however, the emphasis on imaging for valvular heart disease and SHD interventions distinguishes this training from the traditional level III pathway. For practitioners out of training, this document serves as a guide to the appropriate practice-based experience that would be expected to achieve independent competency within IE. At the completion of training, core competencies specific to IE should be achieved. These include general medical and procedural knowledge specific to all SHD cases as well as mastery of skills pertaining to specific SHD interventions. By the end of training, trainees should achieve expertise in advanced TEE of complex cardiac disorders before, during, and after SHD interventions. This includes expertise with intraprocedural, live 3D imaging, manipulation of 3D images, use of 3D color Doppler, and multiplane cropping. General core competencies and skills are listed in Table 7. The use of intracardiac echocardiography (ICE) to guide SHD interventions is evolving. At present, the interventional echocardiographer should be familiar with two-dimensional (2D) and 3D intracardiac echocardiographic images, especially to compare images of pathoanatomy or devices with those acquired on transthoracic echocardiography (TTE) and TEE. Training guidelines to acquire specific competencies in the performance of ICE for SHD procedural guidance have not yet been defined. There are no data that relay the optimal number of procedures needed for an interventional echocardiographer to gain expertise in SHD imaging. This is due in part to the rapidly evolving nature of the field, with new devices and imaging technology constantly emerging. The minimal procedural volumes for level III IE competency are suggested in the ATS document and are reproduced in Table 8. It is emphasized that this table represents the minimal numbers of procedures in each type of SHD intervention. Additional numbers of supervised procedures are likely needed for complex cases and novel devices.



As part of the preprocedural evaluation for TAVR, the interventional echo-cardiographer should have an in-depth understanding of the complex anatomy of the aortic valve and aortic root, including unfavorable or challenging anatomic characteristics such as bulky left ventricular outflow and leaflet calcification, a bicuspid aortic valve with asymmetric calcification, or native aortic valve regurgitation in a noncalcified annulus. Furthermore, the interventional echocardiographer should be highly competent in evaluating and grading normal-flow and low-flow aortic stenosis, left ventricular function, and associated valve lesions and understanding the use of multimodality imaging, particularly CCT, for patient evaluation and preprocedural planning per current society guidelines.41,42 A thorough understanding of CCT becomes particularly important in patients with challenging aortic root features, the use of TAVR for valve-invalve (ViV) interventions in whom, in addition to precise annular and valve sizing, a thorough understanding of the surgical prosthesis characteristics (i.e., leaflet mounting, position of the surgical implant, and potential for fracture) is required, and in determining whether a patient presently being considered for TAVR could undergo a ViV procedure in the future. Three-dimensional TEE with MPR can be used for sizing of the aortic annulus and aortic root, as well as coronary height measurement, especially when the CCT is challenging or produces inconclusive findings, and the interventional echocardiographer should be proficient with 3D image acquisition, cropping, and reformatting to achieve this goal.

Tricuspid Procedures

Tricuspid valve intervention is a burgeoning new field, with >20 new devices in preclinical or early feasibility studies, three ongoing randomized clinical trials, and four devices having received Conformite Europeenne Mark status in Europe.48 Thus, there is an urgent need to develop tricuspid valve imaging training for both faculty and fellows. In general, the tricuspid valve is more difficult to image than the mitral valve, given its position in the chest relative to the esophagus; however, standardized imaging protocols using 2D and 3D echocardiographic modalities have been developed, which should help with training.11 Nonetheless, in the absence of a commercially available device to treat native tricuspid valve disease in the United States, the current numbers of procedures are limited to off-label use of the mitral valve TEER device or implantation of a balloonexpandable transcatheter aortic valve in the inferior vena cava. Although is it not possible to define the minimum procedure volume for tricuspid devices at this time, the volume will likely be greater than that for mitral procedures, given the increased difficulty imaging the valve, as well as the variability of anatomic morphologies and classification systems related to tricuspid regurgitation.49 The suggested medical knowledge and procedural skill competencies for level III IE training for tricuspid valve interventions are summarized in Table 12. These

competencies will likely expand as the field of tricuspid valve transcatheter therapies matures.

CONCLUSION

Treatment strategies for patients with SHD are rapidly evolving. The explosive development of percutaneous devices has allowed patients to undergo treatment for cardiac diseases that was previously only possible with surgery. Percutaneous treatments for SHD are heavily reliant on imaging for preprocedural planning, device implantation, and long-term follow-up. This document expands upon the previously published ACC ATS on advanced echocardiography to provide specific recommendations for training interventional echocardiographers. This document provides the minimum competencies and standards for training institutions to design high-quality programs and for individuals pursuing IE training to understand basic procedural and knowledge-based benchmarks. A core principle of each training program is that the length of program duration or achieved procedure numbers are less important than demonstrated competency in the procedure-specific IE competencies within the milestone domains of knowledge, skill, and communication.

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